

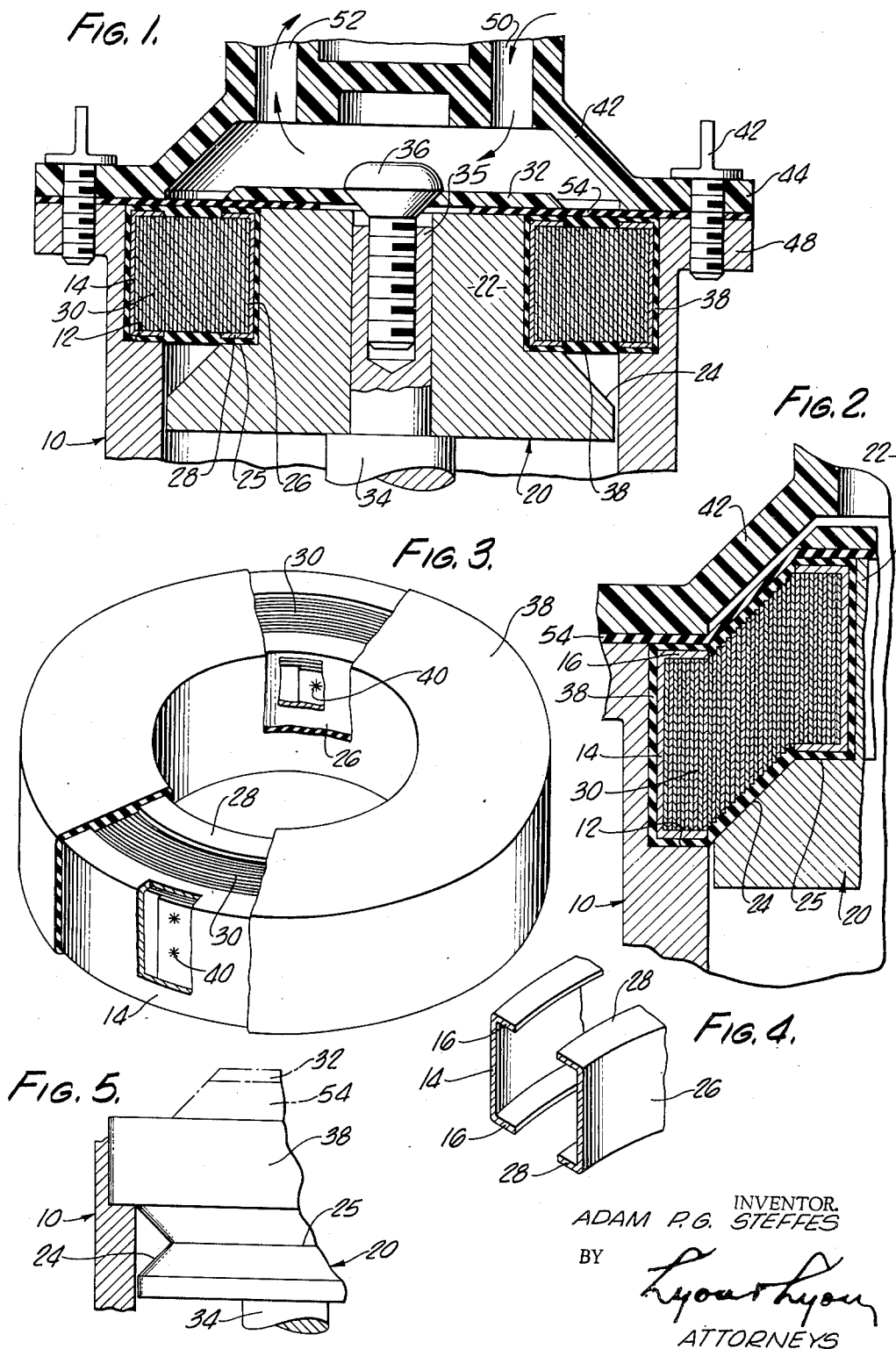
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This invention relates to an improved pump for propulsion of liquid or gas.

Objects of this invention are to provide:

(a) A pump having a relatively short stroke (depending on size and capacity of pump) for positive propulsion of liquid or gas;

(b) A pump having a minimum of moving parts and subject to a minimum of frictional wear and resulting damage;

(c) A pump which can be manufactured economically, and readily and easily assembled;

(d) A pump having novel sealing means preventing leakage, despite high pressure and irrespective of slow or fast movement of piston;

(e) A pump which is hermetically sealed, suitable for moving liquid or gas, which is isolated at all times from the operative parts of the pump;

(f) A pump where chemicals, impurities or other foreign substances in the liquid or gas being moved, cannot cause corrosion, excessive wear or damage to the pump;

(g) A pump where the material being moved can be completely isolated from the metal parts of the pump so that the material will not be affected, tainted, contaminated or damaged by the metal or moving parts of the pump, or by any lubricant used therewith;

(h) A pump which can be used as a substitute for the master cylinder in hydraulic brake systems, which are subject to frictional wear and consequent brake failure;

(i) A pump unit which can readily be adapted into a multiple unit pump (e.g., an oil well pump); and

(j) A pump transducer for converting mechanical, hydraulic, pneumatic, electrical or other energy or force into another type of force.

Other objects and advantages will be readily apparent from the following description.

In the drawings:

FIGURE 1 is a side elevation in section of a pump embodying this invention.

FIGURE 2 is a fragmentary section of the pump in the flexed up position.

FIGURE 3 is a perspective of the spring assembly partially in section.

FIGURE 4 is a fragmental perspective of the inner and outer spring retainers.

FIGURE 5 is a diagrammatic side elevation showing the spring assembly extended in the down position.

The pump of this invention fits within a cylindrical body member 10 having an internal annular shoulder 12 therein. An outer spring retainer 14 is formed of a ring having inturned peripheral flange 16 at each edge thereof. The retainer abuts shoulder 12.

A piston 20 having an upper cylindrical portion 22 and an external annular shoulder thereon 25 forms a support for inner spring retainer 26. The retainer is formed of a ring having inturned peripheral flanges 28. The two retainers are spaced from each other approximately a distance equal to one-half the length of the stroke. A tightly coiled element such as a lubricated flat leaf spring, or similarly formed suitable material fits between a retainer 14 and 26. A flared lower portion 24 on piston 20 forms a support for the spring while flexing and in the flexed up position, insuring positive propulsion.

A cap 32 fits upon spool 20 and extends over the uppermost peripheral flange 28 on retainer 26. A piston rod 34 abuts the lowermost portion of spool 20 and a reduced extension 35 of said rod projects through a central bore

through said spool. A screw 36 screws into said extension maintaining the parts in assembly.

A tightly fitting cover or coating 38 of rubber or other suitable flexible and elastic material is applied entirely over spring 30 and retainers 14 and 26 to form a doughnut-shaped vacuumized pump element, thereby preventing any leakage by the pump thus formed.

Before spring 30 is installed between retainers 14 and 26 the inner and outer ends may be spot-welded or fused as at 40, so as to form closed outer and inner rings of optional thickness, or the ends of the spring may be secured to concentric rings of suitable material, in order to maintain predetermined tightness of coiled spring. The coiled spring need only be loose enough to allow slight sideward movement of each coil on adjacent coil, which for example, in a one inch stroke with a 0.005-inch thick spring, is only 0.010 inch. Before welding or fusing, the spring can be lubricated with sealed in or other suitable lubrication, and the rubber or other similar and suitable cover or coating can be applied so as to insure a perfect vacuum within the "doughnut."

A cap 42 of metal, plastic or other selected material has a peripheral flange 44 which is clamped by screws 46 to a peripheral flange 48 on cylindrical body 10 and has an inlet port 50 and outlet port 52. A diaphragm 54 is clamped between flanges 44 and 48 and has a central opening therein through which screw 36 passes clamping the inner periphery of the diaphragm between 32 and spool 20. The diaphragm may be of suitable material such as surgical grade latex and can be secured temporarily or permanently by a suitable adhesive applied to its lower surface, and can be replaced when desired.

In operation piston rod 34 is reciprocated in body 10 by any suitable means through a relatively short stroke, for example, one inch, where the diameter of the piston head is approximately four inches. This movement upward is reflected in FIGURE 2 and downward in FIGURE 5. This movement along with that of the pump element formed by spring 30 and retainers 14 and 26 and cover or coating 38 as well as movement of cap 32, screw 36 and diaphragm 54, is sufficient to pump for example blood from port 50 out port 52.

While what hereinbefore has been described as the preferred embodiment of this invention, it is readily apparent that alterations and modifications may be resorted to without departing from the scope of this invention and such alterations and modifications are intended to be included within the scope of the appended claims.

I claim:

1. In a pump, a pump body having an internal shoulder, a coiled flat element within said body, an outer element retainer surrounding the outer periphery of said coiled element abutting said shoulder and fixed within said body, an inner element retainer surrounded by the inner periphery of said coiled element, means for reciprocating said inner element retainer within said body, said retainers being spaced from each other a distance equal to approximately one-half the length of the stroke.

2. In a pump, a pump body having an internal shoulder, a coiled flat element within said body, an outer element retainer surrounding the outer periphery of said coiled element abutting said shoulder and fixed within said body, an inner element retainer surrounded by the inner periphery of said coiled element, means for reciprocating said inner element retainer within said body, said element being tightly coiled so as to permit only necessary sideward movement of element surfaces with relation to said shoulder, and having its ends attached to said retainers.

3. In a pump, a pump body having an internal shoulder, a coiled flat element within said body, an outer element retainer surrounding the outer periphery of said

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coiled element abutting said shoulder and fixed within said body, an inner element retainer surrounded by the inner periphery of said coiled element, means for reciprocating said inner element retainer within said body, and a coating on said element and retainers.

4. In a pump, a pump body having an internal shoulder, a coiled flat element within said body, an outer element retainer surrounding the outer periphery of said coiled element abutting said shoulder and fixed within said body, an inner element retainer surrounded by the inner periphery of said coiled element, means for reciprocating said inner element retainer within said body, said retainers being spaced from each other a distance equal to approximately one-half the length of the stroke, and a coating on said element and retainers.

5. In a pump, a pump body having an internal shoulder, a coiled flat element within said body, an outer element retainer surrounding the outer periphery of said coiled element abutting said shoulder and fixed within said body, an inner element retainer surrounded by the inner periphery of said coiled element, means for reciprocating said inner element retainer within said body, said element being tightly coiled so as to permit only necessary sideway movement of said element surfaces with relation to said shoulder, and having its ends attached to said retainer, and a coating on said element and retainers.

6. In a pump, a pump body having an internal shoulder, a coiled flat element within said body, an outer element retainer surrounding the outer periphery of said coiled element abutting said shoulder and fixed within said body, an inner element retainer surrounded by the inner periphery of said coiled element, means for reciprocating said inner element retainer within said body, and a tightly fitting hermetically sealed coating on said element and retainers.

7. In a pump, a pump body having an internal shoulder, a coiled flat element within said body, an outer element retainer surrounding the outer periphery of said coiled element abutting said shoulder and fixed within said body, an inner element retainer surrounded by the inner periphery of said coiled element, means for reciprocating said inner element retainer within said body, said retainers being spaced from each other a distance equal to approximately one-half the length of the stroke, and a tightly fitting hermetically sealed coating on said element and retainers.

8. In a pump, a pump body having an internal shoulder, a coiled flat element within said body, an outer element retainer surrounding the outer periphery of said coiled element abutting said shoulder and fixed within said body, an inner element retainer surrounded by the inner periphery of said coiled element, means for reciprocating said inner element retainer within said body, said element being tightly coiled so as to permit only necessary sideway movement of the element surfaces with relation to said shoulder, having its ends attached to said retainers, and a tightly fitting hermetically sealed coating on said element and retainers.

9. In a pump, a pump body having an internal shoulder, a coiled flat element within said body, an outer element retainer surrounding the outer periphery of said coiled element abutting said shoulder and fixed within said body, an inner element retainer surrounded by the inner periphery of said coiled element, a spool within said inner element retainer abutting same, a cap on said spool clamping said inner element retainer to said spool and means for reciprocating said spool.

10. In a pump, a pump body having an internal shoulder, a coiled flat element within said body, an outer element retainer surrounding the outer periphery of said coiled element abutting said shoulder and fixed within said body, an inner element retainer surrounded by the inner periphery of said coiled element, means for reciprocating said inner element retainer within said body, said

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outer element retainer having inturned flanges encasing a portion of said coiled element, and said inner element retainer having outturned flanges encasing a portion of said coiled element.

11. In a pump, a pump body having an internal shoulder, a coiled flat element within said body, an outer element retainer surrounding the outer periphery of said coiled element abutting said shoulder and fixed within said body, an inner element retainer surrounded by the inner periphery of said coiled element, means for reciprocating said inner element retainer within said body, said outer element retainer having inturned flanges encasing a portion of said coiled element, said inner element retainer having outturned flanges encasing a portion of said coiled element, and a flexible coating on said element and retainers.

12. In a pump, a pump body having an internal shoulder, a coiled flat element within said body, an outer element retainer surrounding the outer periphery of said coiled element abutting said shoulder and fixed with said body, an inner element retainer surrounded by the inner periphery of said coiled element, a spool within said inner element retainer abutting same, a cap on said spool clamping said inner element retainer to said spool, means for reciprocating said spool, and a flexible coating on said element and retainers.

13. In a pump, a pump body having an internal shoulder, a coiled flat element within said body, an outer element retainer abutting said shoulder and fixed within said body, an inner element retainer separated from the outer element retainer a distance equal to approximately one-half of the length of the stroke, means for reciprocating said inner element retainer within said body, said outer element retainer having inturned flanges encasing a portion of said coiled element, said inner element retainer having outturned flanges encasing a portion of said coiled element, sealed in or other suitable lubrication between the adjacent surfaces of the element to reduce the slight friction caused by the sideward motion of the element, and a tightly fitting vacuumized flexible and elastic cover or coating on said element and retainers.

14. In a pump, a pump body having an internal shoulder, a coiled flat element within said body, an outer element retainer surrounding the outer periphery of said coiled element abutting said shoulder and fixed within said body, an inner element retainer surrounded by the inner periphery of said coiled element separated from the outer spring retainer a distance equal to approximately one-half the length of the stroke, a spool within said inner element retainer abutting same, a cap on said spool clamping said inner element retainer to said spool, means for reciprocating said spool, and a tightly fitting vacuumized flexible and elastic cover or coating on said element and retainers.

15. In a pump, a pump body having an internal shoulder, a coiled flat element within said body, an outer element retainer surrounding the outer periphery of said coiled element abutting said shoulder and fixed within said body, an inner element retainer surrounded by the inner periphery of said coiled element separated from the outer element retainer a distance equal to approximately one-half the length of the stroke, a spool within said inner element retainer abutting same, a cap on said spool clamping said inner element retainer to said spool, means for reciprocating said spool, a tightly fitting vacuumized flexible and elastic cover or coating on said element and retainers and a flared lower portion of said spool supporting said flexing element while flexing and in its flexed up position.

16. In a pump, a pump body having an internal shoulder, a coiled flat element within said body, an outer element retainer surrounding the outer periphery of said coiled element abutting said shoulder and fixed within said body, an inner element retainer surrounded by the inner periphery of said coiled element, means for reciprocating

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rocating said inner element retainer within said body, a coating on said element and retainers, a flexible and elastic diaphragm removably supported in said pump body in contact with said coating.

17. In a pump, a pump body having an internal shoulder, a coiled flat element within said body, an outer element retainer surrounding the outer periphery of said coiled element abutting said shoulder and fixed within said body, an inner element retainer surrounded by the inner periphery of said coiled element, means for reciprocating said inner element retainer within said body, a tightly fitting hermetically sealed coating on said element and retainers, and a flexible and elastic diaphragm removably supported in said pump body in contact with said coating.

18. In a pump, a pump body having an internal shoulder, a coiled flat element within said body, an outer element retainer abutting said shoulder and fixed within said body, an inner element retainer, means for reciprocating

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ing said inner element retainer within said body, said outer element retainer having inturned flanges encasing a portion of said coiled element, said inner element retainer having outturned flanges encasing a portion of said coiled element, a flexible coating on said element and retainers, and a flexible and elastic diaphragm removably supported in said pump body in contact with said coating.

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