Aug. 7, 1928.

W. B. CROFTON

1,680,089

DIAPHRAGM PUMP

Filed Jan. 15, 1927

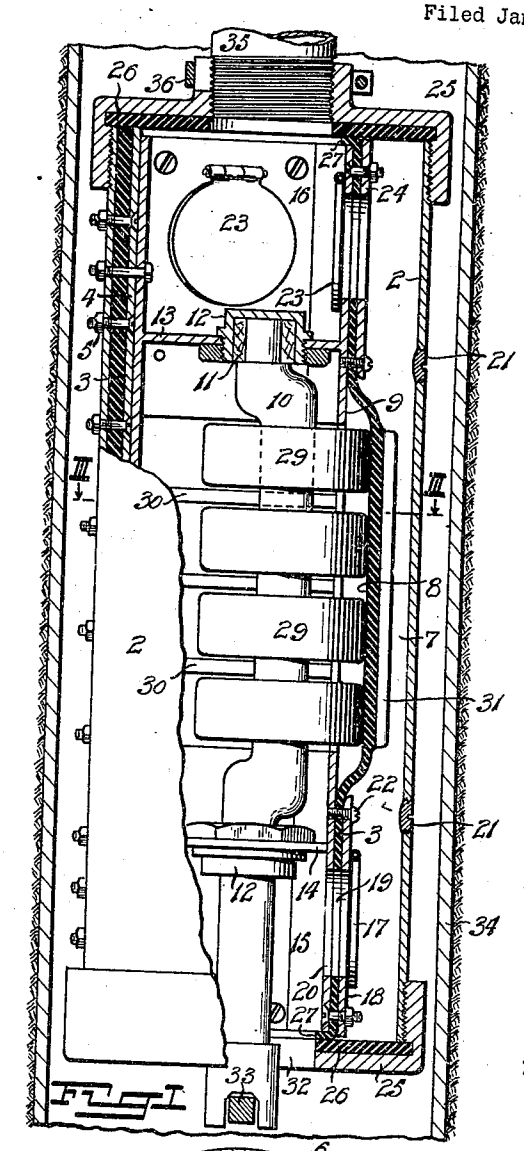


Fig I

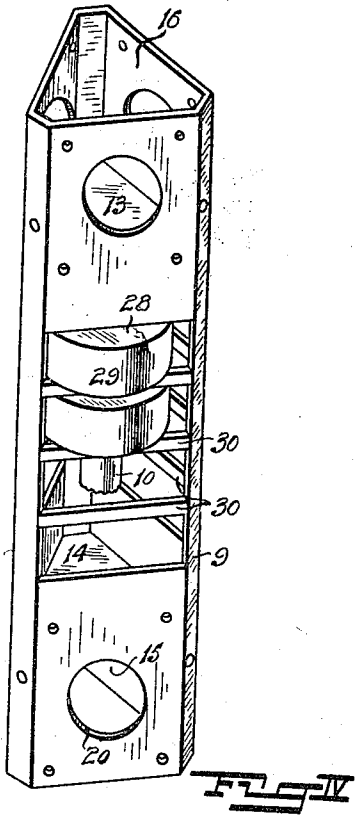


Fig IV

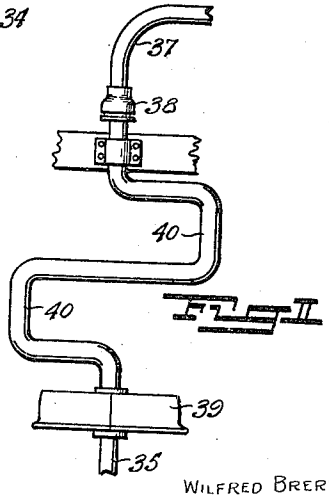


Fig II

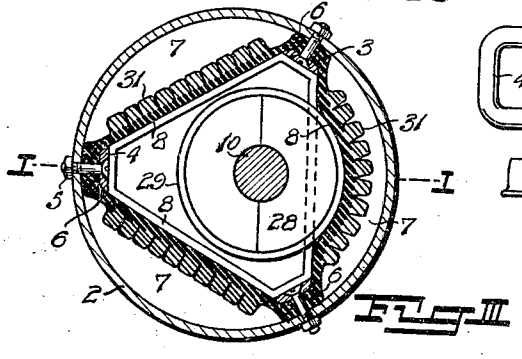


Fig III

WILFRED BRERETON CROFTON
INVENTOR:
By Otto Munn
his Attorney.

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# UNITED STATES PATENT OFFICE.

WILFRED BRERETON CROFTON, OF JOHANNESBURG, TRANSVAAL, SOUTH AFRICA.

## DIAPHRAGM PUMP.

Application filed January 15, 1927, Serial No. 161,322, and in Union of South Africa November 8, 1926.

The present invention relates to diaphragm pumps an object of the invention being to provide a pump of this class suitable for a bore hole pump.

A bore hole pump constructed according to the invention is illustrated in the accompanying drawings in which

Fig. I is an elevation, partly sectioned on I—I Fig. III.

Fig. II is a continuation of the upper part of Fig. I, drawn to a reduced scale.

Fig. III is a cross section on III—III Fig. I.

Fig. IV shows the inner assembly of the pump detached.

2 indicates a cylindrical casing in which is mounted the diaphragm member 3. Said member consists of a triangular rubber tube flattened at the corners, which are secured to the inside of the casing 2 by bolting strips 4 and bolts 5. The corners are reinforced by such means as inserted fabric 6 to protect them against the pressure and flexing which takes place there. The segmental cavities 7 between the casing 2 and the sides of the triangular tube are the pump chambers; the normally flat faces of the tube constituting the diaphragms 8 which are periodically flexed to vary the volume of the pump chambers.

The inner assembly of the pump—shown separately in Fig. IV—comprises a triangular frame 9 which fits within the tube 3. Said frame carries the crank shaft 10, rotatably mounted in bearings 11 which may be of hard wood fixed in caps 12 removably screwed into partition plates 13, 14 forming part of the frame. The diaphragms are comparatively narrow in the direction of the movement of the rollers over them in order to minimize their tendency to form an outwardly bulging wave ahead of the roller, which lessens the displacement of the pump and also tends to injure the rubber.

The end of the frame below the partition 14 forms the common inlet chamber 15 for the several pump chambers; and that above the partition 13 similarly forms the outlet chamber 16. For each pump chamber there is an inlet valve 17 mounted on a plate 18 having a valve aperture 19 corresponding to the valve aperture 20 in the frame 9. The plate 18 clamps the rubber of the tube 3 between itself and the frame 9 to make a water tight joint around the apertures 19, 20; plugs 21 being provided where necessary in the casing to give access to the bolts or screws 22.

An outlet valve 23 is also provided for each pump chamber 7, on the inside of the frame, a clamping plate 24 being secured on the outside thereof. The several clamping plates 18, 24 are positioned and secured after the frame 9 has been inserted into the tube 3.

At the ends of the casing are screw caps 25 fitted with packing 26 for closing the ends of the pump chambers 7. The tube 3 is formed at each end with an inward flange 27 which comes between the end of the frame 9 and the packing 26 to prevent leakage between the frame 9 and the tube 3; said flanges 27 being flexible to permit the frame to be inserted into the tube.

On the crank 10 are mounted rollers which consist of wooden discs 28 halved for assembly on the crank, and rims 29 which hold the halves together in position and are of sufficient diameter to be threaded onto the crank from the end. The rollers are spaced apart by bars 30 forming part of the frame 9 and welded or otherwise secured to the frame corners after the rollers are in position.

The bars 30 also constitute a series of spaced supports for the outer face of the diaphragm which also help to prevent the formation of the aforesaid wave in the rubber. When heavy pressures are to be dealt with the diaphragms are further stiffened by forming on their inner faces a number of ribs 31 which may be of hard rubber vulcanized to the soft rubber of the diaphragm. These ribs extend longitudinally and form with the bars 30 a supporting system for the diaphragm equivalent to a system of beams and rafters. They open out fanwise when the diaphragm is flexed, as shown at the right hand side of Fig. III, but close together laterally and form a rigid block as indicated at the left hand side of the same figure, when the diaphragm flattens again.

The lower end of the crank shaft extends through the opening 32 in the lower cap 25 through which the water enters the pump. It is forked and fits over a bar 33 or other fixture in the bore hole casing 34; or is otherwise held against rotation.

The delivery pipe 35 is screwed into an axial socket in the upper cap and secured by a clamp 36. Said pipe extends to the surface and connects with a fixed delivery pipe 37, (Fig. II) by means of a stuffing

box 38. Any suitable means for rotating the pipe 35 and thereby driving the pump, is employed; such as the split pulley 39 clamped to the pipe and connected by a belt to an appropriate motor.

There is also shown a hand actuating arrangement comprising a portion of the pipe bent to form a pair of hand cranks 40. The vertical rotational drive moreover renders the apparatus suitable to be driven by a horizontal wind wheel of which various forms are known and which may be connected directly to the pipe.

In the operation of the device the rotation of the pump casing structure brings the crank rollers 29 successively into engagement with each diaphragm 8 as indicated at the right hand side of Figs. I and III; liquid is thereby forced out of the pump chamber 7 with which such diaphragm is associated, past its outlet valve 23 into the chamber 16, and so up the pipe 35 to the surface. Meanwhile liquid flows into the other pump chambers 7 (shown at the left in Fig. III) past their inlet valves 17 and fills said chambers ready for discharge when they, in turn, arrive at the crank.

It will be noted that the direction of rotation is immaterial and that oscillating rotation of suitable amplitude is equally as effective as continuous rotary motion. The oscillating motion may be derived from the form of windmill mechanism usually employed to drive a bucket pump; and in the case of hand actuation it may be applied by a lever clamped to the pipe. The capacity of a pump of a given diameter may be varied as desired by varying its length, without altering the throw of the crank and the consequent flexing of the diaphragm. There need be no metal to metal wearing parts in the pump.

I claim:—

1. In a pump, the combination of a rotatable casing structure providing a pump chamber, a flexible diaphragm forming a wall of said chamber, a fixed crank positioned to flex the diaphragm upon rotation of the casing structure, inlet and outlet valves for the pump chamber, and means to rotate the casing structure.

2. In a pump, the combination of a rotatable casing structure providing a pump chamber, a flexible diaphragm forming a wall of said chamber, a fixed crank journalled in the casing structure and positioned to flex the diaphragm upon rotation of the casing structure, inlet and outlet valves for the pump chamber, a delivery chamber in the casing structure and a delivery pipe connected to said delivery chamber and constituting a shaft for rotation of the casing structure.

3. In a pump, the combination of a rotatable casing structure providing a plurality of pump chambers, flexible diaphragms each forming a wall of a pump chamber and arranged equidistantly about the axis of the casing structure, a fixed crank axially journalled in the casing structure and positioned to flex the diaphragms in turn as the casing structure rotates, an inlet valve and an outlet valve for each pump chamber, a common delivery chamber for all the pump chambers, and a delivery pipe connected to said delivery chamber and constituting a shaft for rotation of the casing structure.

4. In a pump, the combination of a casing structure providing a pump chamber, a flexible diaphragm forming a wall of said chamber, a crank rotatable relatively to the casing structure and adapted to flex the diaphragm, and spaced means at the crankward face of the diaphragm to support the same against bulging.

5. In a pump, the combination of a casing structure providing a pump chamber, a flexible diaphragm forming a wall of said chamber, a crank rotatable relatively to the casing structure, rollers on the crank adapted to roll on the diaphragm and spaced members supporting the face of the diaphragm and separating the rollers from one another.

6. In a pump, the combination of a casing structure comprising an outer casing and a removable inner frame, flexible diaphragms supported by the outer casing and the inner frame, and forming with the outer casing a plurality of pump chambers, and a crank journalled in the inner frame and co-operating with the diaphragms to flex the same.

7. In a pump, the combination of a cylindrical outer casing, a polygonal flexible tube the normally flat sides of which form with the casing segmental pump chambers, a similarly polygonal frame within and supporting the tube, and a crank journalled in the frame and adapted to flex the sides of the tube.

In testimony whereof I affix my signature.

WILFRED BRERETON CROFTON.