

## Water pump blues? Consider the trusty ram pump

By Don R. Wilson

**T**he Hydraulic Ram Water Pump is a piece 61 Americana that is as useful today as ever. Utilizing a simple principle, the hydraulic ram can pump water above a source of flowing water with no other power required.

Moving water contains a small amount of kinetic energy, which is the energy of water falling downstream under the force of gravity. For our purposes, we'll call it FALL. The ram pump utilizes this inertial energy to pump water. It runs all the time, requires no fuel, and needs only minor adjustments and cleaning for maintenance. Most designs have only two moving parts—two check (one-way) valves.

Hydraulic rams have been around for many years, in many differing configurations, but have fallen off in popularity as power became more convenient. Many people have never heard

of them, and as a result some sites get an expensive setup or no water at all.

The ram pump occupies a narrow niche in the array of water pump systems available today. Because it is somewhat more involved to set up than a powered pump, it is generally used only where electricity is too expensive or not available, or where the water source is too small to use a high capacity pump. But where it is called for, a ram pump system is a dependable, economical alternative to a conventional electric or gasoline water pumping system. It will give years of service and require only minimum routine maintenance.

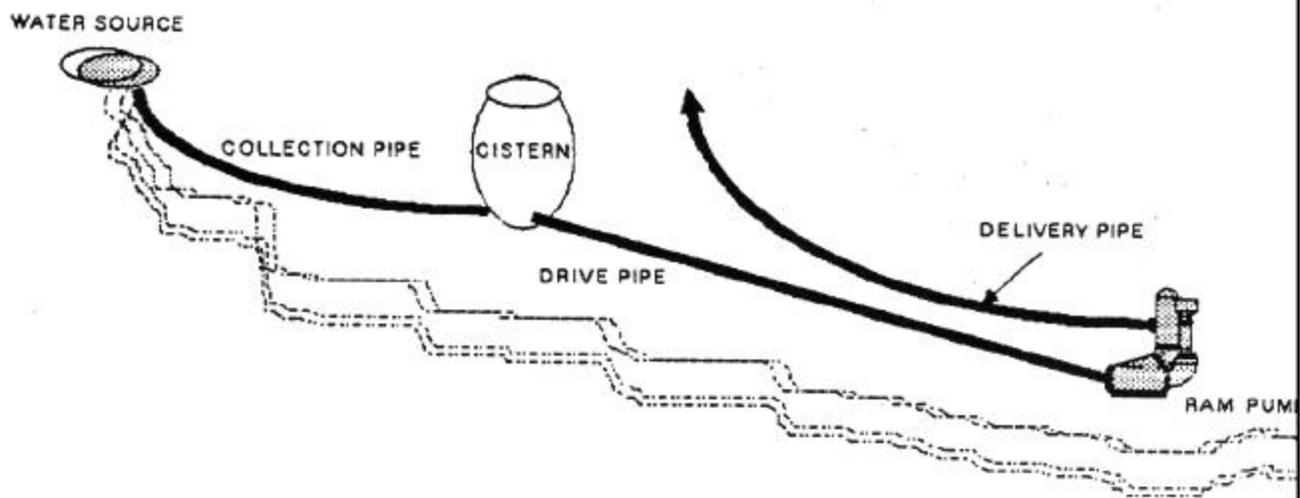
A popular use for a ram pump system is the small homestead or remote homesite. A stream, spring or river is the water source; water running downhill provides the power for the ram, and water is pumped to a storage tank above the level of the house or garden, or delivered directly to the crops for irrigation.

### 3-5 foot fall

The water source for the ram pump needs to be flowing and about 3-4 gal./minute must be available for collection and use. This water must be collected and piped from the source down to the ram, and through the DRIVE pipe. The fall required is a minimum of 3-5 feet, depending on the type of ram pump used. The greater the FALL, the larger the DELIVERY—the amount of water pumped uphill to the end-use area. The water delivered is about 5%-15% of the amount piped to the ram, the remainder having given up its kinetic energy to the hydraulic ram sequence.

This ability to pump water above the source is accomplished by utilizing some simple, basic laws of physics....

An object resists movement, and an object in motion resists stopping. This applies to water as well. Additionally, most liquids, including water, are incompressible.



*The Ram Pump is situated at least 3 feet BELOW the water source or the water level in the cistern. The DRIVE PIPE is laid from the source or cistern down to the pump site. The DELIVERY PIPE is laid from the pump site to the storage tank.*

Hence it follows that water, moving under the force of gravity and contained within a pipe, will resist being stopped. When it is stopped suddenly, the weight of water moving within the pipe will exert a pressure much greater than the weight of the water alone at the point where it is stopped. Within the plumbing trade this is known as ‘water hammer’—very destructive to pipes and fittings unless counteracted.

**Clack valve**

The ram pump is constructed to initiate and use this force. The ‘clack’ valve is a check valve held open by an

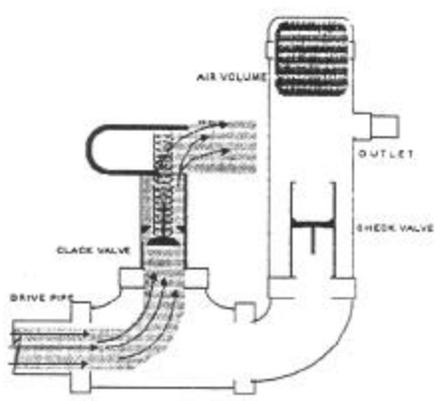
adjustable spring. Water from the drive pipe flows through this valve. The clack spring is adjusted so that when the force of the drive water gushing through the valve is greater than the spring tension holding it open, the clack valve will close suddenly. The sudden closing of the clack valve creates a momentary pulse of high pressure—the water hammer or ram effect.

There is another check valve near the clack valve. This serves as a kind of relief valve, allowing the increased water pressure a way out. A small amount of water is rammed through this one-way valve into the ‘high-pressure’ side of the

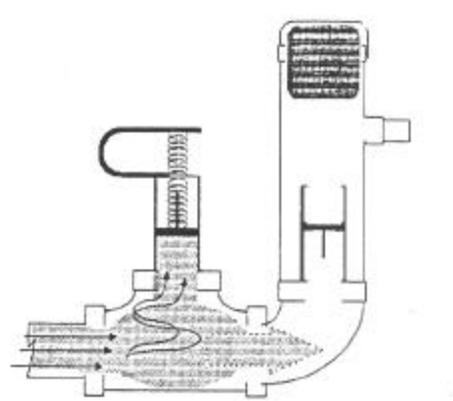
ram pump. This is usually some kind of tank, with the delivery pipe connected to it. There is an air volume inside this tank that acts as a sort of cushion for the incoming pulse of water. Water is forced up to the end-use area through the delivery pipe by this increased pressure. The clack spring then opens the clack valve and the cycle repeats, each sequence taking a few seconds. The well adjusted ram pump will tirelessly pump away and cost nothing to operate.

**Collection cistern**

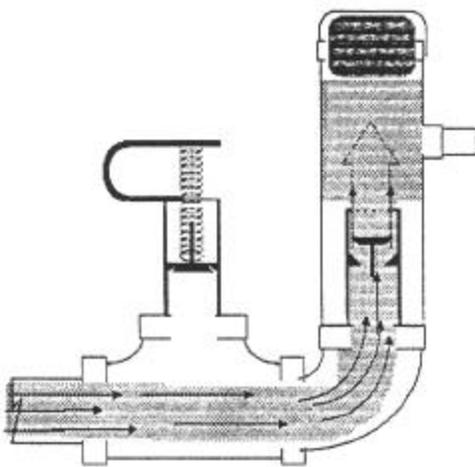
A collection cistern is not necessary, but highly recommended. This can be



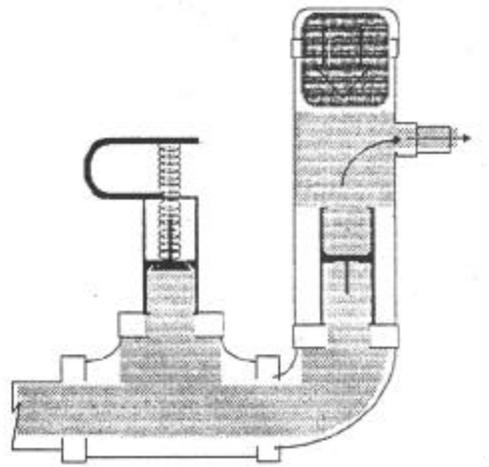
1. Water entering through the drive pipe exits through the clack valve.



2. As the speed of the water increases, the clack valve is forced closed against the tension of the clack spring. The weight of the still moving drive water creates momentary high pressure against the check valve.



3. The check valve is forced open and water is rammed into the pressure tank. The air volume is compressed.



4. The drive water has stopped. The check valve closes. The compressed air volume forces the water out the outlet up the end-use area.

any large container—a barrel, tank or pond...as large as possible and able to hold water. It is placed down from the source, and fills with water through its own STRAINED pipe from the water source. There may be several collection pipes all going to the one cistern—this is a handy way to get enough water when there are several small springs around, none alone large enough to drive the ram pump.

The drive pipe is attached near the bottom of the cistern or water source, and is generally required to be at least 100 feet in length and 1¼" diameter. Both source and drive pipe inlets MUST BE STRAINED! If not, there will be endless problems...trash and rubbish will surely enter the system and catch in the clack valve and stop the ram. You may be a little queasy to discover a watersnake or crayfish trapped there. This has happened! The strainers must be secure against passive trash AND inquisitive creatures (including humans!) If the ram stops because of foreign matter caught in the clack valve, the collection cistern will drain and air will enter the drive pipe. In order to get the pump going

again, the cistern will have to refill and air be flushed from the drive pipe.

### Three factors

The three factors that determine the amount of water delivered are: the amount of water available at the water source, the amount of FALL, and LIFT (the vertical distance from the ram pump site to the water storage tank). Because all of these factors are interrelated, it is difficult to estimate an exact figure for a delivered amount of water for a given pump. There is a formula that can be used to calculate this essential figure fairly accurately, and one can then determine the feasibility of going with this type of water pump system. Please note this formula pertains to the ATLAS ram pump only, which pumps about twice as much water in a given setting than the other two rams I have been able to get figures for.

Source volume in gals./min. X (2 X FALL in feet) divided by (1.4 X LIFT in feet) = gal./ min. delivered. Multiply the result by 60 (min./hr.) then by 24 (hrs./day) to get the daily delivered amount.

Ram pump efficiency is dictated by some other minor factors. One must consider friction, which tends to slow the water flow. Sharp turns and all connections cause friction. Any leaks in the line will lower the delivery amount drastically as well.

The amount of water available also plays a large part in determining the output of the ram. The more available, the higher the clack spring can be adjusted -up to the capacity of the drive pipe. Increasing the diameter of the drive pipe raises this capacity and adds that much more weight and inertia to each ram sequence.

The amount of water delivered may seem small. A large storage tank can offset even the tiniest trickle. Because water is always trickling into the tank and usage is sporadic, eventually the tank will fill and you will never run out of water. A 1,000-5,000 gallon tank should be enough for the average home. Ferro-cement is the easiest and least expensive construction for a large tank.

(For more information, plans, and operation manual for the Atlas ram pump (\$5.00) or Atlas rams ready to go (\$125.00), write D.R. Wilson, 4040 10th St, Sebastian, FL 32976.) Δ



*Domestic work in the wilderness.*

*Enlighten the people generally, and tyranny and oppressions of body and mind will vanish like evil spirits at the dawn of day.*

Thomas Jefferson

*Yesterday, the greatest question was decided which ever was debated in America, and a greater perhaps never was nor ever will be decided among men. A resolution was passed without one dissenting colony, "that these United Colonies are, and of right ought to be, free and independent States."*

John Adams (July 3, 1776)