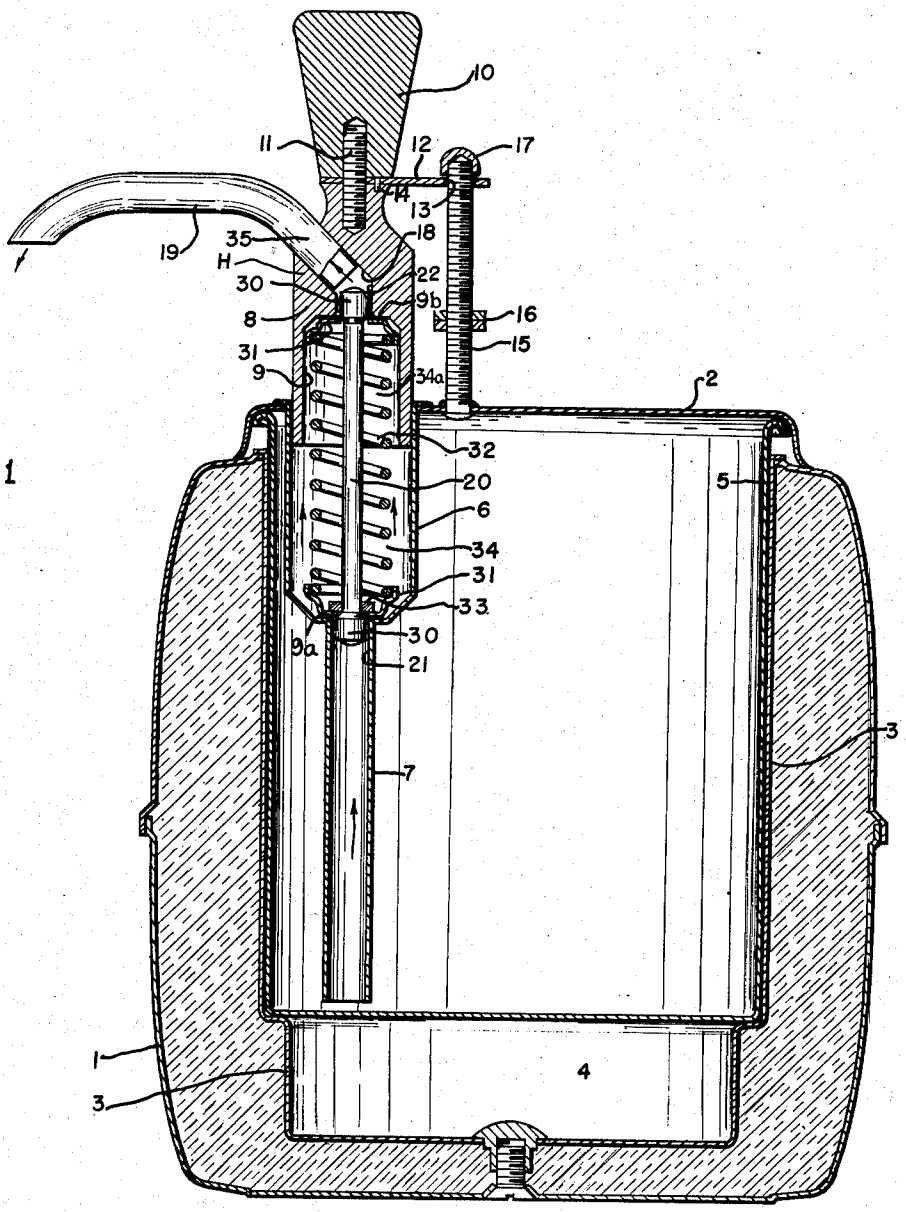
June 22, 1954 T. L. TITUS 2,681,622

SPOOL VALVE PUMP

Filed April 18, 1949 2 Sheets-Sheet 1

Fig. 1



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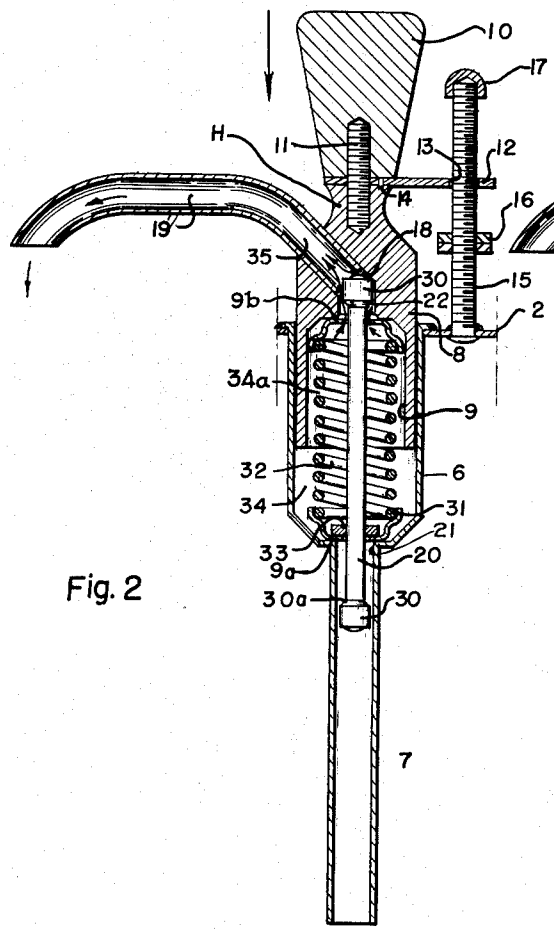

Fig. 2

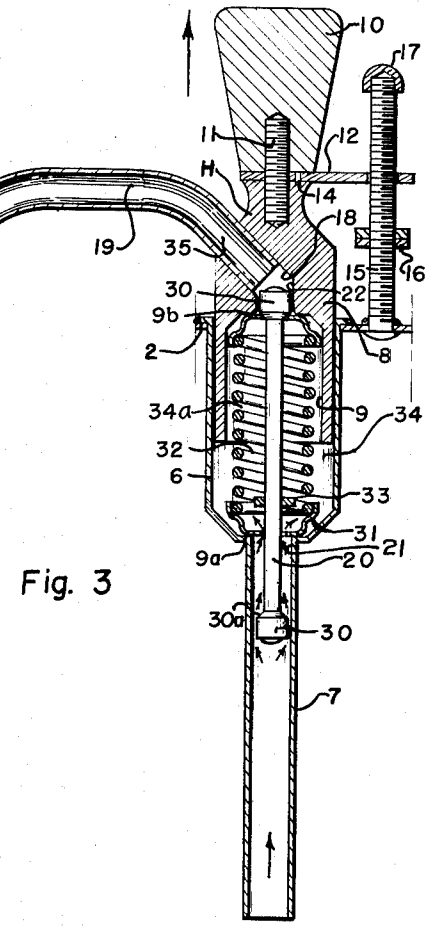

Fig. 3

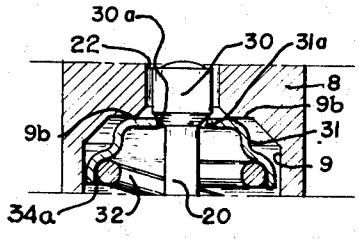

Fig. 4

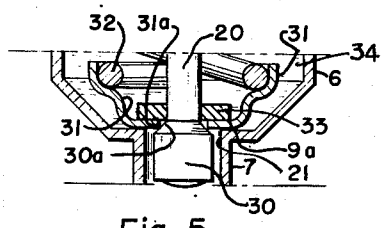

Fig. 5

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SPOOL VALVE PUMP

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2 Claims. (Cl. 103—153)

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This invention relates to pumps, and in the preferred embodiment here illustrated to pumps for dispensing fluids, such as cream, soda fountain liquids or syrups. More particularly, this invention relates to pumps having a pair of opposing chambers adapted to telescoping or plunger movement of one chamber with relation to the other, and each chamber having a centrally aligned port.

It is a primary object of this invention to provide such a pump with a novel unitary spool valve assembly.

Another primary object of this invention is the provision of such a valve assembly including a pair of opposing spring cage washer valves.

Another object is the provision of such a valve assembly with a gravity operated flash check valve.

Another object is the provision of such a valve assembly of simple, durable and economical construction, in combination with such a pump, and which is readily removable for cleaning or other purposes.

Other and further objects will be apparent to those skilled in the art from the accompanying drawings, in which

Figure 1 is a vertical cross-sectional inoperative condition view of my novel pump secured to the cover of an open topped receptacle;

Figure 2 is a vertical cross-sectional view of my pump during partial downward plunger stroke operation thereof, showing operation of my novel spool valve assembly during fluid discharge from the pump;

Figure 3 is also a vertical cross-sectional view of my pump but after the fluid discharge stroke has been completed and the plunger has started to move upwardly under the action of the tension spring from a lowermost position, showing the operation of my novel spool valve assembly during fluid refilling of the pump chamber;

Figure 4 is enlarged, fragmentary, cross-sectional view of the upper end of my novel spool valve during inoperative condition.

Figure 5 is, similarly to Figure 4, an enlarged, fragmentary, cross-sectional view of the lower end of my novel spool valve during inoperative condition.

Referring to the drawings, the reference numeral 1 designates a suitable open mouth receptacle having a spaced inner liner wall 3, as illustrated, with suitable insulating between same. A cup 5, as illustrated, rests on a shoulder provided near the bottom of the wall 3, and is adapted to receive the fountain liquid therein. A space

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between the bottom of the cup 5 and the adjacent wall 3 is purposely provided to be used for storage of a refrigerant material therein, such as Dry Ice, for preservation of the liquid syrup in the cup 5. A suitable removable cover 2 is provided across the open top of member 3. I secure my pump through an opening provided for the purpose in the cover 2, as by welding the upper outer flange of the tube 6 to the cover. Member 6 is a cylindrical tube, comprising a cup-cylinder chamber-member constructed with its lower end crimped inwardly to form a shoulder 9a around a central longitudinal opening 21 at its lowermost point. An extension pipe 7 extends downwardly from that opening 21 into the cup 5 to a point slightly above the bottom of the cup. Member 7 is sealed to that opening as by welding.

I will now proceed to explain the construction of my novel pump and valve which operate within the chamber 34 of the tube 6. I provide a plunger type, inverted cup shape, handle assembly, designated generally as H, the lower portion of which is constructed with a cavity or chamber 34a in opposing relationship to the chamber 34 of the tube 6, with a central outlet port 22 originating in longitudinal alignment with the inlet port 21 and tube 7 of member 6. A shoulder 9b is also provided, as illustrated, around that port 22 the same as around the inlet port 21. The plunger is designated as member 8, having a hollow extension 9, to form a cup-plunger chamber-member, of a size in diameter so as to be adapted for piston-sealed plunger movement of 9 longitudinally within member 6. The outlet opening 22 mentioned extends upwardly into the center of the piston 8 a short distance and then at an angle out the side thereof, as illustrated, the said angular portion being designated as 18. The top of the plunger 8 is constructed with a removable upper projection 10, secured to the remainder of the plunger by a suitable screw pin 11, as will be understood. A guide bar 12 is secured between members 8 and 11 and is provided with an opening designed to fit loosely over a guide post 15. Projection 10 is secured rigidly to plunger 8, by means of threaded pin 11, and with the washer portion of bar 12 being secured around pin 11 and between members 8 and 10. Bar 12 comprises a rigid part of the plunger assembly, and, obviously, as the plunger is operated the projected end thereof adjacent post 15 slides along said post, thus acting to support the handle assembly H as used. To further assist in that support of the plunger by the bar 12, a set key 14 is inserted through a suitable opening for the

purpose in 12, adjacent pin 11, and into another opening for the purpose in the adjoining surface of 8, as illustrated, before member 10 is screwed onto pin 11, to act as means for locking the bar 12 from rotating on the axis of the pin 11. Post 15 is welded rigidly to cover 2. A pair of lock nuts 16 are threaded onto post 15 which is screw threaded to receive them, for reasons to be explained. A stop nut 17 is threaded onto the top of post 15, after the inner spool valve assembly has been placed in chambers 34 and the handle assembly or plunger has been inserted in place, for reasons also to be explained. A suitable spout 19 is placed snugly within so as to extend the opening at one side of the top portion of the member 8, for directing the fluid discharge from the pump during downward stroke of the plunger, as will be explained.

My novel spool valve assembly, used in combination with said opposing pair of telescoping cup-like chambers, comprises a pair of opposing spring cage washers 31, adapted to hold a suitable tension coil spring 32 therebetween, as illustrated, each washer having a longitudinally aligned central orifice 31*a*. Extending longitudinally within the spring and through said orifices is a round shaft 20, each end of which is reduced in size to form a shoulder adjacent each end, and a round collar 30 is suitably rigidly secured onto each reduced end thereof, as by burring each end after the collar is in place. Each collar 30 is slightly less in diameter than the inside diameter of the tube 7, or inlet valve port, and that of the outlet port at the top of the valve, to permit liquid to pass therebetween each, as will be explained. In assembly of my valve, a collar is first secured to one end of the shaft 20, then a washer 31, with its cage portion extending inwardly, is next placed onto the shaft, then the spring 32 is placed over the shaft, then a gravity flash check washer valve 33 is slidably inserted onto the shaft 20, then the other washer 31 is placed over the shaft and against the spring, with its cage portion opposing that of the first spring cage washer, and then the other collar is placed onto the other end of the shaft and burred onto the shaft against the compression resistance of the spring 32, thus making a spool valve, spring and cage assembly as a unit. As will be more fully explained, spring 32 is of sufficient strength to normally press and hold upper cage washer 31 against its adjacent collar 30, against the weight of the plunger H, after assembly and during inoperative pump condition illustrated in Figure 1. Each collar 30, being larger than the shaft 20, has a bevelled surface 30*a*, formed on the inner edge of each collar where each extends from the shaft, for purpose of acting as a valve contact surface against its adjacent orifice 31*a*, of the adjacent spring cage washer 31, as a result of the outwardly expanding tension pressure normally exerted by the spring 32 against each spring cage washer 31, as further illustrated in Figure 1. The central orifice 31*a*, of each spring cage washer 31, is round in contour, and of a size slightly larger than the diameter of the shaft 20 but smaller than the outer diameter of the collars 30. Each opposing peripheral shoulder 9*a*, adjacent the inlet port at the bottom of the valve chamber, and 9*b* also adjacent the outlet port at the top of the valve chamber, as illustrated, is formed and designed to act as a seat against which the outside of each respective spring cage washer 31 contacts for purpose of forming another valve seal at each of those peripheral surfaces. Flash

check washer 33 is a flat, reasonably tight fit, slidably mounted washer, and is free to move along the shaft 20, between washers 31, for reasons to be explained. Each end of my novel spool valve assembly, 20—30—30—31—31—32—33, is identical, and, therefore, in pump assembly either end thereof may be placed upwardly, and should the flash check valve 33 thereof not be down at the lower end of the shaft 20, upon insert of the spool valve assembly into the chamber 34, then said flash check washer will slide downwardly by gravity on that shaft as illustrated in Figure 1. Flash check washer 33 assists the lower one of spring cage washers 31, in certain valve operation, as will be explained relative to down plunger stroke. I construct the parts just described, so that in the position illustrated in Figure 1, the valve stem or shaft 20 has a collar at one end extending downwardly into the intake port 21, and with the collar at the other end thereof extending upwardly into the outlet port 22. Each port and collar, respectively, is of like diameter to the opposing pair thereof. The speed of discharge flow of cream, for instance, from the chamber through the upper or outlet port 22, is directly controlled, in proportion to the pressure created by downward plunger movement within the chambers 34—34*a*, by the clearance or peripheral space provided for that purpose between the outer surface of the upper spool collar 30 and the inner surface of the adjacent outlet port 22. I find it preferable to limit that clearance space so that the operator cannot operate the pump with too great a force and expel the liquid as a result too rapidly, to prevent splashing and wasting of liquid as discharged from the spout.

When the pump has been assembled, by inserting the entire spool valve assembly as a unit, previously described, into lower chamber 34, and then placing the plunger handle H assembly, with its chamber 34*a* of member 8 in opposing relationship with that of member 6 and over said spool valve assembly, and with the opening of the guide bar 12 placed to slidably operate over guide post 15, then stop nut 17 is secured to the top of that post above that bar 12, as illustrated. Post 15 is sufficient in length, as illustrated in Figure 1, so that when stop 17 is seated it does not cause spring 32 to be compressed by exerting any downward pressure on assembly H through member 12, but permits complete expansion movement of the spring 32 as controlled by opposing bevelled surfaces 30*a* of the collars 30 through the spring cage washers 31. Thus it will be seen, in said inoperative pump condition, illustrated in Figure 1, a primary lower valve chamber gravity seal is effected between lower shoulder 9*a* and its adjacent spring cage washer, as will be explained. A secondary lower valve seal is also effected in such inoperative condition between lowered bevelled surface 30*a* and its adjacent orifice 31*a* due to spring tension, as shown in Figures 1 and 5. In that inoperative position, flash check valve washer 33, slidably operable on shaft 20, effects a gravity valve seal around the shaft 20 and between that shaft and the horizontal upper or inside portion of lower spring cage washer 31, as illustrated in Figures 1 and 5, acting as an auxiliary valve seal to said secondary seal for assisting the seal between the lower collar bevelled surface 30*a* and its adjacent opening 31*a*. During said inoperative position, it will thus be seen that the chambers are held full of liquid by the seals between lower 30*a* and 31*a*, assisted by the seal by 33 between 20 and

31, and between lower shoulder 9a and 31. Referring to my novel spool valve assembly as a unit, it will be noted, by reference to Figure 1, that each upper and lower spool collar 30 normally acts as a valve seal with its adjacent spring cage washer central orifice 31a, due to the expansion pressure of the spring longitudinally outwardly of the spool against each spring cage washer. The weight of the plunger assembly H, on top of the spool valve assembly, normally acts to effect a valve seal between each shoulder 9a, 9b and its adjacent spring cage washer outer surface at each end of the spool valve, due to the spring constantly normally pressing the cage washers outwardly against said collars 30. My novel spool valve comprises one composite unit, upon taking the pump apart for any reason, thus simplifying cleaning thereof and reassembly of the pump. Upon assembly of the pump, the spool valve assembly may be reversed, so that the previously positioned bottom washer 31 becomes the top one. To remove the plunger H the nut 17 is removed, and then the entire valve, 30, 31, 20, 33, 31, 32 and 30, adhering together as a unit, is removed.

The outwardly oblique portion of the outlet port, designated as 18, acts as a stop, during operation of the pump, upon upward movement of the shaft 20, as will be explained. Upon downstroke of the handle H, upon pressure applied to the portion 10 against the tension of spring 32, plunger portion 8, which acts as a piston snugly operable within cylinder 6, acts to compress the liquid within chambers 34—34a, and thereby forces the liquid therein upwardly into the upper outlet port and out spout 19, as illustrated in Figure 2. During that downstroke of 8, first the liquid presses upwardly against upper collar 30, raising the spool, 30—20—30, upwardly as the liquid rises into and out the outlet port, due to the limited space between the said upper collar and adjoining discharge channel wall. Said upward movement of the shaft 20, caused by the liquid flowing out the discharge channel, is limited when its upper collar 30 strikes oblique portion 18 of the outlet port; and then as the plunger continues in its downward stroke, during which fluid is continued to be pressed upwardly and out the top of outlet port, said further downward movement of the plunger assembly H carries the said shaft 20 down with it, with upper collar 30 held against said portion 18. During the downward plunger stroke, as illustrated in Figure 2, flash check valve washer 33 acts to seal the fluid within the opposing chambers 34—34a from escaping downwardly out the lower orifice 31a of lower washer 31. Upon reaching the downward limit of plunger stroke in that direction, and as may be limited by a prior upward setting of lock washers 16, and upon a release of downward pressure on the handle H, then expansion of spring 32 takes place and causes the plunger 8 to rise. During the beginning of that rising or upward motion of the plunger the shaft 20 falls by gravity, due to overall expansion of chambers 34—34a releasing upward fluid pressure, and shaft 20 falls until its beveled edge 30a, of its upper collar 30, rests on its adjacent orifice 31a, of the upper spring cage washer 31, thereby forming an upper valve seal. Thereby upon continuance of the upward or return spring actuated plunger stroke, and during the remainder of that stroke, a vacuum suction is created within the valve chambers 34—34a as plunger 8 moves upwardly or out of cylinder 6, causing fluid from the supply cup 5 to be sucked up into tube 7 and from that tube upwardly, between lower orifice 31a and the shaft 20, into the chambers 34—34a, until the limit of that return stroke is reached, as defined by the lower spring cage washer orifice 31a, seating against its adjacent collar bevelled surface 30a. That seating, between the lower cage washer 31 and its adjacent lower collar surface 30a, occurs when the spring has raised the plunger H far enough, and at the same time the spring, through the upper cage washer and its collar, has also raised shaft 20, so that and when said spring has extended itself the full limit of the distance it is normally confined in inoperative pump condition between the cage washers 31, by the opposing cage washers 31 being held by and between opposing collars 30. That seating occurs when shaft 20 is so raised until lower 30a meets lower 31a. That upward chamber refilling liquid flow, just described, causes a liquid upper flow friction against the under side of flash check valve washer 33 and effects a lifting of 33 along shaft 20, as illustrated in Figure 3. When spring 32 has then fully expanded to its limit, as illustrated in Figure 1, and as controlled by opposing surfaces 30a, then upward plunger stroke is completed, and then the expansible tension of the spring, exerted through each spring cage washer 31, effects a valve seal, at each end of the spool valve, between each bevelled surface 30a and its adjacent orifice 31a of respective adjacent spring cage washers 31, thereby sealing the fluid within the chambers 34—34. As previously explained, the weight of the assembly H, accentuated by the weight of the spring cage spool assembly, acts to effect the seal between lower shoulder 9a and the outside of its adjacent washer 31, since, as explained, the spring transmits the weight of plunger H to that lower cage washer. After completion of upward plunger stroke, flash valve 33 falls down onto the lower cage washer 31, as in Figure 1, and then acts as an auxiliary inoperative position valve seal, as explained. Said auxiliary valve sealing, 33, becomes part of the primary lower valve sealing means upon downward plunger operation.

The quantity of fluid capable of being discharged from chambers 34—34a can be limited by limiting the length of plunger stroke, by adjustment of companion lock washers 16 on guide post 15. It is also to be noted that said lock washers 16 can be adjusted to a point at the extreme upper end of said post so that the arm 12 is pressed upwardly against nut 17, thereby preventing operation of the pump and in that position comprising locking means.

My novel pump and valve combination is simple and economical to manufacture, easily and efficiently operable, and can be easily taken apart and cleaned by one inexperienced in the art and reassembled without a chance or erroneous assembly due to too many disconnected or isolated parts. My novel spool valve assembly, when taken out of the pump, remains together as one unit, and as such is easily cleaned in such unitary condition, and is easily reinsertible in the pump.

Having thus shown and described a modification of my invention, it is to be understood that many changes may be made therein without deviating from the spirit of my invention, and, therefore, I wish to be distinctly understood as being limited in my invention only by the appended claims.

What I claim and desire to secure by Letters Patent is:

1. In combination, a reciprocating vertical pump and spool valve assembly, comprising, a stationary upright cup-cylinder chamber-member having a central intake port at the lower end thereof, a shoulder around said port and a supply pipe extending downwardly from said port, a removable and slidably reciprocating inverted cup-plunger chamber member telescopically operable vertically with relation to said cylinder-member and having a central discharge port with a second shoulder around said discharge port at the upper end thereof, said discharge port having a channel extending same in alignment with the intake port and pipe, and a reversible spool valve assembly unit removably resting within the cylinder and plunger chamber-members and comprising, a uniform cylindrical shaft having a pair of identical collars secured each to an end thereof, an identical pair of spring cage washers and a gravity flash check washer valve placed between said cage washers, each of said washers being slidable on said shaft and between said collars, and a coil spring compressibly held around said shaft and between said spring cage washers by said cage washers, said shaft and collars comprising a spool adapted for confining the washers between said collars, said spring being adapted to normally press each washer against its respective collar in a first valve sealing relationship, the outside of each spring cage washer being adapted to seat against one of said shoulders in a second valve sealing relationship, said second valve sealing relationship being effected by the weight of the plunger causing a seal between each shoulder and its adjacent spring cage washer, said collars being of uniform diameter and said diameter being less than the internal diameter of each of the supply pipe and also of the discharge port channel, one of said collars being positioned within said pipe and the other thereof being positioned within said channel, said gravity check valve washer being sealingly and gravity-slidably-mounted over and along said shaft between said spring cage washers and having an external diameter larger than the internal diameter of each of the openings of the spring cage washers, whereby, upon compression of said spring upon down-plunger stroke, the gravity check valve washer assists in effecting the lowermost of said first valve sealings, and upward fluid discharge effected by said stroke causes a fluid friction against the uppermost of said collars and thereby raises said spool with its upper collar well upward into said discharge channel and thereby opening said discharge port, and whereby upon discontinuance of said plunger downstroke, substantially before the start of spring actuated plunger upstroke, said spool falls by gravity lost motion into a first valve sealing upper seal relationship with the upper one of said spring cage washers for effecting thereafter a suction refill of said chambers by said plunger upstroke, said fluid friction raising motion of the spool and said lost motion gravity falling of the spool are each effected without any direct immediate connection between the spool and the rest of the spool valve assembly unit and also without such connection between the spool and the cylinder and plunger members.

2. A pump spool valve assembly, adapted for vertical use, comprising a cylindrical shaft, a gravity operable flash check valve slidable over said shaft, a coil tension spring positioned around said flash check valve and over said shaft and of an extended length longer than the shaft, a pair of opposing spring cage washers each having a central opening loosely slidable over said shaft and one at each end of the spring, and a pair of spool collars secured one at one end of the shaft and the other of said collars secured to the other end of said shaft, the spring being compressed on the shaft between said spring cage washers, and the flash check valve positioned between said spring cage washers, said washers being adapted to compressibly confine the spring therebetween, said collars being adapted to confine the washers therebetween, and at a point of confinement contact of each collar with its adjacent washer to effect a removable liquid valve seal, and each of said collars being adapted to effect said valve seal externally of its adjacent spring cage washer central opening.

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