

THE SHIPMAN OR ACME ENGINE FOR PUMPING WATER.

These engines are specially adapted to pump water for farm and city homes because they can take care of themselves.

How to determine the amount of power required to pump a given quantity of water a given height? One gallon of water weighs about eight and one-half pounds; therefore, if a pump is passing ten gallons of water per minute and lifting it one foot, eighty-five pounds per minute of power will be required to do it; lifting it ten feet, ten times eighty-five pounds.

How to determine the quantity of water that can be raised with any given size pump? We speak of a cylinder as having a certain diameter and of a piston as travelling a certain number of inches each time it moves up and down.

Now if we can know how many feet a pump piston will travel in one minute at a given number of revolutions, and how much water the cylinders can take in and give out each time the piston makes a "round trip," we can then determine the amount of water the pump can deliver at any given height and the necessary power in the engine to do it.

To make this rule perfectly understood we will give an example and work it out with the Alert Pump, No. 4. This is a **double-acting pump** and has been designed and built to use with our engines by **The Gould Manufacturing Company, Seneca Falls, N. Y.**

If the Pump has a three-inch cylinder, and the piston has a five-inch stroke and travels in the cylinder—down and return—50 times per minute, how much water will it deliver from a well, lifting it 25 feet and forcing it into a tank 75 feet above the pump, making a total elevation of 100 feet, and how much power is required to do it?

A cylinder three inches in diameter has an area of 7.0686 cubic inches. Multiply this area, if it is a double-acting pump, by twice the length of the piston stroke, which in this case is 10 inches, and this will give you the amount of water raised per stroke, which is 70.686 cubic inches. Multiply this result by 50, the number of strokes per minute, and you have the quantity of water raised in one minute, which is 3534.3 cubic inches. There are 231 cubic inches in a gallon of water; and if you divide the last product by 231 it will give you 15.3 gallons of water raised per minute. Multiply this amount by 60, and it will give you 918 gallons, the amount of water raised per hour.

Now to ascertain the power required to raise this water 25 feet and elevate it 75 feet from the pump. Multiply the number of gallons raised per minute, namely, 15.3 by 8.25, which is the weight of a gallon of water, and you have 127.555 pounds. Now multiply this product by 100, that being the entire height the water is to be raised, including the distance both below and above the pump, and then divide this product by 33,000, which represents the number of pounds one horse power will lift in one minute, and you have as the required power 127.555/33,000 horse power.

Now allow for friction of water in pipes, and friction of machinery. When this is added you will require fully two-thirds horse power to do the above work. It may be a safe rule to estimate the exact power required and then add two-fifths to the actual power as the required power.

With the above as an example you can estimate quite accurately the capacity of pump and power of engine you require for any given work.