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(54) **Bore hole pump.**

(57) A helical gear borehole pump in which the outer member, having an internal helical gear form thereon, is used as the rotor and the discharge column 22 is itself rotated. It is dispensive of the need of a drive shaft within the discharge column and this also reduces the pressure drop up the discharge column. The device is particularly suitable for hand operation by means of handle 17.

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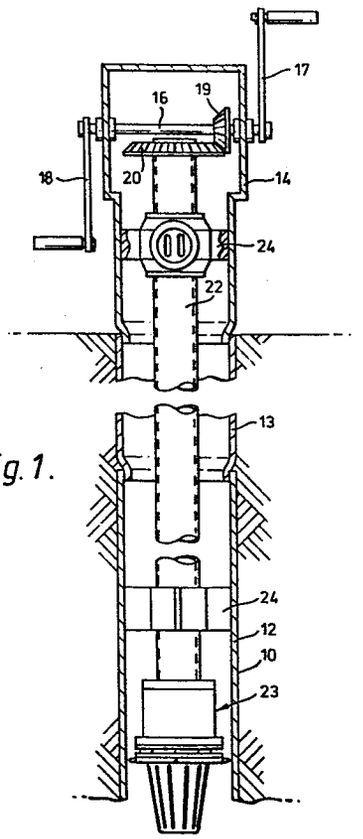

Fig. 1.

DESCRIPTION

"BORE HOLE PUMP"

The present invention relates to borehole pumps.

Various forms of borehole pump have been proposed, including centrifugal pumps having a casing and volute secured to the borehole or its lining and a rotor driven by a drive shaft, axial flow pumps including a rotor having a plurality of spaced impellers intercalated with stator bowls which are secured to the borehole or its lining, and helical gear pumps in which the outer member forms the stator which again is locked to the borehole or its lining.

These pumps have proved reasonly satisfactory when they are motor driven, but the starting torque required if they are hand-operated in remote areas where there is no power supply or where internal combustion engine driving is too expensive, is too high. Furthermore, the losses experienced at the discharge column lead to certain problems.

It is now proposed, according to the present invention, to provide a borehole pump comprising an outer member having an internal helical gear formation thereon, with n starts, an inner member having a complementary external helical gear formation thereon with n + 1 starts, a

substantially vertical tubular discharge column secured to 0095288
the outer member, means to rotate the column about its substantially vertical axis, whereby said outer member also rotates, and means to prevent the inner member from rotating.

Such a structure can be made very simply. It does not require a central drive shaft or bearings within the discharge column and this is of considerable importance in reducing the pressure loss from the helical gear pump to the surface to which the water is being pumped.

Furthermore, because there is no need for a drive shaft or the bearing, the cost of the pump assembly is significantly less. This makes it particularly attractive for use in poorer areas where there is a great water shortage.

The construction is particularly suitable for making the column of simple plastic material tubing. This too can be inexpensive and because of the high moment of inertia of a tube, the torque which it can stand is high as compared with a simple shaft.

The column itself is preferably centered for rotation in the borehole by means of a plurality of axially spaced bearing bobbins. Such bearing bobbins are conventionally applied between the discharge column and the borehole or its lining and so the provision of these as bearings will not affect the cost price significantly.

The means to rotate the column in an advantageous construction comprises at least one manually operable hand wheel or crank rotatable about a horizontal axis and gearing to convert the rotation of the hand wheel or crank about a horizontal axis to a vertical axis of rotation. Suitable gearing would be, for example, bevel gearing or where it is desired to reduce the hand torque as much as possible, one could use a worm and worm wheel.

The rotating column may discharge to the exterior simply by leaving its upper end open, means being provided to collect the water discharging from this upper end. Alternatively, a rotatable pipe coupling is provided at the upper end of the column, so that water pumped up through the column may leave via a stationary pump.

In order that the present invention may more readily be understood, the following description is given, merely by way of example, reference being made to the accompanying drawings, in which:-

Figure 1 is a schematic cross-section through one embodiment of borehole pump according to the invention;

Figure 2 is an enlarged cross-section through the lower part of the pump of Figure 1 illustrating the rotation arresting device; and

Figure 3 is a section on the line III-III of Figure 2.

Referring first to Figure 1, there is illustrated a borehole pump inserted in a borehole 10 provided with a lining 12 made up of a string of lining pipes 13. The lining pipe is provided with a housing 14 which is located above the ground and includes a horizontal shaft 16 with a crank handle 17,18 at each end. Also mounted on the shaft is a bevel gear 19 meshing with a further bevel gear 20 which is rotatable about a vertical axis.

The bevel gear 20 is secured against rotation with respect to the discharge column 22 of the pump indicated by the general reference numeral 23 at the lower end. In order to centre the discharge column in the lining 12, there are provided a plurality of axially spaced bearing bobbins 24.

Now it will be appreciated that when the handles 17,18 are rotated, the bevel gears 19,20 will cause the discharge column 22 to rotate within the bearings 24.

If reference is now made to Figure 2, it will be seen that the lower end of the discharge column is preferably made of a string of plastics tube provided with the conventional screwthreads at each end.

The helical gear pump 23 is of the "wobbly stator" type but in which the inner member 26, which is provided with an external helical gear formation 27 thereon, is fixed and the outer member 28 having an internal helical gear formation 29 thereon of complementary shape to that of the

gear formation 27, is mounted on a boot 30 which is capable of flexing. Thus, when the drive shaft 22 is rotated, the outer member 28 instead of being a "stator" is a rotor and the inner member 27 is the stator. The flexible boot provides the necessary orbiting action inherent in these helical gear pumps.

A radial flange 31 on the boot 30 is clamped between a radial flange 32 on the lower end of the lowermost column pipe 22 and the upper edge of a barrel 33.

In order to clamp these parts together, a threaded cap 34 is screwed onto the upper end of a support tube 35. The connection provided by the cap 34 is such as to enable the tube 22, the outer member 28 and the barrel 33 all to rotate relative to the support 35.

At its lower end the support 35 is bolted onto an upper ring 40 of the rotation arresting device, this ring having three arcuate circumferentially spaced slots 41 (see particularly Figure 3). Extending downwardly within each slot 41 is a pivot pin 42 which is threaded in to a lower ring 43.

Each pivot pin 42 forms the pivot of a pawl 44. Figure 3 illustrates the pawl 44 in a retracted position, and the pawl at the lefthand side is shown in phantom in its active position. The outer edge of each pawl is serrated for a reason which will become clear below.

Secured to the lower surface of the upper ring 40 are three cam members 45 positioned to abut the inner surface of each pawl in a manner to be described later.

The lower ring carries four radially extending vanes 50 having a circumferential foot 51.

Secured to the one of the rings, and as illustrated the lower ring 43, is the lower end of the inner member 26 of the helical gear pump, this being provided with a thread 52 engaged in a threaded hole in the ring 43 and a locknut 53. The two rings are each provided with a plurality of circumferentially spaced holes 54.

Secured by means of bolts 55 to the lower surface of the lower ring 43 is a conventional strainer 56, and if desired, a foot valve (not shown).

In use, one could lower the helical gear pump 23, the strainer 56 and the arresting device 40, 54 into the borehole steadily by introducing the discharge column sections 22 in turn. Eventually when the pump has reached the water, the top section and its associated housing 14 are secured in place. At this time, the pawls 44 will be in the retracted position and this will not cause any problem in lowering the assembly into the bore hole lining.

The handle 17, 18 is then operated to cause the pump to rotate in the direction of the arrow 60 shown in Figure 3. This rotation initially will cause the pawls 44 to move out slightly due to centrifugal action. At the

same time the vanes 50 moving in the water at the bottom of the borehole will tend slightly to restrain the movement of the lower ring 43 so that it will move, in effect, relative to the upper ring in an anticlockwise direction as viewed in Figure 3. Because the pawls 44 have moved slightly upwardly under centrifugal force, the cam surfaces 45 will be able to engage against the inner curved surface of the pawl and the slight relative movement will urge the pawls outwardly to their fully active position in which the serrated ends thereof engage on the lining 12 or the borehole itself, if there is no lining at this stage.

The effect of this will be to cause the two rings 40, 43 to lock against rotation, thus locking the inner member 26 of the helical gear pump against rotation. The relative movement between the rotating outer member 28 and the inner member 26 will cause the pump to operate.

Because there is no other drive shaft, there is no need for the conventional internal bearings or internal drive shaft within the discharge column. This means a significant reduction in cost and a significant reduction in pressure loss. This means that the assembly described can be made relatively cheaply and is particularly suitable for use in rural areas.

C L A I M S

1. A borehole pump comprising an outer member (20) having an internal helical gear formation (28) thereon, with n starts, an inner member (27) having a complementary external helical gear formation thereon with n + 1 starts, a substantially vertical tubular discharge column (22) secured to the outer member, characterised in that means (16-20) are provided to rotate the column about its substantially vertical axis, whereby said outer member also rotates and in that means (40-60) are provided to prevent the inner member from rotating.

2. A borehole pump according to claim 1, characterised in that the column is formed of a plastics material tubing.

3. A borehole pump according to claim 1 or 2, characterised in that the column is centred for rotation in the borehole by means of a plurality of axially spaced bearing bobbins (24).

4. A borehole pump according to claim 1, 2 or 3, characterised in that the means to rotate the column comprise at least one manually operable handwheel or crank (16-18) rotatable about a horizontal axis and gearing (19,20) to convert the rotation of the handwheel or crank about a horizontal axis to a vertical axis rotation.

5. A borehole pump according to any preceding claim, characterised in that the upper end of the rotating column (22) is open, and means are provided to collect water discharging from this upper end.

6. A borehole pump according to any one of claims 1 to 4, characterised in that a rotatable pipe coupling is provided at the upper end of the column, so that water pumped up through the column may leave via a stationary pipe.

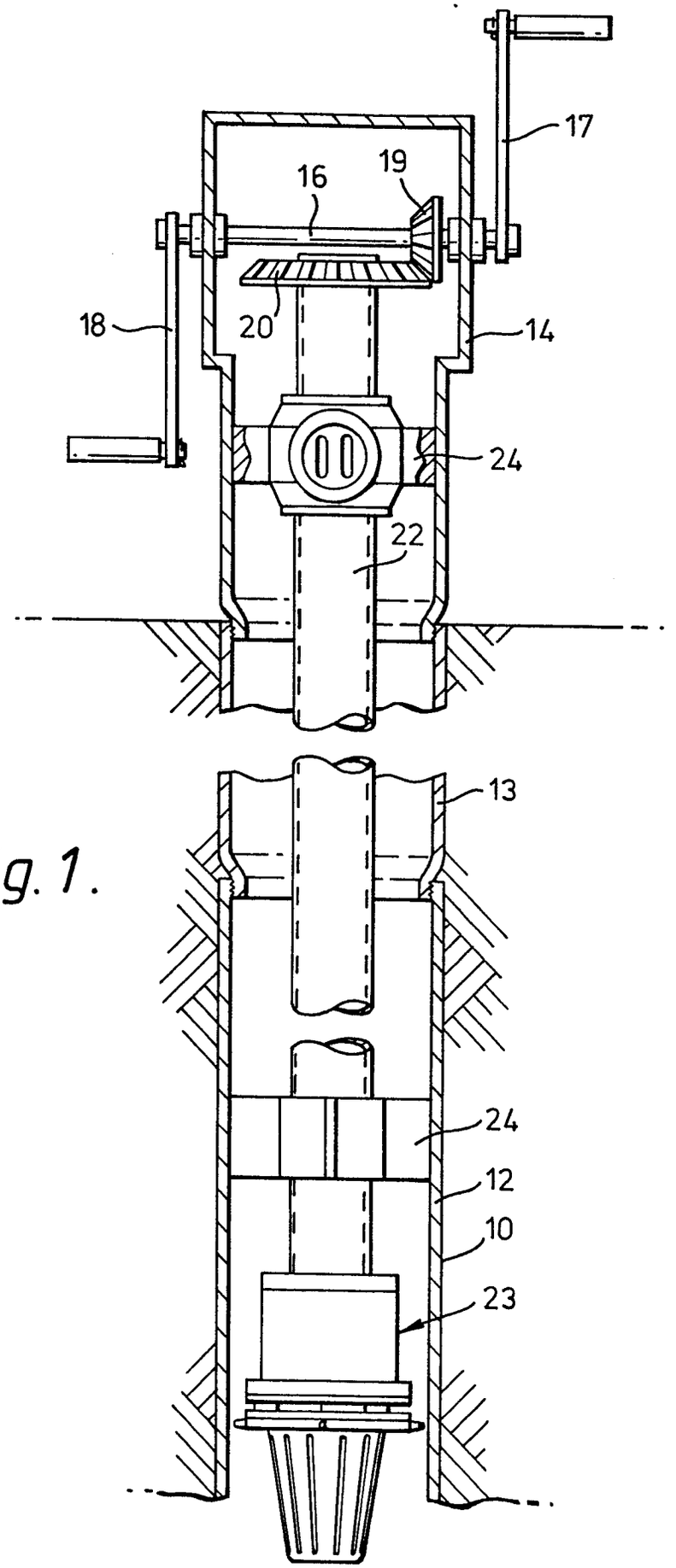

Fig. 1.

Fig. 2.

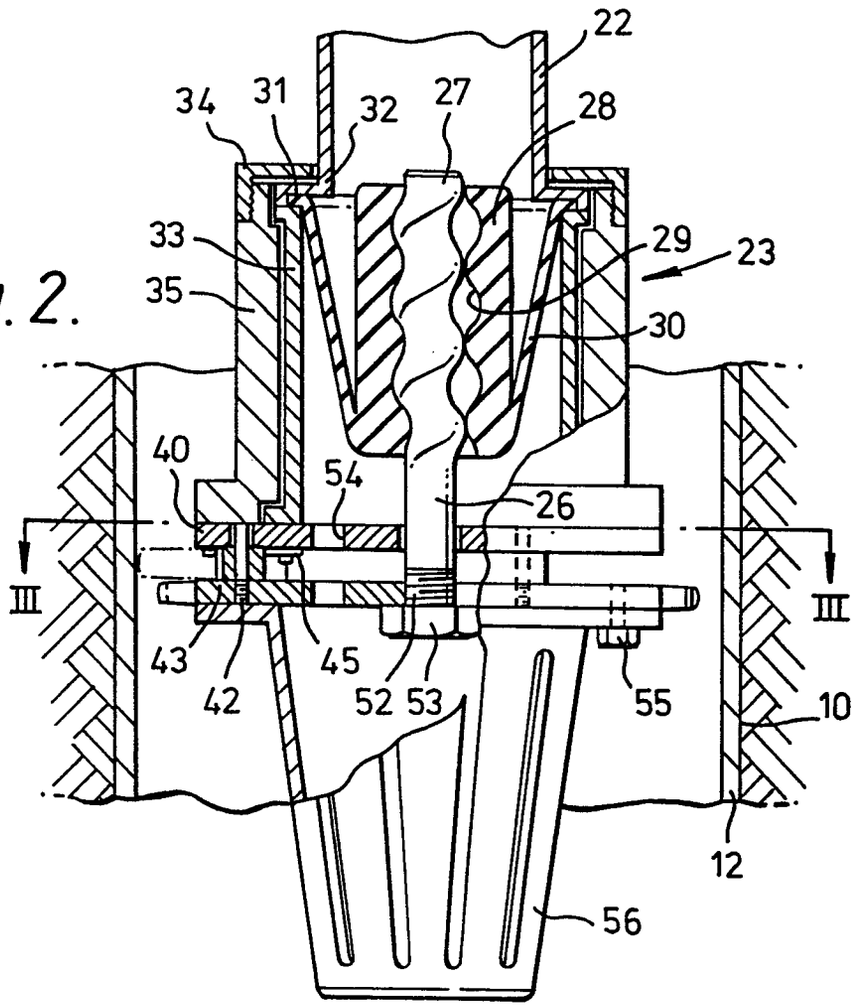
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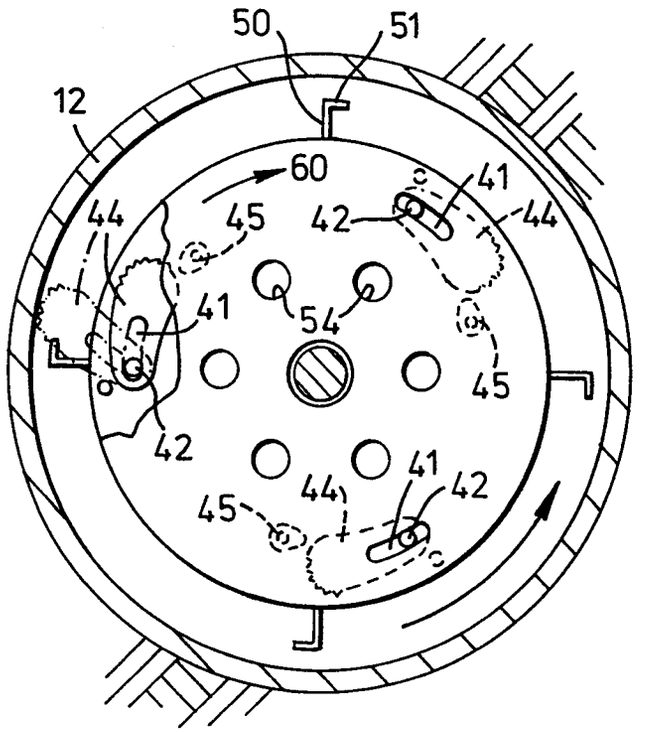
Fig. 3.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EUROPEAN SEARCH REPORT

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DOCUMENTS CONSIDERED TO BE RELEVANT

EP 83302701.4

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int. Cl. ³)
X	GB - A - 1 188 669 (MAGNESITA S.A.) * Page 3, lines 35-110; fig. 1,9 *	1,3,5,6	F 04 C 2/107
A	US - A - 3 932 072 (CLARK) * Column 2, lines 1-45; fig. 1 *	1,3	
A	US - A - 534 428 (P. DEAN) * Page 2, lines 21-42; fig. 1 *	1,4	
A	US - A - 3 195 641 (J.G. BECKER)		

TECHNICAL FIELDS SEARCHED (Int. Cl. ³)

F 04 C 2/00

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
VIENNA	24-08-1983	WITTMANN

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
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