A pair of cylinder bores 3 and 3a are to be provided in the block 2 for each engine cylinder or for such other intended points of delivery for the liquids A and B. One cylinder bore 3 would preferably extend through the block and have a lateral fuel intake duct 11 for communicating the bore 3 with its liquid chamber 4. The intake duct 11 may be arranged in the block so as to intersect the bore 3 within the inward and outward reciprocating limit of the plunger 7 as shown in the illustration. In this case the plunger 7 will act as a valve for closing the intake duct 11. When the plunger 7 is utilized as the means to seal off the intake duct 11 all downward plunger movement will be below the lowermost portion of the intake duct and is effective in forcing the liquid B through the duct 12, around the check valve 13, and through the delivery duct 14. It will be noted that an adjustable reciprocating means 9 would allow the effective stroke of the plunger 7 to be altered and thus variable amounts of the liquid B could be pumped and delivered.

Another obvious manner of entering fuel into the bore 3 would be to provide a check valve (not illustrated) of any suitable design in the intake duct 11 and if such check valve arrangement were provided the point of intersection of the duct 11 with the bore 3 could be positioned below the lowermost reciprocating limit of the plunger 7. However, providing a check valve means in the intake duct 11 and positioning its point of intersection with the cylinder 3 below the reciprocating limit of the plunger 7 will only permit constant amounts of the liquid B to be pumped and delivered as plunger movement would be effective.

The lower extremity of the bore 3 should contain a check valve 13. This check valve may be adapted to seat against a discharge duct 12 of a smaller diameter than the main cylinder bore 3 as illustrated. It is desirable to have the check valve arrangement 13 as near to the intake duct 11 as the lowestmost reciprocating limit of the plunger 7 will allow, but if this is not possible in a particular design the check valve may be positioned outside the block 2 in any convenient position along the delivery line 14.

The second cylinder bore 3a would be parallel with the cylinder bore 3 and extended into the block 2. The bore 3a is adapted to contain an auxiliary free piston 18 which has a diameter corresponding to the diameter of bore 3a. The free piston 18 is to be held below the lowestmost reciprocating limit of the plunger 7a by a suitable obstruction such as the illustrated rivet 17. A compression spring 19, adapted to operate between the bottom of the piston 18 and the bottom of the bore 3a, urges the piston 18 to assume a normal position of rest against the obstruction 17. A relief duct 20 is provided below the lowestmost reciprocating limit of the piston 18 and communicates the bottom of the bore 3a with the liquid chamber 4a.

The intake duct 11a is extended through the bore 3a in a manner which provides a linear distance between the points 15 and 16 where duct 11a intersects and passes through the bore 3a. The distance between these points 15 and 16, together with the diameter of the bore 3a determines the maximum amount of fuel or liquid which can be ejected from the bore 3a. An economical and practical means of establishing the volume limit of the pumping stroke from the cylinder 3a to alter the angle of the intake duct 11a. In FIGURE 1 the intake duct 11a is extended through the bore 3a on a rather pronounced angle so as to better illustrate the distance between points 15 and 16. Altering this angle will change the linear distance between these points and thus alter the volume of liquid B which can be pumped from the cylinder 3a. The plunger 7a, as it passes the point 15 on its downward stroke will begin to force the liquid A through the discharge duct 12a, around the check valve 13a, and on
through the delivery duct 14a to the intended delivery point for the liquid A.

When the plunger 7a passes the point 16 a hydraulic coupling will be established between the bottom of the plunger 3a and the top of the free piston 18. The force of the pistons downward movement is transferred through the liquid coupling and acts to force the free piston 18 downward and thus forces that part of the liquid A below the piston 18 out of the bore 3a through the relief duct 20.

A critical point in the construction of the apparatus is to have the diameter of the piston 18 precisely conform to the diameter of the bore 3a and to ensure that the spring 19 is stronger than any pressure acting against the liquid in the delivery line 14. Should the spring 19 be weaker than the resistance in the delivery line 14 the delivery of liquid A cannot be effected.

The illustrations show three means for reciprocating the plungers 7 and 7a. The arrangement in FIGURE 1 shows the outward extremity of the plungers 7 and 7a fastened onto a cap 8. A compression spring 10, operative between the cover 5 and the side of the cap 8, holds the assembly in contact with a cam 9. Thus, whenever the cam 9 is rotated, the plungers will reciprocate in unison.

FIGURE 2 illustrates a cam 9 made large enough to catch the caps 8 of both plungers 7 and 7a. The elongated cam 9 will, with the aid of the springs 10, reciprocate the plungers 7 and 7a in unison.

FIGURE 3 shows a means for staggering the delivery times of liquids A and B. By providing individual cams 9 and 9a for the respective plungers 7 and 7a, any delivery sequence for the liquids may be established. In this particular illustration the cam 9 will start the downward, or effective stroke of the plunger 7 prior to the cam 9a starting the downward stroke of the plunger 7a. When the intake ducts 11 and 11a are positioned at a uniform depth as shown in FIGURE 1 this cam arrangement will start the delivery of liquid B prior to the delivery of liquid A. It can be readily seen that, by positioning the cams 9 with respect to the cams 9a, any sequence of delivery for the liquids A and B may be established.

The foregoing specifications clearly set forth the invention; namely, the use of an auxiliary free piston to effect the simultaneous or sequential delivery of two liquids from the pump apparatus. It is to be clearly understood that the selected embodiment in no way limits the design of an apparatus utilizing this invention and that all rights are reserved when any application falls within the scope of the claims hereinafter set forth.

1. A dual delivery pump apparatus having a cylinder block, a first cylinder bore in said block, a first reciprocating plunger slideably received in said first bore, a liquid duct through said block and angled through said first bore between the inward and the outward reciprocating limits of said first plunger, an obstruction within and partially blocking said first bore below the innermost reciprocating limit of said first reciprocating plunger, an auxiliary free piston mounted for reciprocation within said first bore inward from said obstruction, a compression spring within said bore below said free piston, a relief duct communicating the bottom of said first bore with said liquid and a second cylinder bore in said block vertically aligned with said first bore, there being a second reciprocating plunger member slideably received in said second bore and a cap means joining the free ends of said plungers outside said block, said cap engaged with the apparatus reciprocating means.

2. A reciprocating piston type pump apparatus comprised of the combination of a cylinder block having a center portion containing two independent and vertically aligned cylinder bores; sealed liquid receptacles on opposite sides of said center portion; a reciprocating member having a cap with two piston extremities fastened thereto in a manner aligning said pistons with said cylinders, the free ends of said pistons being mounted for reciprocation within said cylinder; a liquid duct extending from each such receptacle and engaged with independent sources of liquid, each such liquid adapted to flow through its respective duct into its respective receptacle; an intake duct communicating one such cylinder with one such liquid and a second intake duct communicating the second cylinder with the second such liquid, said ducts engaging their respective cylinders at a point between the inward and the outward reciprocating limits of said pistons; a discharge duct in the first named cylinder below the inward reciprocating limit of said reciprocating member; a discharge duct in the second named cylinder below said cylinder’s intake duct and within the inward and outward reciprocating limits of said reciprocating member; an obstruction within and partially blocking said second named cylinder below the innermost reciprocating limit of said reciprocating member; a free piston mounted for reciprocation within said second named cylinder inward from said obstruction; a compression spring within and operative between said free piston and the bottom of said second named cylinder; and a relief duct means communicating the bottom portion of said second named cylinder with its respective liquid receptacle.

3. A liquid pumping and delivering apparatus comprising the combination of a pump cylinder block; a first liquid and said receptacle adjacent to a side of said block; a second liquid receptacle, adjacent to said block on the side opposite from said first liquid receptacle, a first cylinder bored in said block, a first plunger member having an end portion thereof equal in diameter to and slideably received in said first cylinder, a second cylinder bored in said block parallel to said first cylinder, a second plunger member having an end portion thereof equal in diameter to and slideably received in said second cylinder, said plungers having caps outward from said block engaged with the apparatus reciprocating member, a first liquid admitting duct extended from said first liquid receptacle and engaged with said first cylinder between the inward and the outward reciprocating limits of said first plunger, a first liquid discharging duct engaged with said first cylinder inward from the innermost reciprocating limit of said first plunger, said first liquid discharging duct adapted to deliver said first liquid through a check valve means to a predetermined delivery point outside of said block, a second liquid admitting duct extended from said second liquid receptacle and engaged with said second cylinder at a point within the reciprocating range of said second plunger and inward from said second liquid admitting duct, an obstruction within and partially blocking said second cylinder inward from the innermost reciprocating limit of said second plunger, a free piston member having a diameter equal to said second cylinder and mounted for reciprocation therein below said obstruction, a compression spring within and operative between the inward extremity of said free piston and the bottom of said second cylinder and a relief duct means communicating said second liquid receptacle with said second cylinder at a point below the innermost reciprocating limits of said free piston.

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