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VALVES ARE THE KEY

Automating Surface Irrigation Systems

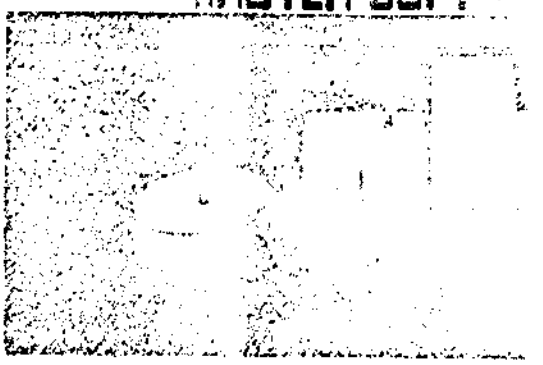
By Allan S. Humpherys and R. L. Stacey

SOCIETY is demanding that farm irrigators use their water supply more efficiently and decrease irrigation-related pollution. Sediment has been labeled as one of the worst pollutants of our natural streams. Better water control and decreased tailwater runoff are needed to reduce the amount of sediment leaving an irrigated farm. To achieve this goal, many irrigators must improve their facilities. The current trend is toward greater use of both buried pipelines and gated pipe. Additional labor is needed to improve irrigation efficiency beyond its present level on most well-managed farms. Because of the cost and general scarcity of competent labor, automation is needed.

One of the main problems in automating furrow irrigation systems is that of obtaining uniform, constant water delivery to each furrow. Furrow tubes, spiles, notched outlets, and weir outlets have been used, but none of these devices are completely satisfactory in an automated system. Besides the labor required for installation, they are susceptible to washing-out and require periodic attention to maintain good working order. Gated pipe with an adjustable outlet for each furrow appears to be the most promising means of distributing water to furrows in an automated system.

Large fields are needed to accommodate modern farm equipment. It is increasingly difficult to operate large machines in small fields that are cut up with irrigation ditches. Because of the need to farm larger areas, irrigation runs are often longer than optimum for efficient irrigation. With gated surface pipe and automation techniques, the use of portable, semiportable, and solid set surface systems is possible. The pipes can be placed in the field to obtain an optimum or near optimum irrigation length-of-run and later be removed to provide a larger field without ditches for maneuvering large equipment.

To automate pipeline systems, one must have automated valves and control systems to sequence irrigation from one turnout or irrigation set to another. Automatic controls for surface irrigation are not generally available commercially. USDA's Agricultural Research Service is conducting research at Kimberly, Idaho and Fort Collins, Colorado to develop valves and other control devices for automating irrigation pipeline systems. Low pressure valves developed at the Snake River Conservation Research Center, Kimberly, are equipped with irrigation pipe fit-



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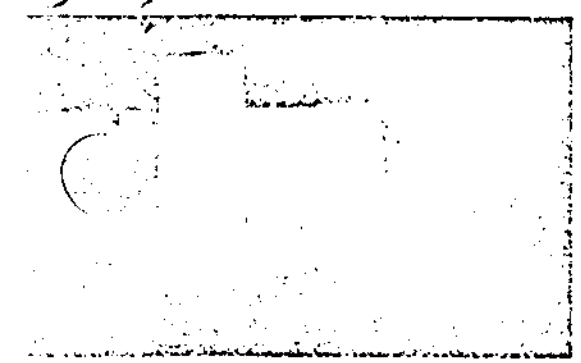

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tings and can be connected to gated pipe or to hydrants on pipeline risers. Both 6- and 8-inch valves have been made and tested for systems operating at a pressure of about 12 psi or less.

The working part of the valve consists of a modified tire inner-tube or bladder. Figure 1. This tube, supported by an outside covering, is placed in the valve body between two parallel surfaces of the flow area. When the bladder is inflated, with water from the pipeline, it expands to fill or seal the flow area to close the valve. when the bladder is deflated, water flows past it and the valve is open. The force of the flowing water on one side of the bladder flattens it so that the flow area is only slightly restricted. A brass three-way valve is used to control inflation and deflation of the bladder. The three-way valve in turn is controlled by a 24-hour timer. The water for inflation is supplied from a tap in the pipeline on the upstream side of the valve. Thus, the timer and three-way control

Fig. 2. Low pressure valve being field tested with gated pipe.

valve can be placed close to the irrigation valve for a simple and compact installation.

The valves were used to irrigate corn plots during 1971 and 1972 field tests. Figure 2. They were used in such a way that interconnecting lines or tubing were not needed to coordinate the opening of one valve with the closure of an adjacent one. The flow transition from one valve to the next was accomplished smoothly and the first valve did not close until after the second one opened.

The 1972 corn plots were irrigated with short, frequent irrigations to minimize runoff and tailwater sediment. This also resulted in a greater number of irrigation cycles for testing of the valves. The valves can be used with recirculating tailwater systems and programmed timers to achieve a cutback flow for furrow irrigation. The cutback method provides a means of increasing irrigation efficiency with reduced runoff, but is used very little because of the high labor requirement. The valves were also tested for border irrigation. In this installation, water discharged directly from the valves into the borders.

Another type of valve was tested on the Eugene Thomas farm near Filer, Idaho. The valve consists of a homemade, cylindrical hydro-bladder inside of the pipeline turnouts shown in Figure 3. The bladder is filled with water at a pressure slightly greater than that in the pipeline. In this test, water for inflating the valves was taken from the pipeline at the upstream end of the field and conveyed to the valves in a 1-inch plastic pipe.

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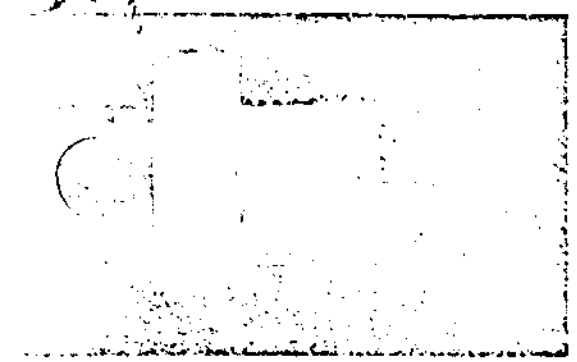

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