

Double acting reciprocating pump⁶⁵

CONSOLATION

Manubha Vaduji Jadeja (41), known by the nickname of Budhubha, hails from a farmer's family of Mundra Taluka of Kutchh district, Gujarat. Manubha has also served as the Vice Sarpanch (deputy head) of the gram panchayat (village council) for about a year and a half. Manubha's family consists of his wife and two sons.

Genesis

In the monsoon-dependent Indian scenario, equipment for lifting water from the ground plays an important role in farming. As farmers face acute water scarcity due to the falling water table, accessing under ground water through an efficient reliable pump has become imperative. Having had first hand experience both in farming and in motor rewinding, Manubha knew that drawing groundwater by using submersible pumps was an unreliable and expensive proposition. This made him search for an alternative to draw the groundwater with lesser recurring cost and which small farmers could afford. Initially he started working on the single acting reciprocating pump. But discharge level of this kind of pump is very low and it also has fluctuating discharge because one stroke is idle out of two strokes in a cycle. Realising this limitation, Manubha thought of making both the strokes effective. The main problem he faced was in getting the parts most of which were not available readymade and so he had to get the parts fabricated and assemble the pump. Of particular challenge was the task of obtaining quality weld joints without losing mechanical alignment. Finally after about two years of hard work, he

developed the innovative concept and working prototype. The cost of the pump without motor would be about Rs. 8,000 for 6" bore diameter and Rs.2500 for 3" bore.

The innovation

This innovation comprises a water lifting pump adapted to be operated by means of a prime mover through a balancing mechanism. It can be mainly classified as having two parts i.e. a pumping unit and a lifting mechanism

The pumping unit

The pumping unit consists of the piston, cylinder (Bi-housing body), valves, oil seal, sleeve, compression ring, piston rod and suction and discharge pipes. The pump works on the principle of reciprocation of the piston and the cylinder. Creation of vacuum resulting in suction and compressing of the water resulting in discharge is the basic principle of operation. Each cycle consists of two strokes. Both the strokes are effective and hence it is known as a Double Acting Reciprocating Pump.

Lifting mechanism

The lifting mechanism consists of the crank, coupler, walking beam and



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connecting rod. Prime mover (electric power or diesel engine), belt and pulley, revolute joints and bearings are also the accessories of the mechanism. The mechanism works on the principle of four-bar linkage mechanism having single degrees of freedom and there is a provision of balancing the load in the mechanism.

Functioning

Using two chambers in the cylinder as well as a creative arrangement of valves, double acting is achieved. This water lifting pump can be installed in the well bore or any other suitable water source simply by increasing the length of the piston rod of the pump. Manubha has also developed an idea of balancing mechanism in this pump. In the conventional pump, weight of the piston rod remains unbalanced and so during upstroke, the lifting mechanism needs to carry the extra load of the piston rod. However during the down stroke the piston rod reduces the required workload. But, due to this, the total system suffers from an unbalanced load distribution throughout the cycle. By introducing the balancing mechanism, the innovator has introduced a system, where throughout the cycle, the load is uniformly distributed. Adjusting the weight of the balancing mechanism enables the smooth operation of the pump.

Advantages

This pump has a discharge of 220-litre/ min at a water head (discharge) of 18 metres. Unlike the single acting reciprocating pump, in this pump, both the strokes are effective and thus gives continuous water supply with no fluctuation in discharge. This pump can be operated by electricity or a diesel engine. Since the motor is above ground level, it is easier to maintain as compared to the submersible pumps. The unique balancing mechanism gives constant load distribution throughout the cycle- a desirable criterion for any mechanical system.

Apart from lifting water from deep wells, irrigation and water storage in overhead tanks, the pump can also

be used easily in conjunction with sprinkler systems since the relation between discharge and flow pressure can easily be controlled, unlike submersible pumps where it cannot be controlled. The other applications for this double acting reciprocating pump could be in oil rigs, hand pumps and also in Auto/Fire extinguishers due to high pressure discharge of this pump.

Institutional support

Various institutions have been involved in promoting this innovation in terms of evaluation and product development. They are the Rural Technical Institute, Gandhinagar, LD College of Engineering and Nirma Institute of Technology as well as GIAN and SRISTI. The Department of Science and Technology has supported the project under the Technopreneur Promotion Programme (TePP) scheme. NIF has filed a patent application(28/MUM/2003, 08-01-2003).

The desire to be different

After completing his eighth standard, Manubha took to farming but due to frequent droughts in the area, he did not find it satisfactory. Then he worked as a truck driver for six years (1983-89) and in this period he gathered some knowledge regarding mechanical / electrical items. But because of risk and uncertainty involved in this, he quit driving trucks and worked for some time in an electrical motor repairing shop where he acquired quite a good understanding of motor repairing and winding. He did it for seven years and then left it as he felt that he was not utilising his ability there and he didn't want to remain an 'ordinary man'. In this period he also used to repair and service pumps of various types. After trying out these various options, he finally took up farming again in his 12 acres of land and utilised his innovative mind in developing the Double Acting Reciprocating Pump, which he believes will make the task of drawing water affordable to everyone.