A piston pump for submerging in an oil well, consisting of four pistons that, by means of a fixed interlock (105) between two opposing pistons and a cog wheel interlock (104) between these and the two other pistons, get two oncoming piston pairs in which the mass forces are balanced. On the suction side, the pump has a valve set with a suction- and pressure valve for each of the cylinders in the bottom section; and, on the drive side, a bistable 3-5 port valve that alternately reciprocates the hydraulic oil flow from the drive unit to the one or the other cylinder pair.
Title: PUMP FOR TAIL PRODUCTION OF OIL.

Abstract: A piston pump for submerging in an oil well, consisting of four pistons that, by means of a fixed interlock (105) between two opposing pistons and a cog wheel interlock (104) between these and the two other pistons, get two oncoming piston pairs in which the mass forces are balanced. On the suction side, the pump has a valve set with a suction- and pressure valve for each of the cylinders in the bottom section; and, on the drive side, a bistable 3-5 port valve that alternately reciprocates the hydraulic oil flow from the drive unit to the one or the other cylinder pair.
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For two-letter codes and other abbreviations, refer to the “Guidance Notes on Codes and Abbreviations” appearing at the beginning of each regular issue of the PCT Gazette.
PUMP FOR TAIL PRODUCTION OF OIL

The invention concerns a piston pump for oil production from oil wells having low pressure.

The typical oil well in the North Sea, for example, firstly has an overpressure phase in which the oil in the structure possesses such a high pressure that it flows up through the production tubular by itself. This phase may last for some years, but gradually the pressure decreases sufficiently low for the well not to be self-producing any longer. At this stage, however, large amounts of oil remain in the structure, often as much as 80% of the total. There are mainly three methods of recovering more of the remaining amount. One method consists in gas injection down into the annulus, causing gas and liquid to flow out in a manner similar to that of a coffee maker. Another method consists in injecting water into the structure, thereby increasing the pressure therein. The third method consists in introducing a pump down in the drilling string and pumping up the oil.

Such a pump must be constructed for usage under extreme conditions. Firstly, the production tubular is of a relatively small diameter; and secondly, it pertains to lifting heights of several thousand meters, hence very high
pressures. Perhaps the biggest problem for today's pumps is
that when the pressure in the oil structure is low, the
amount and volume of gas in the oil will increase steadily,
and the existing pumps do not function when the gas volume
exceeds even a relatively small percentage amount.

Usually, these pumps are constructed with a large number of
axial pumps on a long, joint shaft and have a motor either
below or above the very pump that may be 10-20 meters long.

Onshore, for example well known from the USA, piston pumps
are used in relatively shallow wells. The piston then is
generally run up and down with a wire attached to an
eccentric shaft. A pulsating oil flow, having delivery each
time the piston moves upwards, is then achieved. This is
acceptable when the oil column is this short.

Piston pumps are pressure-powerful in a single step and may,
under certain conditions, handle a relatively large amount of
gas together with liquid and should, based on this, be ideal
for recovering a maximum amount of oil from deep wells having
low pressures in the structure. Publications NO 305 667;
US 3,625,288; US 4,268,277; US 4,536,137 and GB 2 100 362
disclose pumps based on pistons.

In deep wells, such as those in the North Sea and other
offshore regions, oftentimes the length of the drill string
is many kilometres, and commonly the geographic lifting
height may be 3-5000 meters. Pumping under such conditions
requires the oil column above the pump to flow relatively
evenly; otherwise the acceleration forces will become
unrealistically high.
The object of invention is a piston pump for submerging in a drilling pipe, in which the pump will produce a relatively even oil flow; tolerate relatively large amounts of gas during induction; and simultaneously having a pump with no or very small and free mass forces that produce vibration.

The pump according to the invention is shown in fig. 1 and consist of, from bottom, a suction mouth piece (1), a valve housing (2), a pump cylinder section (3), an interlock section (4), a drive cylinder section (5), a control valve housing (6) and also a hydraulic drive unit (7) on top.

As disclosed in fig. 2, the pump has four pistons, each respective end having a pump piston (101) and a drive piston (101). It is further disclosed that two of the radially opposing shafts (102) of the one piston pair is mechanically connected by means of a linkage (105), hence move axially alike. The two other piston pairs are connected with the two preceding ones at cog wheel (104) and therefore will have to move in the opposite direction of these. This provides full balancing of the mass forces in the pump at the same time the volume flow becomes relatively constant, even though a pressure surge will arise when the pistons reciprocate. On the drive side, the oil channel of the cylinders is placed below the top of the cylinder, thereby allowing the piston to stop against an oil pillow and not mechanically. In turn, the pressure surge in this oil pillow is used to rearrange a bistable 3-5 port valve that reciprocates the oil flow of the pistons. Thus, the drive unit has an even oil flow through its pump.
Claims

1. A piston pump for submerging in an oil well, characterised in that it has four pistons (101) that, by means of a fixed interlock (105) between two opposing pistons and a cog wheel interlock (104) between these and the two other pistons, get two oncoming piston pairs.