

# AGRICULTURAL ENGINEERING NEWS LETTER

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## PUMP JACKS

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Originally a pump jack was a man, usually a hired laborer, who operated a pump. The term has come to mean a mechanical device for changing the rotary motion of a motor or engine to the vertical reciprocating motion necessary to operate a water pump. If the mechanism is entirely enclosed and is located directly over the well fixture, it is commonly called a pump or pump head. The term pump jack implies an intermediate mechanism between the source of power and the pump.

One of the most common uses of pump jacks is to supplement some other method of pumping such as the windmill. Certain very definite amounts of water are needed on stock and dairy farms and the wind does not always blow hard enough to furnish the necessary power. A pump jack operated by an electric motor or a gasoline engine is about the only alternative to hand pumping.

### Types of Pump Jacks

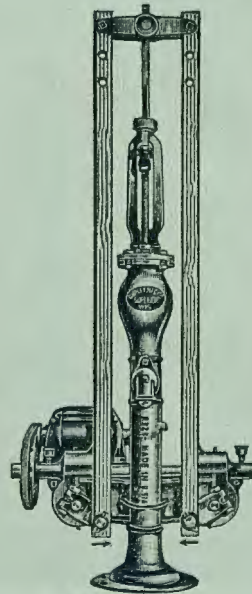
There are three rather distinct types of pump jacks, the single or double worm drive; the slotted lever actuated by a cam, roller, or eccentric; and the simple back geared variety. In general the exposed gear jack is the cheapest and most commonly used. The gear or gears are nearly always cast while the pinion may be cast or cut. The bearings are usually plain with an oil hole or possibly a grease cup for lubrication purposes. Since jacks of this kind usually retail for ten or twelve dollars, it is obvious that the material and workmanship cannot be of the highest class. If roller bearings and cut gears are used, the cost will be two or three times that of the common jack.

Many of the simple geared jacks are so made that they may be clamped to the pump stand while others are bolted to the well platform. If the jack is to be driven by a gas engine, tight and loose flat iron pulleys are usual, and flat rim or V-groove pulleys are used for motor drive. The size of the pulley is determined by the drive, large for electric motor and smaller for gas engine. The length of stroke is usually adjustable, 5-7 and 8 inches being common. While there is no standard, a gear ratio of about 6 to 1 is frequently used. A gear ratio and pulley size which will give from 30 to 40 upward strokes per minute is about right. For very deep or hard pumping wells, the number of strokes per minute should be reduced.

### Direction of Rotation

All pump jacks, of whatever kind, are made to give a relatively slow upward

stroke and a faster downward stroke. It sometimes happens that an engine or motor is so connected as to reverse these motions with the result that considerably more power is needed and the strain on belt, gears, and other parts is greatly



increased. If the direction of rotation is wrong, it may be remedied by reversing the motor or changing the motor or engine end for end. A crossed belt is sometimes used but is not good practice.

The jack should be placed close to the pump stand so that the lift stroke is as nearly vertical as may be. Most modern jacks are either clamped directly to the pump stand or are fitted with some device which regulates the distance from it.

One of the least desirable features of the cheaper jacks is the gear assembly. In most cases the gears have cast teeth, which necessarily are rather rough and cannot be meshed correctly. As the gears wear, backlash develops when the crank pin passes dead center. This lost motion is hard on both the jack and the pump. In some cases the lost motion is so great that a decided jerk is given to the pump rod with the result that the coupling threads are stripped or the rod is broken.

### Enclosed Gear Pump Jacks

The enclosed gear pump jack is a decided improvement over the open gear type as lubrication of all rotating parts is entirely automatic. The rotary motion is changed to reciprocating motion in various ways, but commonly by means of a slotted lever or an eccentric. Many ingenious motions have been developed but, in general, the simpler the better. In order to keep costs down, the enclosed gear jack is made as small as possible with the result that bearing pressures are high and wear is rapid, particularly if lubrication is faulty. In general, when cut gears are used, the workmanship is superior, which naturally results in a higher cost.

### Worm Drive Jacks

The application of the worm gear drive to pump jacks is relatively new, but the advantages are considerable. Lubrication is automatic and much of the mechanism is completely protected from weather and dust. The gear ratio is usually about 16 to 1 and for that reason small pulleys may be used for either motor or engine drive. The unit is usually bolted to the pump standard and requires very little room. A desirable feature of this type of jack is that the thrust on the pump rod bushing is practically eliminated.

### Pump Jack Troubles

Most machinery is neglected, and it sometimes seems that all pump jacks are always neglected. The simplest back geared jack has not less than 8 or 10 bearings and bolted connections, many of them hard to lubricate or keep tight. Protection against the weather is seldom adequate. Bearings are not always what they should be. Pump stand clamps frequently work loose. The result, of course, is wear which means noise and lost motion which means more noise and lost motion and so on. In some observed cases a 6-inch stroke has been reduced to 5 inches or even less by this lost motion. In many cases the pump jack crosshead is connected to the pump rod by a pin which is nearly always loose. A tapered pin or a bolted connection at this point is desirable.

For good results, buy as good a jack as you think you can afford, keep tight, the places which should be tight, keep greased the places which should be greased and make some one person responsible for seeing that these things are done.