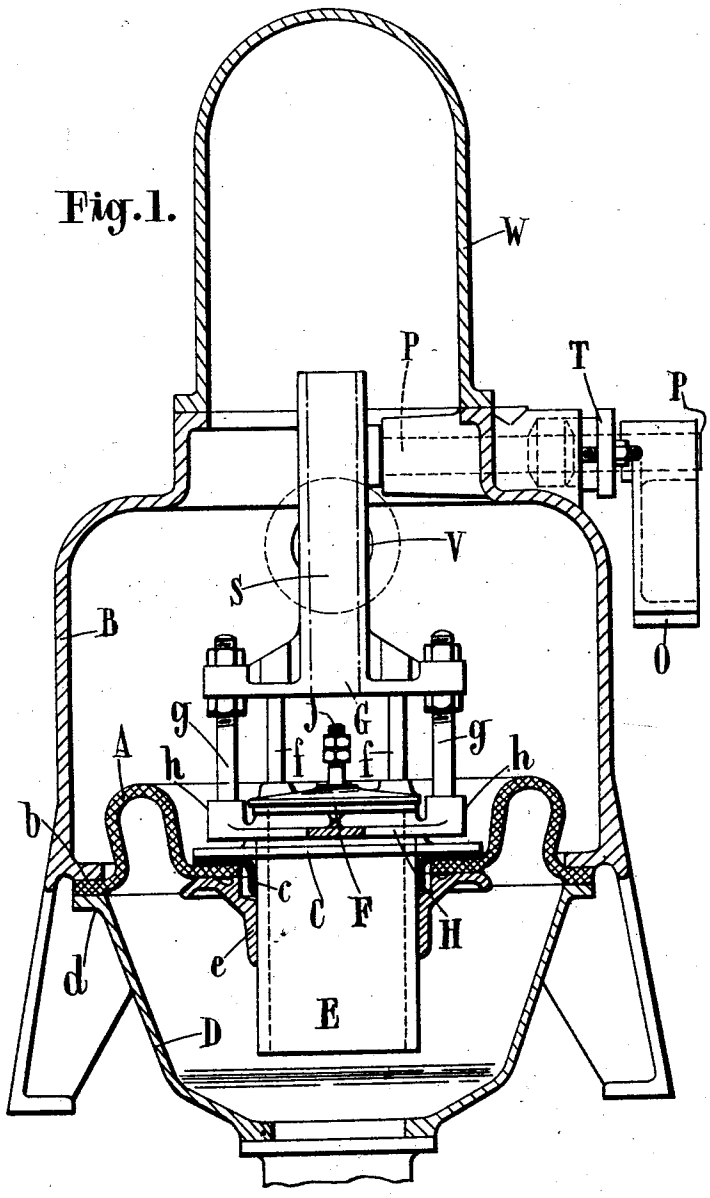
Feb. 21, 1928. 1,659,860

T. D. DENHOLM

PUMP

Filed March 3, 1927 3 Sheets-Sheet 1

Fig. 1.



INVENTOR
T. D. Denholm
BY
ATTORNEY

Feb. 21, 1928. 1,659,860

T. D. DENHOLM

PUMP

Filed March 3, 1927 3 Sheets-Sheet 2

Fig. 2.

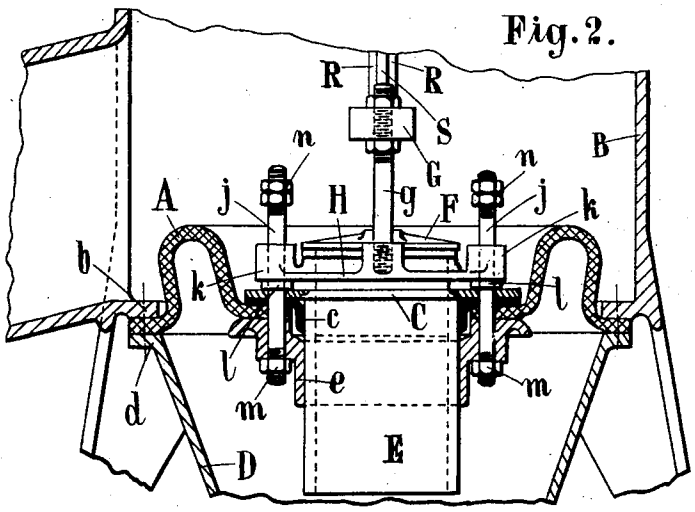
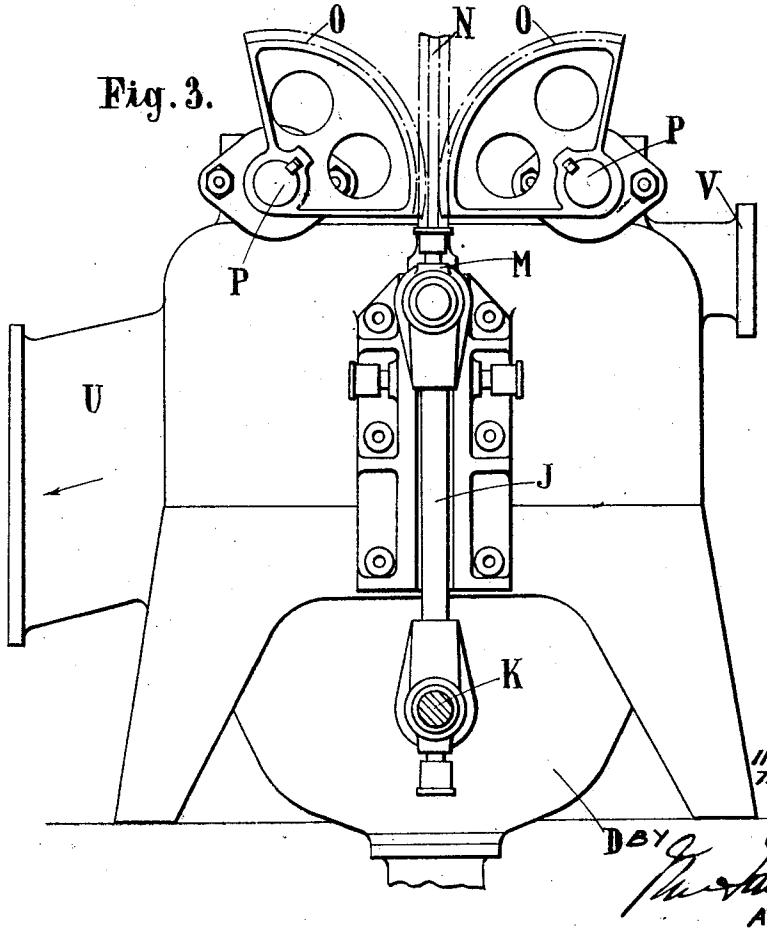


Fig. 3.



INVENTOR
T. D. Denholm

BY

ATTORNEY

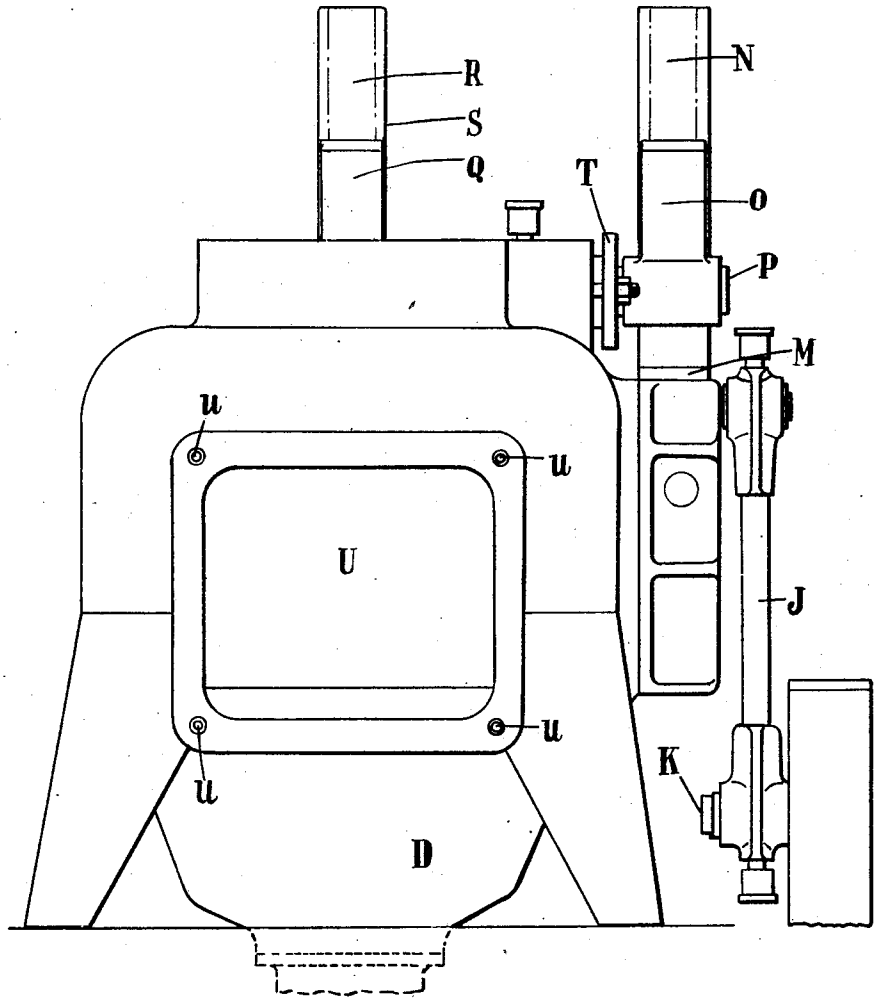
Feb. 21, 1928. 1,659,860

T. D. DENHOLM

PUMP

Filed March 3, 1927 3 Sheets-Sheet 3

Fig.4.



INVENTOR
T.D. Denholm

BY
ATTORNEY

Patented Feb. 21, 1928. 1,659,860

UNITED STATES PATENT OFFICE.

THOMAS DOUGLAS DENHOLM, OF BRIXTON HILL, LONDON, ENGLAND.

PUMP.

Application filed March 3, 1927, Serial No. 172,521, and in Great Britain March 22, 1926.

This invention relates to pumps of the type in which a reciprocating member causes a diaphragm to cause periodic variation in the volume of a chamber thus with the aid of a valve or valves giving a pumping effect—this type will be referred to hereinafter as the reciprocating diaphragm type.

The object of the invention is to provide an improved form of pump of the above type which will be simple in construction, and is particularly applicable for use by contractors who have to deal with the pumping of water, often containing mud, sand and stone, and who require a pump which can be readily adapted for a number of purposes, is robust in construction and can be readily dismantled for the replacing or renewal of worn parts.

A further object is to provide an improved pump provided with a plunger which can move relatively to the diaphragm so that the stroke of the plunger is greater than that of the diaphragm, moreover, the amount of relative movement between the two can readily be adjusted. The reciprocating movement of the plunger is effected through an improved driving mechanism which comprises an external reciprocating member provided with racks on each side engaging oscillated toothed sectors which are mounted on shafts passing through the pump casing through glands; these shafts carry inside the pump casing toothed sectors which engage racks on both sides of the reciprocating member to the lower end of which the plunger is secured.

To enable the pump to be used either as a suction pump or a lift pump a large discharge casing is provided just above the level of the diaphragm, and when the pump is used as a suction pump the water lifted by the plunger and diaphragm on their upward strokes passes out through this casing. A closure plate can be bolted to the outlet face of this casing and connection to a delivery pipe made to a higher outlet for using the pump as a lift pump. In the latter case, an air chamber dome is fitted on the top of the pump casing, the reciprocating member carrying the plunger passing upwards into this air chamber.

With these and other objects such as may hereinafter appear the invention comprises the novel features, arrangements and combinations of parts which are embodied in the form of pump to be described and are pointed out in the claims.

In the accompanying drawings which illustrate one embodiment of the invention,

Fig. 1 represents a transverse section through the pump, certain details of the external driving mechanism shown in Figs. 3, 4 being omitted.

Fig. 2 represents a corresponding view of a portion of the pump on a section taken on a plane at right angles to that on which Fig. 1 is taken.

Fig. 3 represents a side elevation of the pump.

Fig. 4 represents a front elevation of the pump.

Referring to these drawings, a flexible diaphragm A is secured at its outer edge between a flange *b* projecting from the discharge chamber B and a flange *d* formed upon the base D which forms part of the suction or pump chamber.

The diaphragm A, which is shown in its lowest position, is secured along its inner edge between annular members C, *e* which form the guide for a plunger E which is reciprocated by mechanism to be described in detail later; a flanged packing ring *c* acting as a gland is clamped between the annular members C and the diaphragm. The plunger is hollow and has mounted at its top a valve F which may move relatively to the plunger upon guides *f* carried by a cross-head G. Studs *g*, adjustably secured by nuts to the cross head, are fixed into lugs *h* carried by a rim H formed on the upper end of the plunger.

A lost-motion device is provided whereby on the upward movement of the plunger it first slides through the guides *c*, *e* thus moving relatively to the diaphragm, and then moves the diaphragm upwards with it for the remainder of its stroke; on the downward movement the plunger first moves through the guides and then moves the diaphragm with it to the position shown on the drawings. In the form shown this is effected by the provision of bolts *j* which are axially movable through guide lugs *k*, Fig. 2; these bolts are provided with collars *l*, and nuts *m* enable the parts *e*, A, *c*, C to be clamped against these collars. Adjustable nuts *n* are provided on the top of the bolts *j*.

Taking the parts in the lowermost position shown in Fig. 2, the cross-head G on

rising causes the rim H of the plunger to rise and the plunger then moves relatively to the diaphragm until the lugs *k* engage the nuts *n*, whereupon the diaphragm and plunger move together; on the downward movement, the lugs *k* move downward and move the plunger through the guides *e*, *c* until the lugs engage the collars *l*, whereupon the plunger and diaphragm move together.

It will be seen that by removing the nuts *m* and detaching the base D the diaphragm can be removed without disturbing the plunger.

The driving mechanism, Figs. 3, 4, comprises a connecting rod J, driven from a crank pin K, shown at the top of its stroke; the connecting-rod is connected to a vertically-guided cross-head M carrying a double rack N engaging a pair of oscillating sectors O mounted upon shafts P; these shafts pass into the pump casing through glands T and carry similar sectors Q which engage a rack R on each side of the vertical member S which carries the cross-head G.

For use as an ordinary suction pump a discharge casing U is provided; this may be closed by a closure plate secured by bolts passing into holes *u* and the pump can be used as a lift pump and a delivery pipe connected to an upper delivery opening V. An air chamber dome W, Fig. 1, is provided at the top for use when the pump is employed as a lift pump; this dome may be removed when the pump is used for ordinary suction purposes and is not shown in Figs. 3, 4. In each case the pump may be used in conjunction with a suction pipe and inlet valve or foot valve attached to the bottom of the suction chamber as is common practice and requires no special description or illustration.

It is to be understood that the invention is not restricted to the particular construction shown but is intended to cover all constructions coming within the ambit of the following claims and mechanical equivalents of such constructions.

I claim:—

1. A pump having an inlet and an outlet, a diaphragm arranged between the inlet and outlet, a plunger operating through and having sealing connection with the diaphragm, means for operating the plunger, and means to compel a similar movement of the diaphragm following a limited free movement of the plunger.

2. A pump having an inlet and an outlet, an annular diaphragm arranged between the inlet and outlet, a plunger operating through and having sealed connection with the central portion of the diaphragm, means to operate the plunger through a predetermined length of stroke, and means whereby the movement of the plunger compels a similar movement of the diaphragm through a different length of stroke.

3. A pump having an inlet and an outlet, a diaphragm arranged between the inlet and outlet and centrally formed with an aperture, a plunger passing through and having sealed connection with the diaphragm, means for operating the plunger, and means connecting the plunger and diaphragm to permit a limited free movement of the plunger without affecting the diaphragm in each plunger movement.

4. A pump having an inlet and an outlet, an annular diaphragm arranged between the inlet and outlet, a plunger operating through and having sealed connection with the diaphragm, means for operating the plunger through a predetermined length of stroke, and means connecting the plunger and diaphragm to cause the plunger to operate the diaphragm through a length of stroke similar to but shorter than the stroke of the plunger.

5. A pump having an inlet and an outlet, a diaphragm arranged between the inlet and outlet, annular guides secured to the edge of an opening formed in the diaphragm, a plunger reciprocating in said guides and having sealed connection with the diaphragm, and a lost motion connection between the plunger and diaphragm to permit a relatively free movement of the plunger for a portion of each of its strokes and thereafter compel a simultaneous movement of the plunger and diaphragm.

6. A pump having an inlet and an outlet, a main housing carrying the outlet, a suction chamber carrying the inlet, a plunger operable between the inlet and outlet, means for operating the plunger, a diaphragm having its peripheral edge clamped between the main housing and suction chamber, said diaphragm having a sliding connection with the plunger to permit separation of the diaphragm and plunger toward the suction chamber without disturbing the plunger, whereby on removal of the suction chamber the diaphragm is separable from the plunger and housing to render the plunger accessible from the suction side of the pump.

7. A pump including an inlet and an outlet, a diaphragm arranged intermediate the inlet and outlet, a plunger operating through and having sealed connection with the diaphragm, and means connecting the plunger and diaphragm to permit a relatively free movement of the plunger for a portion of its stroke and thereafter compel a similar movement of the plunger and diaphragm for the remainder of the plunger stroke, said means being adjustable to vary the relatively free movement of the plunger with respect to the diaphragm.

8. A pump including an inlet and an outlet, an annular diaphragm arranged between

the inlet and outlet, a plunger passing through the center of the diaphragm, means to reciprocate the plunger through a predetermined length of stroke and to reciprocate the diaphragm through a shorter length of stroke, said means including a member fixed with relation to the diaphragm, a member fixed with relation to the plunger, bolts carried by one of said members and slidable in the other member, and nuts on said bolts to limit the relative movement of the members.

In testimony whereof I affix my signature.

THOMAS D. DENHOLM.