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(12) # EUROPEAN PATENT APPLICATION

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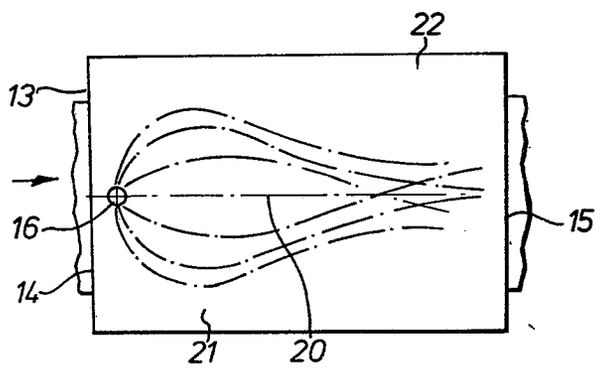
(54) **Oscillatory pump which can be used in pipelines.**

(57) The pump comprises a housing 13 defining a pump chamber which is divided into two compartments 21, 22 by a planar pumping element 20, extending substantially the full width of the chamber. The element is mounted along one edge on a shaft 16 and extends between an inlet 14 and an outlet 15. The element is made of a flexible material, so that, when the shaft is rotatably oscillated, the element flexes into an arched shape as shown. This flexing action acts to pump fluid with a substantially constant thrust.



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TITLE MODIFIED
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"PUMP"

This invention relates to oscillatory pumps.

Existing pumps usually impart a rotary motion to the fluid being pumped, or force the fluid through constricted channels. For some fluids, this can be disadvantageous and there can be high energy losses due to friction.

It is well known to provide positive-displacement pumps, e.g. for pumping concrete, which have a movable rigid flap and inlet and outlet valves. Such pumps have a discontinuous action and the fluid is forced through the constricted apertures of the valves. As a result the pumps are inefficient, especially with highly viscous fluids, and are unsuitable for fluids containing solids, both because of the constrictions and because the pumps apply varying thrust to the fluid.

The present invention provides a pump having a housing provided with an inlet and an outlet, a substantially flat pumping element movably mounted within the housing and extending between the inlet and the outlet, and means for producing oscillatory motion of the element about an axis in the plane of the element, the element being flexible, so that, in use, the element arches to effect a pumping action.

Reference is now made to the accompanying drawings, wherein:-

Figure 1 is a diagrammatic perspective view of a pump according to the invention with its housing partly broken away for clarity and mounted in a pipeline;

Figure 2 is a diagrammatic perspective view of the pump showing drive means therefor;

Figure 3 diagrammatically illustrates operation of the pump; and

Figure 4 is a diagrammatic perspective view of

another embodiment of the invention.

Figures 1 and 2 show the pump 11 mounted in a pipeline 12. The pump comprises a housing 13 of rectangular cross-section, the pipeline having sections communicating with two opposite sides of the housing at an inlet 14 and an outlet 15. A shaft 16 is mounted transversely of the pipeline, in the housing 13, and is journalled in bearings 17 in walls of the housing. The shaft has a co-axial extension 16a externally of the housing. The shaft is positioned adjacent the inlet 14 and flat pumping element 20 is secured to the shaft. The pumping element is in the form of a flexible plate-like member whose degree of flexibility is determined according to the viscosity, or other properties of the liquid, or other fluid material in the pipeline. The element 20 partitions the housing into two compartments 21, 22, both of which communicate the the inlet with the outlet.

In operation, the shaft 16 is oscillated to produce flexing motion of the pumping element 20 sufficient to cause arching of the element without collapse of the element. This flexing motion is illustrated in Figure 3. As can be seen in this Figure, upward flexing of the pumping member tends to force fluid in the upper compartment 22 towards the outlet 15, whilst the lower compartment 21 is enlarged, so that fluid is drawn in through the inlet 14. During downward flexing, the reverse occurs, so that the fluid is pumped in the direction of the arrows in Figure 3.

The flexing of the pumping member, during oscillation, causes a standing wave to pass down the flexible member, the amplitude of the wave increasing along the member. The amplitude is, however, constant across the width of the member (i.e. parallel to the axis of oscillation). A uniform thrust is therefore imparted to the fluid being pumped and continuous flow of the fluid is produced. This

is in distinction from a movable rigid flap, which provides for intermittent displacement and discontinuous pumping. This continuous pumping is highly advantageous with highly viscous fluids to facilitate high efficiency pumping.

As shown in Figure 2, in this example, the shaft extension 16a is driven by a motor 26 through a gear box 27 and a crank mechanism 28.

The shape of the housing and of the pumping element need not be as described, other cross-sections being possible.

The pump may be operated either as a high head, low capacity pump or, as a low head, high capacity pump. This is achieved by controlling the stroke of the pumping element and its frequency of oscillation.

The drive need not be connected through the shaft, but can be connected directly to the pumping element. Also, it is not essential for the shaft to be at an edge of the pumping element and the shaft may be spaced from the edges.

An alternative manner of driving the element is shown in Figure 4. The pumping element 20 is again mounted at one edge on a pivoted shaft 16 in bearings 17. A pair of co-axial cylindrical bosses 30a, 30b is provided, the bosses projecting outwardly from opposite sides of the pumping element with their common axis parallel to and spaced from the axis of the shaft 16. The bosses are contained within the housing 13. A driven shaft 31 is journalled in opposite bearings 32 in the housing 13 and extends above and parallel to the common axis of the bosses 30a, 30b within the housing. The shaft 31 carries eccentrics 34 and each eccentric is slidably rotatably received in a strap 35 at one end of a corresponding link 36. Each link pivotally receives a corresponding one of the bosses 30a, 30b.

In operation, the driven shaft 31 is rotated, for example, by being connected to the output of a gear box (not shown), in turn connected to a drive motor (not shown). Rotation of the shaft 31 causes reciprocation of the links 36 through the eccentrics 34, so that the pumping element 20 is oscillated about the axis of its shaft 16.

According to the purpose for which the pump is intended, the pumping element may be made in varying sizes and thicknesses and of materials of different flexibilities. For example, it is envisaged that for pumping treacle or a like fluid, the element may be made of steel plate, perhaps 1/16 inch thick. On the other hand, for use with an alcohol fraction, the element may consist of a few laminated sheets of the thickness of thin paper.

The pump may be especially useful for pumping fluids consisting of solids in suspension in a liquid.

With the above described pump, the fluid being pumped is not forced through constricted apertures or channels and there is no rotation of the fluid, so that friction losses are smaller than with conventional pumps and there is less risk of breaking up any solids being pumped, where this is undesirable. Cavitation is also avoided, with the loss of efficiency and possible pump damage that this causes.

CLAIMS.

1. An oscillatory pump having a housing provided with an inlet and an outlet, a substantially flat pumping element movably mounted within the housing and extending between the inlet and the outlet, and means for producing oscillatory motion of the element about an axis in the plane of the element, characterised in that the element (20) is flexible, so that, in use, the element arches to effect a pumping action.

2. A pump according to Claim 1, characterised in that the pumping element is pivotally mounted about an axis (16) which is offset from the centre of the element.

3. A pump according to Claim 2, characterised in that the axis (16) is adjacent an edge of the element.

4. A pump according to any preceding Claim, characterised in that the pumping element is mounted on a shaft (16) having a portion (16a) extending to the exterior of the housing, and said means for producing oscillatory motion (26, 27, 28) of the pumping element is connected to said shaft portion (16a).

5. A pump according to Claim 4, characterised in that said means for producing oscillatory motion of the pumping element includes a drive motor (26) and a crank mechanism (28) between the motor and said shaft portion (16a).

6. A pump according to any one of Claims 1 to 3, characterised in that said means (34, 35, 36) for producing oscillatory motion of the pumping element is connected to the element at a position (30a) spaced from said axis (16).

7. A pipeline including a pump according to Claim 1 mounted therein and a non-gaseous fluid in the pipeline.

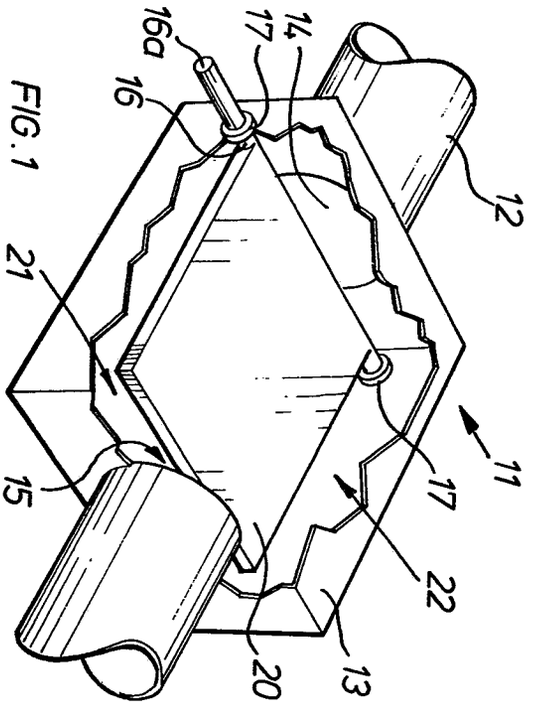

FIG. 1

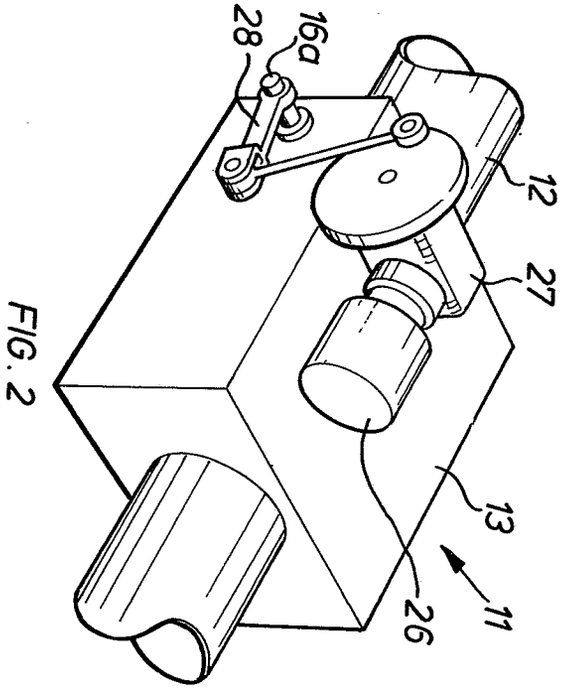

FIG. 2

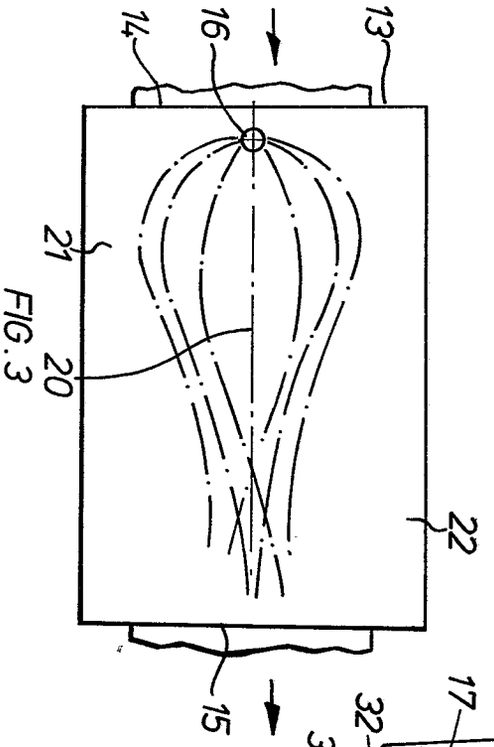

FIG. 3

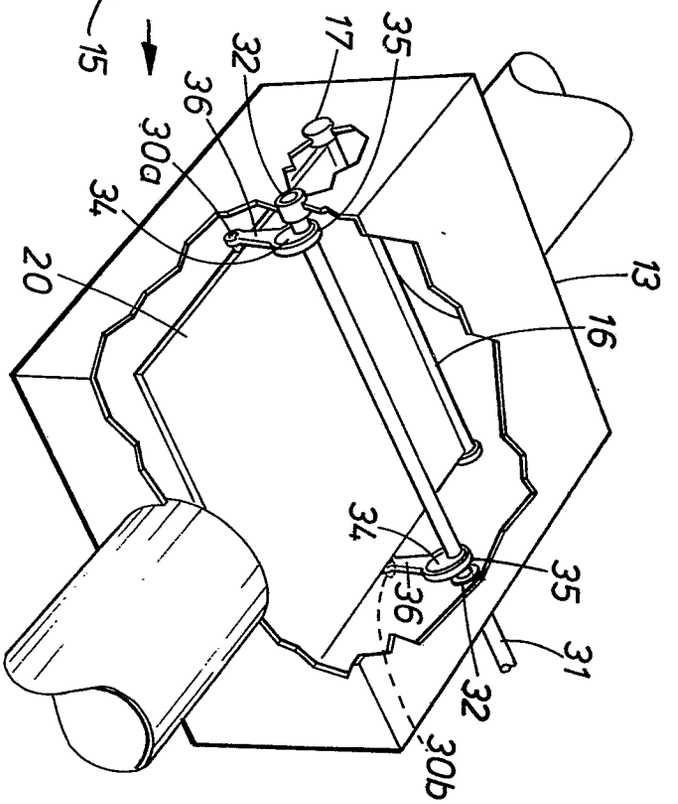

FIG. 4

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EUROPEAN SEARCH REPORT

0050169
Application number
EP 80 30 3665

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim
X	GB - A - 1 291 576 (BALFOUR) * the whole document *	1-5
X	FR - A - 1 218 663 (KÜTTNER) * the whole document *	1-6
X	FR - A - 1 472 317 (HERTEL) * page 1, column 1; figure 1 *	1,2,3,6
	DE - A - 1 728 084 (FLYGT PUMPEN) * pages 2-5; figures 1,2,3 *	7

CLASSIFICATION OF THE APPLICATION (Int Cl.³)

F 04 D 33/00

TECHNICAL FIELDS SEARCHED (Int. Cl.³)

F 04 D

CATEGORY OF CITED DOCUMENTS

X: particularly relevant
A: technological background
O: non-written disclosure
P: intermediate document
T: theory or principle underlying the invention
E: conflicting application
D: document cited in the application
L: citation for other reasons

&: member of the same patent family, corresponding document

X The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
The Hague	18-06-1981	WENZEL

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