Sept. 10, 1968 H. P. WERTHEIMER 3,400,663

RECIPROCATING PLUNGER PUMP

Filed March 9, 1967 2 Sheets-Sheet 1

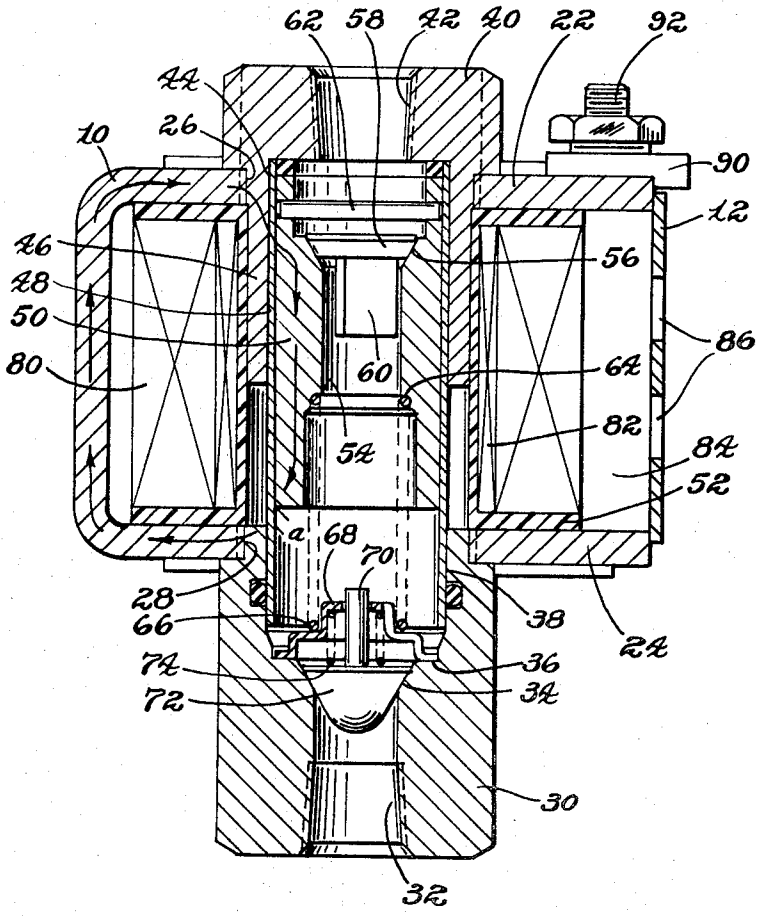

Fig. 1

WITNESS:

Esther M. Stockton

INVENTOR.

Harry P. Wertheimer

BY

W. S. Thompson

ATTORNEY

Sept. 10, 1968 H. P. WERTHEIMER 3,400,663

RECIPROCATING PLUNGER PUMP

Filed March 9, 1967 2 Sheets-Sheet 2

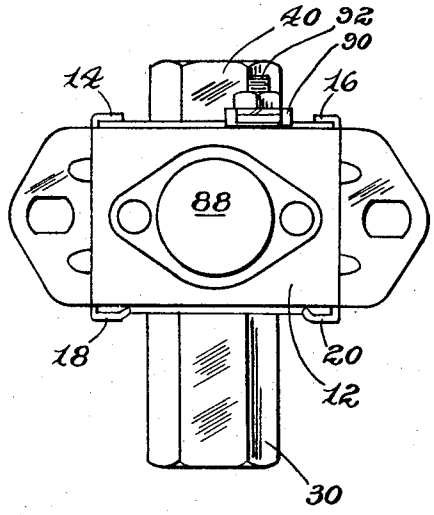

Fig. 2

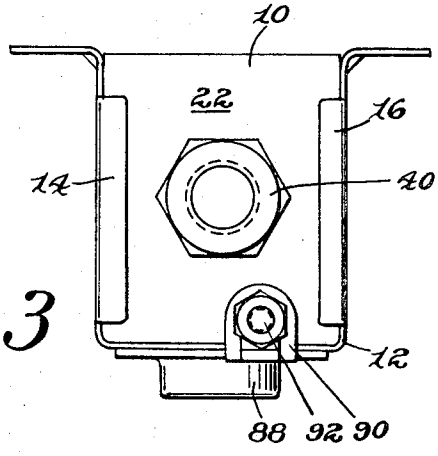

Fig. 3

WITNESS:

Esther M. Stockton

INVENTOR.
Harry P. Wertheimer
BY

ATTORNEY

United States Patent Office 3,400,663
Patented Sept. 10, 1968

3,400,663

RECIPROCATING PLUNGER PUMP

Harry P. Wertheimer, Horseheads, N.Y., assignor to The Bendix Corporation, a corporation of Delaware

Filed Mar. 9, 1967, Ser. No. 621,809
3 Claims. (Cl. 103—53)

ABSTRACT OF THE DISCLOSURE

A reciprocating electromagnetically-driven plunger pump comprised of interfitting U-shaped members forming a housing for pump elements. At least one of the U-shaped members is a substantial structural member and a good magnetic flux conductor. Inlet and outlet fittings are removable plugs or nut-like members retained in opposite legs of the structural U-shaped housing member and retain between them pump sleeve and movable elements such as plunger and valves as a cartridge-like assembly. Electrical components, for example coil, are retained concentrically piloted by one of the fittings and retained laterally by a U-shaped member.

Summary of invention

Prior electromagnetic plunger pumps are commonly housed in a cylindrical or canister-type container, as for example, described in commonly assigned U.S. Patent 2,994,792 in the name of L. C. Parker. Such canister pumps with solid state coil switching components are also known, as for example, described in co-pending U.S. application Ser. No. 565,004, filed July 13, 1966.

The pump of the present invention consists of a basic reorganization of pump structure to achieve a pump functionally equivalent, but at much lower cost and more readily serviceable compared to known pump types.

The attainment of these and other objectives will become apparent on consideration of the appended description and drawings wherein:

FIGURE 1 is a cross-sectional view of a preferred embodiment of my pump;

FIGURE 2 is a plan view of the pump viewing the right side of the pump as oriented in FIGURE 1; and

FIGURE 3 is a top view of the pump rotated 90° from the orientation illustrated in FIGURE 1.

Referring to the drawings, my pump is comprised of two interfitting U-shaped housing members **10** and **12** which form the six sides of a volumetric space for locating basic pump mechanical and electrical parts. Housing member **12** has bent-over tabs **14**, **16**, **18** and **20** laterally forming a connection with legs **22** and **24** of housing member **10**.

Housing member **10** is fabricated from magnetic flux-conducting material such as iron, steel or the like and the metal stock is relatively thick, providing a rigid structural housing member. A pair of aligned holes, **26** and **28**, preferably threaded, are formed in legs **22** and **24** respectively of housing member **10**. An inlet fitting **30** in the form of a hexagonal plug or nut-like member is threaded into hole **28**. An internal passage formed in fitting **30** has varying diameter portions which functionally comprise: inlet passage **32**; inlet check valve seat **34**; seating wall **36** for inlet check valve retainer; and inlet retaining bore **38** of large diameter for receiving the plunger and sleeve cartridge. In outlet fitting **40**, also in the form of a plug or hexagonal nut-like member, is threaded into aligned opening **26** in leg **22**. An internal passage in fitting **40** forms an outlet passage **42** and an outlet retaining bore **44** of diameter equal and aligned to bore **38** for receiving plunger and sleeve cartridge. Outlet fitting **40** has a cylindrical extension **46** projecting

into the housing. Thin sleeve member **48** fits at opposite ends into bores **38** and **42** forming a sliding guide for piston or plunger **50**. Sleeve member **48** is fabricated from brass or other flux non-conducting material. Extension **46** of the outlet fitting extends into the housing sufficiently to provide significant axial overlap with piston **50** for all pumping positions of the piston to insure adequate surface for the transfer of flux from projection **46**, through sleeve **48** to plunger **50** (see arrows indicating flux transfer path in FIGURE 1). Projection **46** also provides a retaining bore internally for sleeve **48** as mentioned, and its external surface provides a locating surface for the annular plastic coil bobbin **52**.

A through-passage **54** is formed in piston **50** and has a frusto-conical section **56** forming a seat for outlet check valve **58**. Valve **58** is loose-fitting and guided by projecting spider **60** and prevented from falling loose by cross pin **62**. A shoulder **64** is formed by throughbore **54** and forms a retaining ledge for spring **66** which, on its lower end, abuts against inlet check valve retainer **68**, holding it in position against seating wall **36**. Retainer **68** guides stem **70** of inlet check valve **72**. Inlet check valve spring **74** is captured between retainer **68** and check valve **72**. An electromagnetic power coil **80** is disposed in bobbin **52**. A number of different and known solid state circuits or interrupter arrangements may be used to obtain periodic energization of coil **80** and basically do not form a part of the present invention. Copending application Ser. No. 565,004 describes a solid state block oscillator circuit of the type that may be used which includes a signal detection coil which may also be wound on bobbin **52** as indicated by coil **82**. As illustrated in FIGURE 1, the legs **22** and **24** of housing member **10** extend to the right of the coil forming a space **84** for housing electrical switching circuit components. Housing **12** has access openings **86** for circuit leads which permit mounting exteriorly heat radiating components such as the transistor **88**, FIGURES 2 and 3. Plastic bobbin **52** has a tap portion **90** which extends through a slot, not shown, in leg **22**. Power-terminal **92** is inserted through tab portion **90** which provides electrical insulation providing a convenient connection to electromagnetic coil and/or control circuit.

Functionally, the pump operates in a known manner. Energization of coil **80** produces flux as indicated by the arrows which tends to shorten the working air gap A by drawing picton **50** downwardly and simultaneously compressing spring **66**. Downward motion opens check valve **58** and closes check valve **72**, causing fluid to flow to the top side of piston **50**. As the oscillating or other control circuit interrupts current to coil **80** allowing it to de-energize, spring **66** will release its stored energy, pushing piston **50** upwardly for a pumping stroke. Upward motion of piston **50** also sucks a new fluid charge past inlet check valve **72**.

The objective of low cost is achieved from the use of U-shaped interfitting housing members providing common structure formerly performed by a number of separate and high tolerance pieces. The U-shaped configuration is easily fabricated from low-cost stampings. Housing member **10** forms the backbone or major pump structural element. Additionally, it comprises the lateral pole pieces for coil **80**, normally provided by separately fabricated pieces, as well as circumferential flux path. Legs **22** and **24** are extended to provide space **84** within the pump housing for control circuit elements. Lastly, housing member **10** is the mounting block for inlet and outlet fittings.

Housing member **12** completes the enclosure, provides a mounting surface for heat radiating electrical components and a pump mounting bracket.

Service is facilitated and it will be observed that simply unscrewing inlet fitting **30** and withdrawing, makes available all pump moving mechanical parts for service and/or replacement. Removal of the second fitting and separation of U-shaped housing segments makes available all electrical elements.

Other variations of the pump may be made without departing from the scope of the invention as defined in the appended claims.

I claim:

1. An electromagnetic plunger pump comprising:

first and second U-shaped housing members each having a pair of interfitting leg members forming opposite housing walls and defining an internal pump chamber;

an inlet fitting extending into an opening formed in one of said pair of legs of said first housing member;

an outlet fitting extending into an opening formed in the other of said pair of legs of said first housing member and aligned with said inlet fitting;

a cylindrical sleeve member of non-magnetic material interposed between said inlet and outlet fittings;

a fluid pumping piston member of magnetic material disposed in said sleeve member and reciprocable therein;

spring means bias said piston member in one direction;

an electromagnetic coil member concentrically arranged about said sleeve member and within the internal pump chamber formed by said U-shaped housing members;

said electromagnetic coil operative when energized to produce flux moving said piston against its spring bias; and

one-way check valve means associated with said piston member permitting fluid to flow through said piston in one direction of movement and to block fluid flow through said piston in the other direction of movement.

2. An electromagnetic plunger pump as claimed in claim **1** wherein:

at least one of said first and second U-shaped housing members is made from magnetic flux conducting material forming a flux conducting pole piece circumferentially and on both lateral sides of said electromagnetic coil member.

3. An electromagnetic plunger pump as claimed in claim **2** wherein:

one of said inlet and outlet fittings has a cylindrical sleeve projection extending into said internal pump chamber radially outwardly from said sleeve member and said piston member; and

said fitting member comprised of flux conducting material operative to distribute flux circumferentially and radially outwardly of said piston member for all operating pistons of said piston member.

References Cited

UNITED STATES PATENTS

1,822,242	9/1931	Schöngut	103—53
2,994,792	8/1961	Parker	310—18

ROBERT M. WALKER, *Primary Examiner.*