MASTER COPY MASTER #

#73

No Reprints Available

AUTOMATING

Allan S. Humpherys
Member ASAE

AUTOMATION of surface irrigation offers exciting possibilities for today's irrigation farmer. It provides a means for improving water use efficiency and cutting labor requirements. Excessive water is often used in current irrigation methods; water application efficiencies usually do not average over 50 to 60 percent. Although many factors affect irrigation efficiency, the water facilities and management practices used by the individual operator have the greatest effect.

Competition for available national water supplies is increasing rapidly. Irrigators eventually may have to justify their use of water. They may not always be permitted to use nearly twice the amount required to satisfy crop consumptive use requirements.

For Greater Efficiencies

Mechanized irrigation can alleviate some problems facing the irrigator. In contrast to sprinkler irrigation systems, the average farm water application efficiency for surface irrigation is low. Many management decisions in a well designed automatic surface system may be taken from the operator and placed in the system design.

Automation offers reduced labor requirements plus making possible the use of less skilled labor. It is especially needed where small continuous streams are used and where light frequent water applications are made. Such applications require almost continual attention.

Sprinkling is used in many areas of high water cost because of the higher efficiencies. However, some warm-season crops are susceptible to certain wet-weather diseases and surface irrigation is sometimes recommended. In these areas, automation of surface irrigation will become very important in keeping irrigation costs to a minimum and in obtaining maximum use from available water.

Recirculating irrigation systems with automatic structures are a promising means of improving individual farm irrigation efficiency. Automatic structures are well suited for use in caring for small and often periodic streams associated with farm recirculating systems.

Research is yielding information which will prove useful in developing automatic irrigation systems — instrumentation to hasten the time of complete soil moisture sensing plus improved materials for automatic facilities. Improved flow measurement and system design techniques plus better consumptive use and moisture requirement data for crops will make irrigation more exacting. Solid state electric devices and improved batteries (possibly recharged by solar energy) will enhance future development of automatic equipment and make some field installations remote from a power source more feasible.

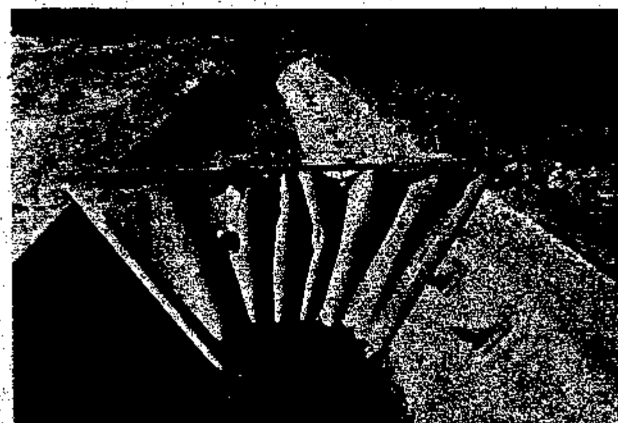


Fig. 1 A portable automatic flexible check dam installed in an experimental steel-lined ditch

Fig. 2 Series of automatic flexible checks installed in a cutback furrow flow portion of an experimental ditch

Recent developments in automatic irrigation include an automatically released canvas dam used primarily for border irrigation — an alarm clock timer operates a border inlet gate simultaneously.

An experimental self-propelled traveling siphon has been successfully tested in areas where large irrigation streams are required.

This is a condensation. A copy of the complete report may be obtained by requesting Report No. H-007 from ASAE, 420 Main Street, St. Joseph, Mich. 49085. Cost is 50¢ each (or ASAE Member Order Form).

Allan S. Humpherys is Research Agricultural Engineer, Snake River Conservation Research Center, USDA-SWC, Agricultural Research Service, Kimberly, Idaho. This is a contribution from the Northwest Branch, Soil and Water Conservation Research Division, ARS, with Idaho Agricultural Experiment Station cooperating.

MASTER COPY

SURFACE IRRIGATION

One radio or tone telemetry-controlled system uses pneumatically operated valves to control the discharge from turnout structures. The pneumatic valve for underground pipeline systems is essentially an O-ring which, when inflated, forms an annular seal between an alfalfa valve seat and lid. The lay-flat pneumatic valve for ditch systems is a

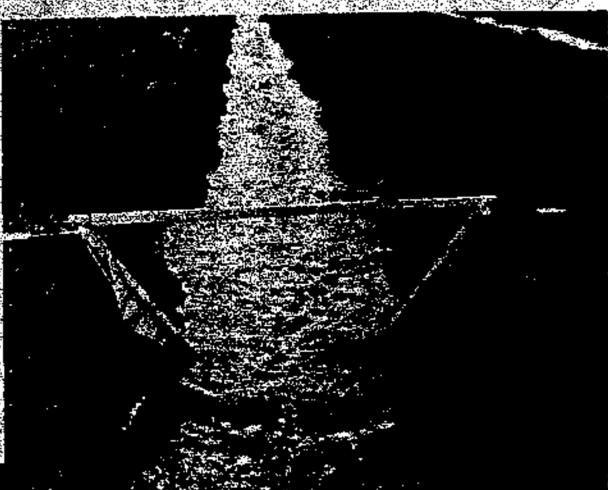


Fig. 3 Semipermanent type butyl check dam mounted on a wood cutoff wall in an unlined ditch

Fig. 4 A portable automatically released check dam for unlined ditches

flat rectangular tube that inflates to form a closure within a portion of the turnout pipe. Another radio-controlled system for border irrigation uses a moisture-sensing device coupled with a transmitter located near the lower end of a border. A gate in the supply ditch is operated by a small battery-powered d-c motor actuated by a signal from the transmitter.

Test Program

Various automatic irrigation structures are being developed at the Snake River Conservation Research Center near Twin Falls, Idaho, to satisfy the requirements of most irrigation systems. These are tested in a recirculating flume in the irrigation laboratory and in an experimental ditch adjacent to the laboratory. Measuring flumes, water stage recorders, and soil moisture instrumentation have also been installed in the field for determining irrigation efficiency.

The semiautomatic flexible check dams in Figs. 1 and 2 are being tested in a furrow cutback portion of the experimental ditch. They may also be used at turnouts into borders or furrows or in diverting water from one ditch to another. A flexible dam is supported in a metal frame that fits the cross section of a lined ditch. When closed, the dam is supported at the top by a rope or boat-cable drawstring threaded through brass grommets. This drawstring is released by a timer after irrigation is completed. The unit is portable and may be placed at any location in a ditch of the same cross-sectional shape. The irrigation time period begins when water enters the ditch immediately upstream from the check. A float-operated timer escapement release permits the check to be reset any time between irrigations. Thus, to begin irrigation, it is necessary only to turn water into the ditch.

Variations of this model are being tested for unlined ditches. A butyl flexible dam is mounted on a metal, concrete, or wood bulkhead or cutoff wall (Fig. 3). The opening conforms approximately to the size and shape of the ditch. The ends of the cutoff wall extend into the sides and bottom of the ditch to prevent piping. This may remain in place permanently or be relocated if desired. A portable dam used in the same manner as a conventional canvas irrigation dam is shown in Fig. 4.

A normally open metal drop gate for lined ditches (Fig. 5) checks water in the ditch when released by a timer or electric solenoid. It is particularly useful in diverting water from one distribution ditch to another. When used as part of an automatic headgate structure for water diversion, it is tripped electrically by a signal from the lower end of the ditch. An adjustable opening can be provided to bypass part of the flow. A modification of this type for use in unlined ditches is also being tested.

Fig. 6 shows another semipermanent structure used in unlined ditches. This model consists of a hinged metal flap gate mounted on a galvanized steel cutoff wall. A latch keeps the gate closed until released by a timer at the completion of the irrigation period. This timer is also fitted with an escapement release which allows the structure to be reset any time between irrigations. These gates automatically check the water and release it sequentially as irrigation proceeds down the ditch.

. . . Automating Surface Irrigation

These structures may be used with different methods of irrigation. They may be controlled by moisture-sensing devices, programmed timers, or radio and float control equipment. The checks may be set by the farmer between irrigations. When used in recirculating systems, the float-operated timer escapement release stops the timer if water flow cases before irrigation is complete. When water is again received from the recirculating system, the timer resumes as if there had been no interruption.

The length of time for a normal irrigation still depends on the farmer's judgment. The irrigation period is altered by adjusting the timer setting. The operator can usually estimate seasonal intake rate changes with the first or second set of each succeeding irrigation and make adjustments to minimize runoff and deep percolation losses. When recirculating systems are used, adjustments for seasonal variations in intake rate are not so critical since runoff water will be picked up and reused.

Studies are being conducted to determine the field water application efficiency possible with automatic irrigation structures. The per acre cost of automatic systems of course will vary with the method of irrigation, the soil, topography, cropping practices, water supply, and other factors. • •

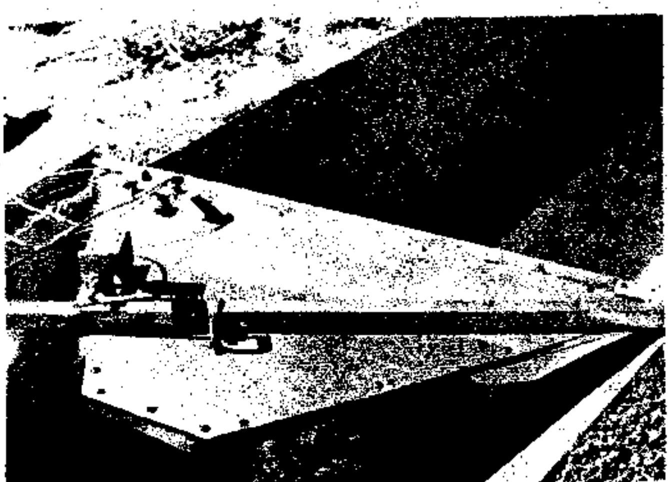


Fig. 5 Electrically-released metal drop gate installed in an experimental steel-lined ditch

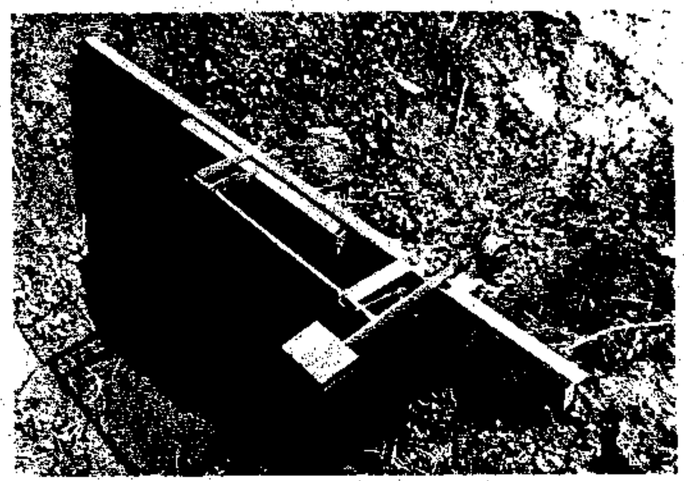
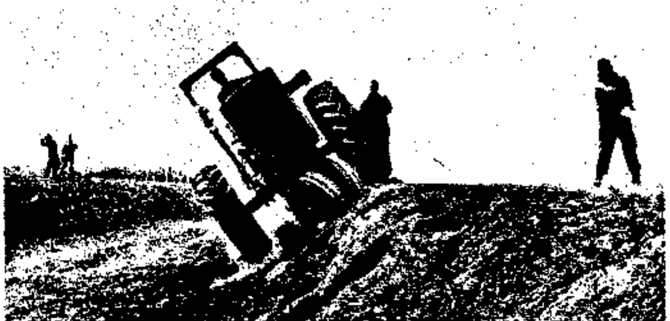


Fig. 6 Timer-released metal flap gate mounted on a steel cutoff wall

NSF Approves Farm Tractor SAFETY RESOLUTION



Accelerated Testing: The Farm Equipment Research and Engineering Center of International Harvester Co. has announced an accelerated program of testing and developing protective frames (anti-roll bars) for farm and individual tractors. Remote-controlled, current model, tractors are driven at high speed along a 42-deg bank and deliberately rolled while electronic devices record the location and force of impact on the frame. The testing project utilizes sophisticated telemetry systems to measure the effects of side rolls and back flips. Strain gages are cemented on to the protective frame at various locations and connected to a radio transmitter. Sound is transmitted through radio telemetry and on impact of the frame with the ground, the tone change occurring is read by a receiver and recorded on tape. Back in the laboratory, the tape is played into an analyzer which translates the tone into forces exerted on the frame. The test also checks on the design and mounting of the frame itself. Such information is shared by other farm and industrial tractors manufacturers in efforts to establish industry standards

The following "Resolution on Overturn Protection for Farm Tractor Operators" has been approved by the Farm Conference, National Safety Council:

Farm tractor overturn accidents result from an adverse interaction of the operator, tractor and environment, and are known to claim more than 500 lives each year.

It is recognized that persons when operating farm tractors should exercise reasonable care and adhere to recommended safety practices. It is further recognized that operator error cannot be totally controlled; thus, tractor overturn accidents, and the resultant deaths and injuries, are likely to continue.

Considerable evidence is available to show that protective frames and crush-resistant cabs have potential to sharply reduce the number and severity of injuries to operators involved in tractor overturns.

The Farm Conference therefore urges action on the following recommendations:

1. That the American Society of Agricultural Engineers and the Society of Automotive Engineers adopt performance standards for basic overturn protection on farm tractors, including protective frames and crush-resistant cabs.
2. That the farm equipment industry make available, as standard equipment, basic operator overturn protection on farm tractors that will conform to American Society of Agricultural Engineers and Society of Automotive Engineers standards.