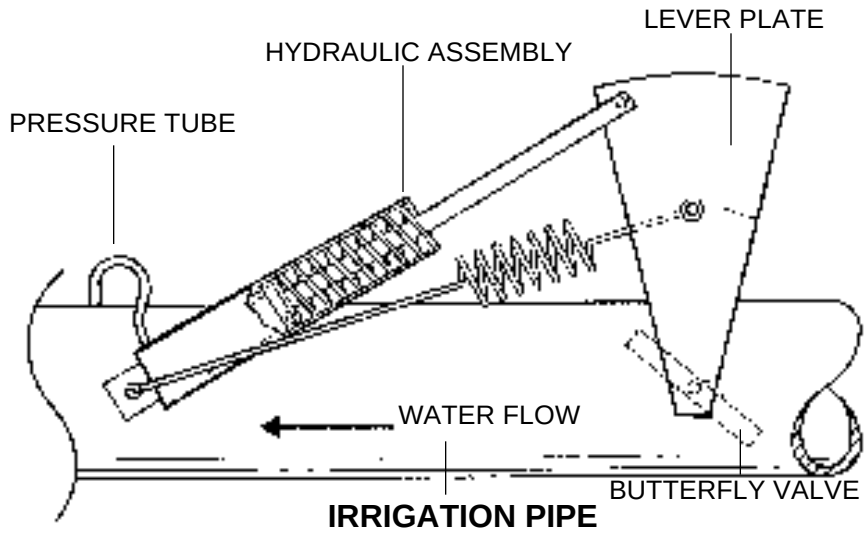
Another Kind of Surge Protector

Easy to install automatic pressure-control device works with many different types of irrigation systems and can help reduce erosion on slopes.



A new device automatically blocks unwanted surges in water pressure throughout farm irrigation networks, yet is simpler to use and less costly than some other options.

The apparatus, says agricultural engineer Dennis C. Kincaid, keeps pressure to within 10 percent of the target level. This precision helps ensure that thirsty plants growing on steep slopes are watered uniformly. Too, the device helps growers avoid the overirrigation that could otherwise trigger soil erosion and accelerate leaching of farm chemicals into underground water supplies.

Growers can use the lightweight, low-maintenance apparatus with a variety of irrigation systems, including surface or buried drip and lateral-move or center-pivot sprinkler. And the device can be easily spliced into existing setups, according to Kincaid. He is with the ARS Northwest Irrigation and Soils Research Laboratory at Kimberly, Idaho.

The components, Kincaid says, are inexpensive, readily available, and easy to adjust. They include a butterfly valve or similar disk, a metal plate that acts as a lever, a small air cylinder actuator that serves as the hydraulics assembly, a simple external tension spring that works alongside the air cylinder, and a length of flexible tubing.

Kincaid estimates that about 11 million acres of irrigated farmland in the United States are hilly enough—with slopes of 5 percent or more, for example—to warrant pressure control valves. He admits that the idea of using manually operated butterfly valves to do this task isn't new. But the automatic control system that he devised and that ARS has now patented is unique.

In brief, the butterfly valve in the irrigation pipe is connected to the metal plate or lever outside the pipe. The external tension spring and air cylinder are aligned, at their base, to connect with the pipe. At their other end, they are bolted to the metal plate at two different positions, using holes pre-drilled into the plate for this purpose. The flexible tube transmits pressure from the irrigation pipe to the base of the cylinder.

At the proper initial setting, the spring and cylinder are retracted and the butterfly valve opens. The spring's tension will keep the valve open and resist the cylinder's force when pressure downstream of the valve is at or below the level the grower selects.

When the downstream pressure exceeds the target, however, the resulting pressure in the flexible tubing will force the cylinder to overcome the spring's tension. The spring and cylinder extend, moving the metal lever and causing the butterfly valve to close. As the pressure decreases, the spring and cylinder contract to their starting positions, causing the lever to shift and the butterfly valve to open.

Building upon earlier work by Kimberly colleague Allan S. Humpherys, Kincaid compiled a series of standard mathematical equations that irrigation system designers or valve manufacturers can use to determine the correct size of the spring and cylinder, as well as the correct angles or settings to use when bolting these components to the lever. Or they can do the calculations on a computer using the spreadsheet program that Kincaid and coworker David G. Romspert have prepared.

Units would cost about $100 to $150 each, depending on pipe diameter and other factors, Kincaid estimates. He says the device is suitable for pipes or conduits that measure 2 to 12 inches in diameter, carry flows of 25 to 2,500 gallons per minute, and handle pressures of 5 to 90 pounds per square inch.—By **Marcia Wood,** ARS.

For more information on U.S. Patent No. 5,509,449, "Control of Fluids," contact Dennis C. Kincaid, USDA-ARS Northwest Irrigation and Soils Research Laboratory, 3793 North 3600 East, Kimberly, ID 83341; phone (208) 423-6503, fax (208) 423-6555, e-mail Kincaid@Kimberly.ars.pn.usbr.gov ◆