Flo-thru gated pipe may lower costs

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With increasing energy and labor costs, irrigators are looking for ways to minimize costs and at the same time use their water more efficiently.

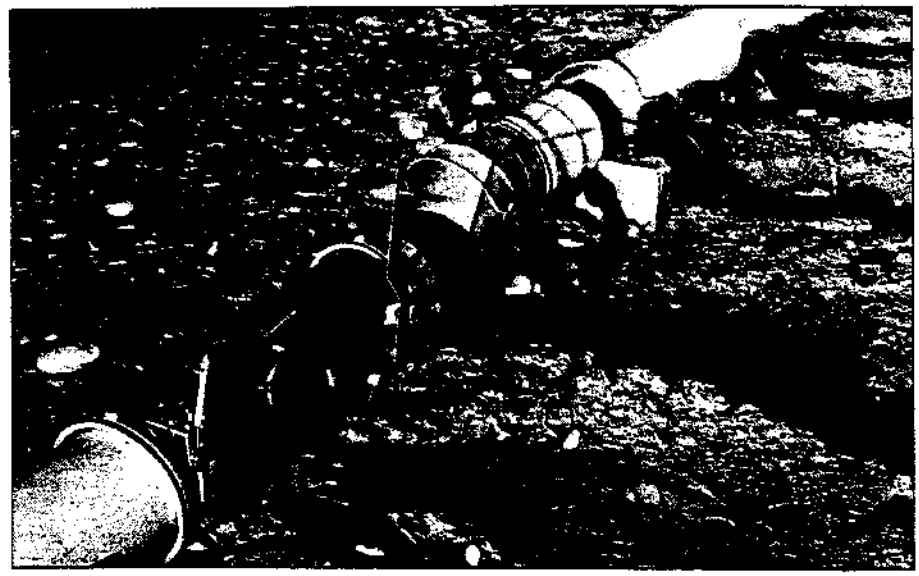
One system used quite extensively during the past two or three years in the Grand Valley of Colorado is the semiautomated "flo-thru" gated pipe system. This system uses a single gated pipeline for a number of irrigation sets without the irrigator having to close one group of gates and open another group at each irrigation set change.

Opening and closing gates require a considerable amount of labor and extra trips to the field. Several attempts have been made to simultaneously open or close all of the gates of one irrigation set so that the gated pipe can be used as an automated single-pipe system. However, these systems were primarily experimental.

The gated pipe on a flo-thru system is installed in a series of sections on a stair-step grade at the upper end of the field. (See diagram). Each section comprises one irrigation set and has a drop at its lower end. A semiautomatic valve is located immediately downstream from each drop. During irrigation, water flows as pipe flow in the downstream operating section and as an open channel or free surface flow in all of the upstream sections. Water is discharged into furrows from gated openings in the downstream operating section of the pipeline.

The conditions for which this system can be used are limited. The required field cross slopes for the pipe grade range from .4 to 2 ft. per 100 ft. of drop (.4 to 2% slope). A minimum slope of about .4% is necessary to provide the required amount of drop at the end of each section. The drops are standardized at .4 foot as much as possible; however, drops of .3 foot are sometimes used with small streams.

The flow range for most systems varies from about .5 to 1.5 cfs (225 to 675 gpm). Systems can be designed for flows smaller than .5 cfs but farm stream sizes are usually larger than this. Flows larger than 1.5 cfs require larger pipes and steeper field slopes than are usually available.



Semiautomatic torsion-spring-operated butterfly valve used in a flo-thru gated pipe system in the Grand Valley of Colorado.

The irrigation supply stream is sometimes divided into more than one stream so that smaller pipes can be used to minimize pipe cost. A flo-thru system requires approximately one increment larger pipe size than would be used for conventional gated pipe systems.

These systems are designed by Soil Conservation Service technicians who have developed a small computer program to simplify system design.

The pipe is designed so that the free surface flow in the upstream sets occupies about 60 to 75% of the pipe cross sectional area. The pipe is placed in the field with the gates approximately 30° from vertical so that the water flows beneath the openings as free surface flow for all downstream sets.

Concrete pillars or pipe supports are used to prevent pipe movement and to maintain pipe grade if the pipe is removed and then later replaced. The pillars are located at each drop, in the center of the section.

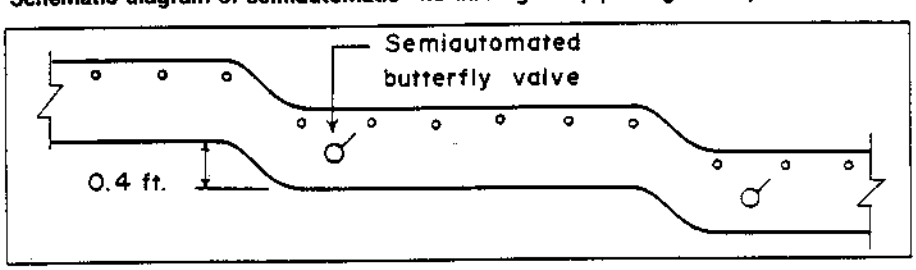
The valve located immediately below each drop opens to allow irrigation to proceed to the next downstream set in the sequence. The newly developed low pressure butterfly valve is used to semiautomate the system.

The valve consists of a short section of pipe containing a butterfly valve with a torsion spring operator and a 24-hour mechanical timer. A torsion spring was specially designed for this purpose. It was designed to rotate the valve disc through an angular distance of 90° when the timer trip mechanism is released.

An automated valve is often used at the inlet end of the flo-thru system to divert water from the supply source into the pipeline. The semiautomated spring-operated valves can be used here. However, they are a single function valve in that they only open and have to be manually reset. They are not as satisfactory for use at the upper end of the pipeline as a dual function valve that will both open and close automatically. Valves for this purpose can be either water-operated valves, such as the Hastings Irrigation valve, or pneumatically operated valves.

The principal advantage of this system is that a single pipeline used both for water supply and distribution can be automated.

Soil erosion sometimes occurs from water discharged from the pipe gates which are located near the top of the pipe. The water flows from the pipe in an arc and falls some distance to the ground. Socks are sometimes used to control erosion.

A more effective device is an energy dissipating screen ("Softflow" screens available from Gary McClelland, Vale, Ore.). This screen is located over the gate opening and is very effective in dissipating the energy of the emerging water jet.

Schematic diagram of semiautomatic "flo-thru" gated pipe irrigation system.