

# Ditch Irrigation Can Be Automated

By ALLAN S. HUMPHERYS

MODERN TECHNOLOGY offers exciting possibilities for today's irrigation farmer by providing improved structures and practices that could enable the farmer to apply irrigation water more uniformly with less labor and to better control the amount applied.

During the past decade, the sprinkler industry has led the way in irrigation automation with the development of solid set and traveling sprinkler systems. Although the automation of surface irrigation has not kept pace with sprinkler irrigation, automatic and semi-automatic gates and systems are now being developed to reduce irrigation labor and to permit better utilization of the available water supply.

For example, existing structures can be modified for semi-automatic operation using time clocks and most of the gates required for this can be made in a farm shop. This obviously requires a smaller initial investment than automatic sprinkler irrigation, and operating costs are lower because the water is not applied under pressure. It is also possible to automate a farm irrigation system piece-meal by equipping one field at a time. Materials for the metal gates described in this article are readily obtainable, costing \$5 to \$8 per gate, depending upon gate size, without timer. Timers cost about \$3 to \$20, depending on the type used.

### Drop Gate Automation

One example of a surface irrigation automation device is the drop gate. This gate is suspended over the ditch so that when released by an alarm clock or other means it falls by its own weight and stops the flow of water in the ditch or through the opening where it is placed. It mounts directly on a metal or concrete cutoff wall or on a portable frame such as the angle iron frame shown in photo 1.

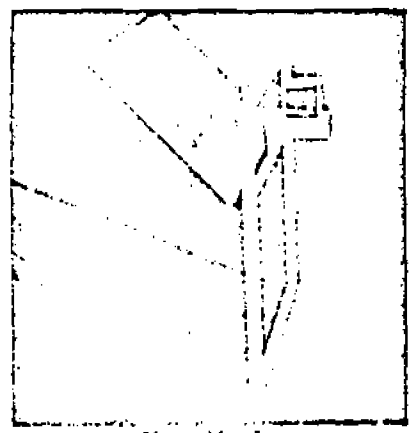
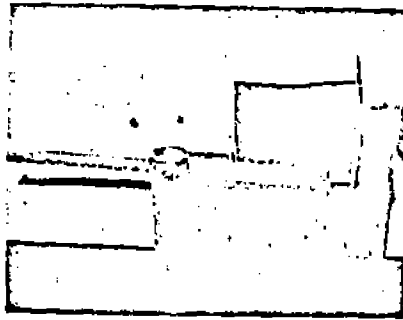


Photo No. 1  
A drop gate on a portable metal frame with an alarm clock trip.

The portable unit can be used in the checkboard guides or notches of existing structures. The gate is 16-gauge galvanized sheetmetal on a 1 in. x 1 in. x 1/2 in. steel angle frame. Thin rubber strips or a continuous rubber bead from a caulking gun are used to seal the edge of the gate and also the frame where it fits in the checkboard guides to make the structure watertight.

A regular alarm clock can be used to trip this gate as shown in the photo. The clock case should be sealed to keep out dust and water. A thin rubber sheet is cemented over the back of the clock and the joints of the case are caulked with rubber bathtub sealer.

The trip mechanism operates by having the gate tripping arm rest against the alarm windup stem, as shown in photograph 2, so that when the alarm starts ringing, the stem rotates away from the trip arm to release it. This is usually more satisfactory than requiring the clock to pull a string or otherwise supply energy to operate the trip. The timer with its accompanying trip can be removed from the gate by fastening the clock to a short piece of pipe as pictured; this, in turn, fits over a stud on the gate frame.



**No. 2**  
Alarm Clock and gate trip on a removable mount.

For use on other gates, the clock and trip unit are merely lifted from the pin. Since the timers represent a significant part of the total gate cost, the

For use on other gates, the clock and trip unit are merely lifted from the pin. Since the timers represent a significant part of the total gate cost, the cost of automating a field or farm is less if fewer clocks are required and they are used in more than one location. The cost of automating a farm will also be less if the gates are portable so that they, too, can be used in more than one location.

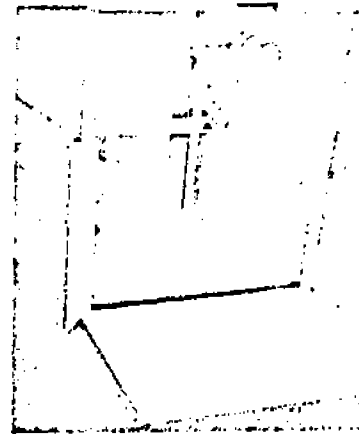
A newly-developed, 24-hour timer can be used to trip the drop gate as shown in photo 3. This Japanese-made clock has a start-stop device operated by a small float in the stilling well.



**No. 3**  
Special 24-hour Japanese-made irrigation timer with a start-stop device and a portable mount, being used on a drop gate.

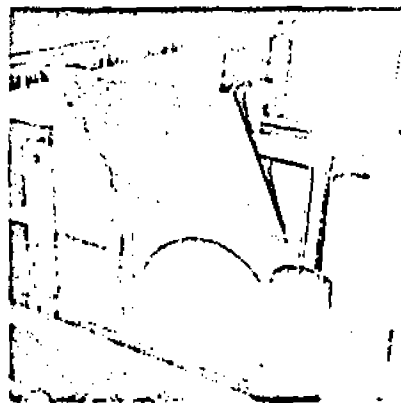
With this feature, the timer can be preset between irrigations. The clock will not run, however, until water enters the ditch and lifts the small float to release the start-stop mechanism. The total preset operating time for a group of structures is greater because only one timer is running at a time. This timer can also be placed on a portable mount so that it can be used on more than one gate. Although more costly, this timer has proven to be very reliable and is widely used in Hawaii for automatic irrigation. It may be obtained from the Brumley-Donaldson Company. (See page 21 for the address).

An inexpensive way of automating precast concrete pipe headgates or field turnouts with drop gates is pictured in photograph 4. The timer and gate are mounted on a bracket which is clamped on the top of the concrete headwall. Apron gates, such as the one shown in photo 5, are used as dams to check the water in a supply ditch or at flow diversions. They release the



**No. 5**  
Timer-controlled apron gate on portable frame. Gate drops open downstream side.

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**No. 4**  
Drop gate installed on a precast concrete pipe turnout.

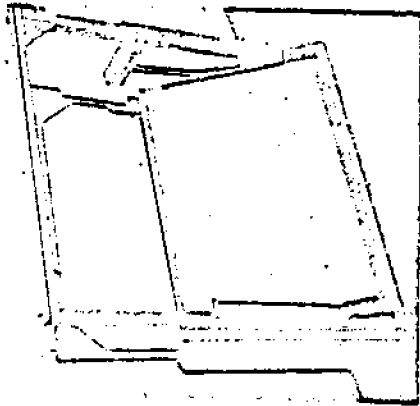
# ... ditch irrigation ...

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water sequentially downstream. This gate and the drop gate can also be used to check the water in a supply ditch for automatic distribution to the field through auto-start siphon tubes, (see page 6.)

The gate can be mounted on a cutoff or head wall or, as shown in the photo, on a portable, one-inch, angle iron frame. The portable frame is designed to fit in the checkboard guides or notches of conventional structures and may be used to automate existing systems. The gate is hinged at the bottom and has a latch on the top that is released by a timer. Thin rubber strips are cemented to the downstream side of the frame to provide a seal between the 16-gauge galvanized sheetmetal gate and the frame. The frame can be sealed in the notches of the head wall structure in the same way as the drop gate.

Another gate that has proven very reliable is the pressure gate shown in photo No. 6. The frame is similar to that used for the drop gate. The gate swings on a



No. 6

Pressure gate mounted in a portable frame.

shaft located a certain distance above the bottom of the gate. This distance is determined by subtracting 1 15-16 inches from the desired gate tripping depth and dividing by 3. The gate is counterbalanced with a stainless steel Neg'ator constant force extension spring. (See page 21.)

In operation, the gate opens when the water level on the upstream side reaches a predetermined depth. It can be used with either the drop gate or the apron gate in relatively flat ditches that require a gate at each field turnout or at flow diversions.

Low cost overflow weir crests or sills in field turnout openings are usually more economical than automatic or semi-automatic gates. Also, communication or interaction between multiple turnout structures of the same irrigation set and the check gate in the supply ditch is not neces-

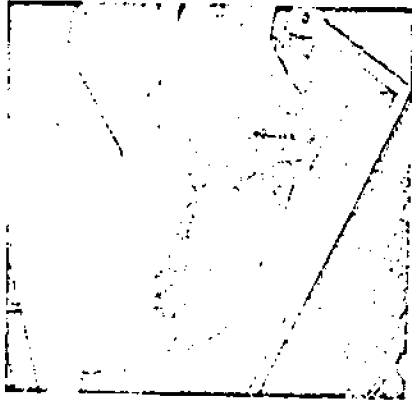
sary when weir-type outlets are used. Weir crests made from either sheetmetal or fiber glass can be attached to the upstream side of a field turnout as shown in photo 7.

During irrigation, water in the ditch is checked until it flows over the crest and onto the field. When irrigation is completed, the water is diverted to another portion of the field by a timed check gate in the supply ditch and the water in the ditch drops below the level of the field turnout crests not being used for irrigation.

Automatic irrigation is accomplished in this same manner when auto-start siphon tubes are used. Prefabricated crests can be easily mounted on existing concrete structures using explosive "ramset" charges or with anchor bolts. They can be made for mounting on either vertical or sloping face turnouts such as in a lined ditch.

Prefabricated crests made in quantity from fiber glass are expected to be reasonably low cost and can be used with either drop gates or apron gates for conversion to semi-automatic irrigation. Weir overflow crests can be used only on ditches having sufficient slope so that the elevation difference between consecutive turnouts or groups of turnouts is greater than the head required over the crest.

Construction drawings and



No. 7

Precast concrete pipe turnout fitted with a sheetmetal wire crest.

details for the gates described above can be obtained from the author. (See note page 18.)

## Gated Pipe Improvement

Gated pipe is used extensively in many areas of the U.S. for water distribution into furrows. Although its use is increasing, it is not as widely accepted in the Northwest. Gated pipe provides a good means of obtaining uniform water distribution to each furrow. U.S. Department of Agriculture researchers of Fort Collins, Colorado are developing methods of automating gated pipe using hydraulic and pneumatic valves. Valves are being developed to automatically control water flow from buried pipe-line risers into gated pipe and also to control the flow from individual pipe openings. Low cost molded plastic components such

Continued



No. 8 A

8 B

8 C

Turnouts from a lined ditch automated with push-off gates (left and center) and a butterfly gate (right) powered by plastic hydraulic cylinders.

as hydraulic cylinders have recently become available and are being used to automate surface

irrigation systems.

Two types of hydraulic cylinder actuated gates on pipe turn-

outs are shown in photo 8. The gate pictured in photo 8a is opened by the cylinder pushing the cover from its seat. When the cylinder retracts, the gate is closed as shown on the left in 8b. Flow rates may be controlled by presetting the cylinder mounting bracket to limit maximum gate opening. Since the push-off gate is limited in size by the thrust of the hydraulic cylinder, it can only be used on smaller gates. Larger gates or checks can be operated with single or double cylinders by using a center pivot or butterfly gate design as shown in 8c.

Hydraulic pressure for this type system can be obtained from municipal or domestic water systems, electric pump, or a water-wheeled powered pump and pressure tank. Where 110 volt AC power is available, programmed controllers can be used to fully automate a field with this system.

For information about the automatic timer described, write: Brumley-Donaldson Company, 3050 East Stausen Avenue, Huntington Park, California. For information about the Negator constant force extension spring, write: Hunter Spring Division, Ametek, Inc., Hollfield, Pa.

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