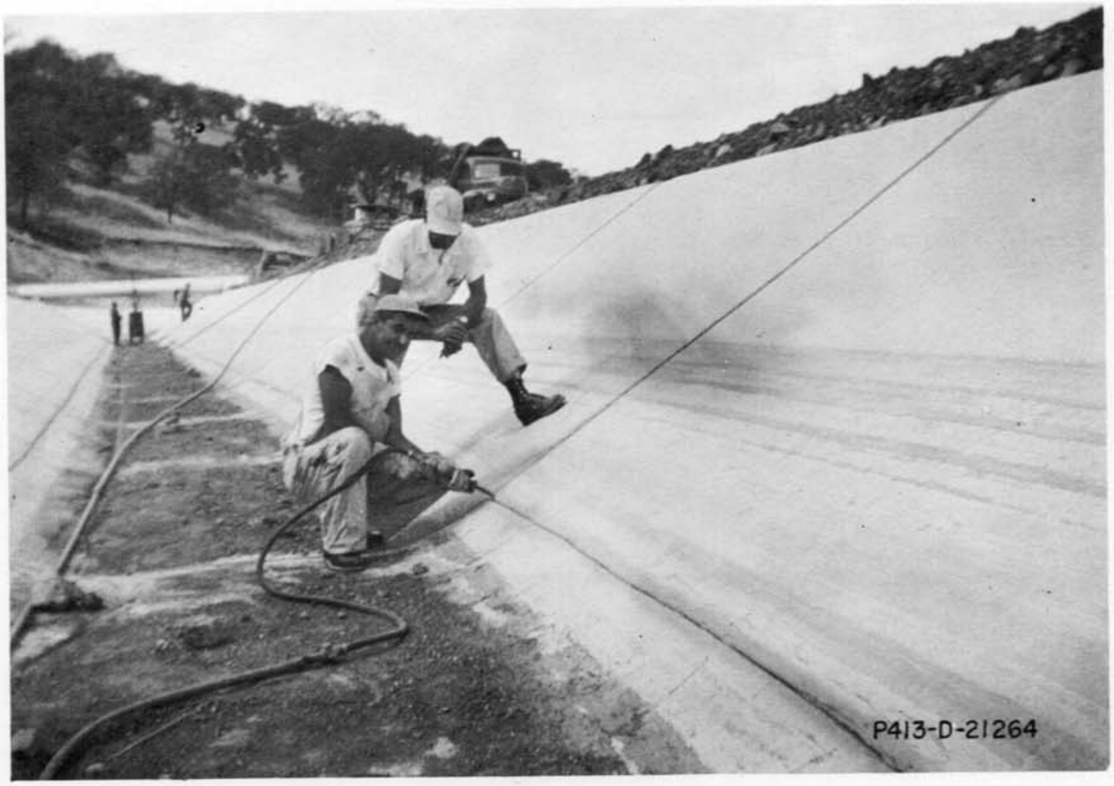
Department of the Interior
Bureau of Reclamation

OPERATION AND MAINTENANCE EQUIPMENT AND PROCEDURES

RELEASE NO. 32

April, May and June 1960



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CONTENTS

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COVER PAGE

Filling of the grooves in the concrete lining of the Putah South Canal, Solano Project, California, was accomplished by contract in a minimum of time. A description of the operation is presented beginning on Page 14. Photo No. P413-D-21264

OPERATION AND MAINTENANCE

EQUIPMENT AND PROCEDURES

Release No. 32

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INTRODUCTION

This bulletin, published quarterly, is circulated for the benefit of irrigation project operation and maintenance people. Its principal purpose is to serve as a medium of exchanging operation and maintenance information. It is hoped that the labor-saving devices or less costly equipment developed by the resourceful water users will be a step toward commercial development of equipment for use on irrigation projects in a continued effort to reduce costs and increase operating efficiency.

We wish to thank Mr. Maurice K. Strantz, Manager, Tulelake Irrigation District, Tulelake, California, who has prepared the article on the Tulelake Irrigation District's Automation Program appearing in this issue of the bulletin beginning on page 2. Mr. Strantz wishes to emphasize the time and effort spent by his Assistant, Ed Lance, in following through on the remote control installations and the important practical operating experience of Watermaster, Harold Kniskern, which was essential in the final selection of designs to meet operational needs.

To assure proper recognition of those individuals whose suggestions are published in this and subsequent bulletins, the suggestion number as well as the person's name is given. All Bureau offices are reminded to notify their Suggestions Awards Committee when a suggestion is adopted.

Attached to this issue of the bulletin is an up-to-date index of material contained in Releases No. 1 through 32. The new index supersedes the one dated September 1959, which can be destroyed.

* * * * * * * *

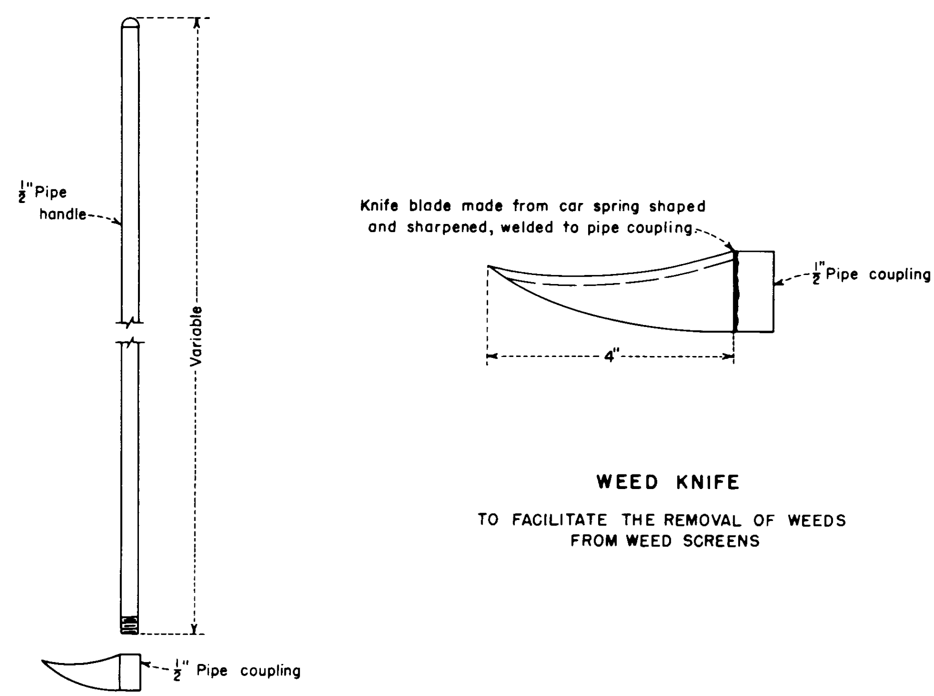
Division of Irrigation Operations
Commissioner's Office
Denver, Colorado

WEED KNIFE
(Suggestion - R1-59-185)

Trouble has been experienced at all Roza pumping plants, and at the Chandler Power and Pumping plant, Yakima Project, Washington, from weeds and debris collecting on plant trashracks and weed screens in such a way as to be very difficult to remove. Floyd L. O'Banion, Plant Mechanic, made a knife for cutting, and thereby loosening weeds and debris from the trashracks and screens which have greatly reduced the weed removal problem.

The knife can be made quite quickly and easily from a part of an old automobile spring, welded to a 1/2" pipe coupling, cut, pointed and sharpened as required as shown below. The pipe coupling can then be screwed to the required length of ordinary 1/2" water pipe, to be used as a handle for the knife.

Since material for the knife is readily available from used material, the main cost is in cutting, welding, and sharpening the spring. Maximum cost is estimated at $7.



WEED KNIFE

TO FACILITATE THE REMOVAL OF WEEDS FROM WEED SCREENS

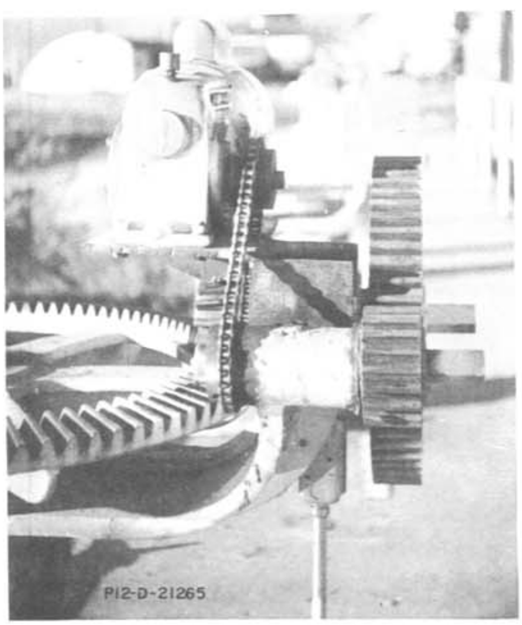
TULELAKE IRRIGATION DISTRICT AUTOMATION PROGRAM

The Tulelake Irrigation District located in Northern California, operates the irrigation and drainage facilities of the Tulelake Division of the Klamath Project. The Klamath Project is one of the oldest in the West, with some of the storage facilities completed in 1910. The Tulelake facilities, however, were installed in the early 1920's.

Operation of the Tulelake Division facilities was transferred from the Bureau of Reclamation to the Tulelake Irrigation District, January 1, 1957. To date the District has been conducting a sizable maintenance and rehabilitation program to improve service and reduce operating costs. Two of the early improvements were: (1) a two-way radio system, which permitted centralized water control from the District's office, and (2) the installation of time switches to start and stop low-head pumps furnishing supplemental irrigation water from drains.

In 1958, District Manager, Maurice K. Strantz recognized a need for remote control of certain water control structures and for automatic control of others. A study of benefits received vs. costs was made for each system of control. For the first phase of this over-all Automation Program, the Manager and his staff designed and installed one remote control system to operate the Lower Lost River Diversion Dam and an automatic system, on the order of the Bureau's "Little Man" checks, 1/, to control water elevations above major checks on the water supply system. These systems operated during the 1959 irrigation season.

Remote Control of Diversion Dam



Hoist Mechanization

The remote control of the Lower Lost River Diversion Dam was accomplished in two steps. The first step was to mechanize existing gate hoists which were of the open, double gear, two-speed, hand-operated, pedestal-lift type with gear ratios of 24:1 on the low speed shaft. While the District considered discarding the gears and purchasing a commercial electric valve operator, which fits over the gate stem, it was found considerably cheaper to adapt gear motors to existing gearing arrangements as shown in the photograph at left, in which the driving sprocket replaces a shaft stop collar.

1/ Release #20, page 1, Operation and Maintenance Equipment and Procedures bulletin, April, May, and June 1957.

A one-half-horsepower gear motor driving the low speed shaft at 51 r.p.m. and providing a maximum torque of 30 ft. lb. is required for seating the gates. This speed lifts the gate at a rate of 0.19 feet per minute, operating three 7'x6' gates simultaneously, providing an area change of 4 sq. ft. per minute. Slow speeds were used to protect the existing bronze collar bearings and un-machined cast gear train.

Double throw limit switches were placed in a central location on the face of the dam to work off of each gate stem. A manual by-pass was added so that the gates can be individually seated. A single magnetic reversing starter was installed to control all 3 motors. A hand-off-automatic selector switch was also added.

The cost of motorizing each gate was $400.

The second step consisted of selecting and installing a remote control system that best suited requirements. In dealing with companies that specialize in remote systems, it was found that it is necessary to make the following decisions.

1. Is mode of communication carrier to be radio or wire?

2. If wire, what type of connection is desirable, constant or occasional?

3. What degree of accuracy is required?

4. What operations must be made with equipment?

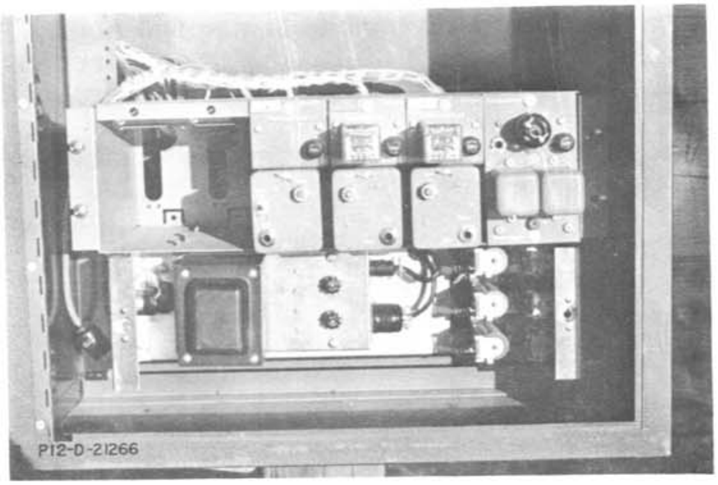
5. What is overall remote control program?

The remote control system which was installed by the District was provided by a firm specializing in telemetering and automatic control equipment. The system consists of a group of components working in pairs to accomplish the necessary functions. The components are shown schematically in Diagram 1 on page 6 and are described and illustrated in subsequent paragraphs.

Tone Transmitter and Tone Receiver

This is the basic component of the system. Three transistor transmitters operating on a 22-V, DC power source generate a steady audible tone at 465, 665 and 765 cycles per second. Three transistor receivers operate at the opposite end of the circuit to receive either 465, 665 or 765 cycles per second, thus creating three separate tone channels.

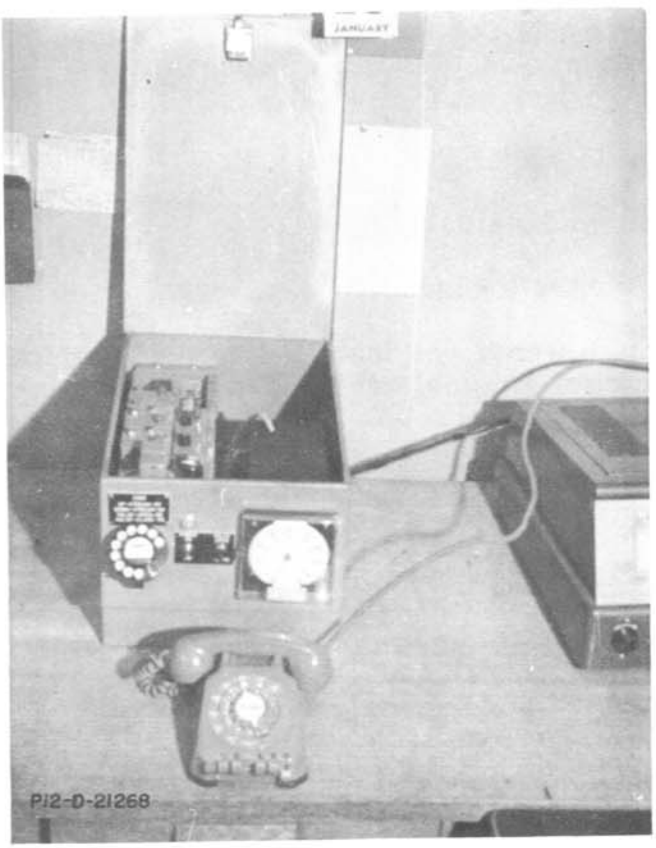
The equipment located at the dam, and as shown in the photograph at the top of page 4, consists of from top left to top right the tone transmitter 465, tone receiver 665, tone receiver 765 and 22-Volt



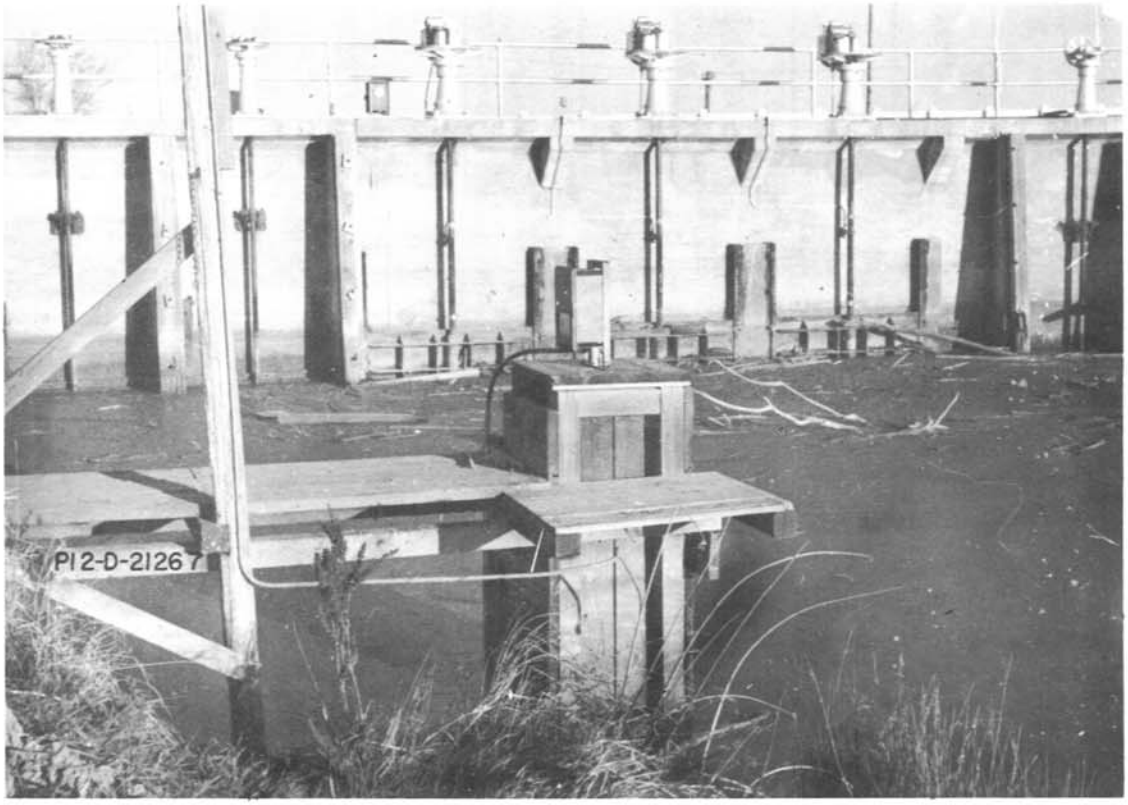
A.C. power supply for tone equipment. At bottom left is 22-Volt D.C. power supply for the decoder. Pulsating and slow release armatures are located at rear of the cabinet. At bottom right are the function relays.

Selector Dial

Remote controlling equipment located at the office, as shown in the photograph below, includes on the front panel, the power off-on switch, the gate open-close switch, position and level indicator and the selector dial. In the cabinet are tone transmitters 765 and 665, tone receiver 465 and 22-V, A.C. power supply.



The selector dial sends out pulses when dialed over one tone channel to the decoder located at the diversion dam. The decoder uses a code wheel, a pulsing armature, a slow release armature, and a set of code pins to select and close the desired function relay, i.e., with reference to Diagram 1, page 6, it selects $F1_a$ and $F1_b$ when number 66 is dialed, $F2_a$ and $F2_b$ when 68 is dialed, F3 for number 62 and function relay F4 when the Code 64 is dialed.



Level Transmitter

The level transmitter, located at the dam, and mounted in the stilling well immediately upstream from the dam, as shown in the foreground of the photograph above, transmits the position of the water level or of a gate over a second tone channel to the Position and Level Indicator located at the office. The gate position transmitter also is shown in the above photograph at upper left on top of the dam.

The level transmitter employs a measuring element and an impulse transmitting unit. The position and level indicator employs a receiver mechanism, consisting of two differential units driven by a constant speed synchronous motor. The differential units are linked to an indicator, which seeks and finds a position corresponding to the indicator at the transmitter. In this system, the level is transmitted as a function of time interval between transmitter pulses.

Operation

Using Diagram 1, page 6, again one may follow the complete operation obtainable with this system. The operation of receiving two water levels, the position of the gates and the movement of the gate up or down may best be described in five steps.

Step 1: Using the District's telephone, the number of the diversion dam is dialed. The automatic answering relay, furnished by the telephone company and located at the dam, responds to the ring and sends a bell tone back as soon as it has completed the circuit. As soon as the bell is heard, the operator is ready to proceed with Step 2.

Step 2: The power switch on the equipment located at the office is turned on, energizing the equipment and putting a tone generated by T 765 across the lines to be received by R 765.

Step 3: To read the water level above the dam, the operator dials Code Number 62 on the selector dial. This code is fed into the decoder by the tone channel 765 and the decoder selects and closes F3 (Function Relay #3). This puts the upstream level transmitter and tone channel 465 into action thus actuating the position and level indicator to give the water level reading.

Step 4: The water level below the dam is selected by Code No. 64, closing relay F4 and is read as described in Step 3.

Step 5: To read the position of the three 6'x7' gates at the dam, either Code Number 66 or 68 may be dialed depending on whether it is anticipated that the gate will be moved up or down. If Code 68 is dialed, the decoder selects and closes function relays $F2_a$ and $F2_b$. The closing of $F2_b$ puts the gate position transmitter and tone channel 465 into action again causing the position and level indicator to respond to give the desired reading.

Knowing the head acting on the gates and the discharge area, the present discharge is calculated. The operator, knowing whether or not a new flow is desired, can then compute the required discharge area. If the gates are to be closed, all the operator has to do is key the gate switch which puts tone channel 665 on the line operating through $F2_a$ (Relay was closed with $F2_b$ in Step 4) to close gates. Gates will continue to close as long as T 665 is keyed. If the gates were to be opened, Code 66 on the selector dial would have to be dialed first, closing $F1_a$ and $F1_b$. Gate switch key then may be closed causing gates to open. It is possible to monitor the position of the gates as they are moving, since either $F1_b$ or $F2_b$ remains closed as long as either $F1_a$ and $F2_a$ is closed, and the levels are transmitted back to the office.

Using the above operating procedure, all the desired information, area computations, and gate movements for an area change of 8 sq. ft. (resulting in flow change from 30 c.f.s. to 79 c.f.s. depending on the discharge head) may be made in a 3-minute phone call. Accuracy of this type of equipment is estimated at 1 per cent of the range of measurement. The District selected a common operating range of 4 feet for water levels and gate position.

Experience indicated that errors of that magnitude would not adversely affect operations and that the 4-foot operating level would be useful in other locations. Equipment with a greater range and greater accuracy is obtainable but at a somewhat higher cost.

The District chose the telephone answering relay connection instead of a pair of leased telephone lines. In this case the initial lease line rental was twice that of the answering relay, and it appeared that with experience the leased line system would be proportionately even more expensive.

Automatic Gate Control System

In searching for an economical and simple means of installing a control system to keep stable water levels above checks, automatic check installations designed, installed and operated by the Bureau of Reclamation were observed and their plans studied. The Bureau's "Little Man" checks used the floats, micro switches and timers to accomplish this.

Another system of liquid level control called the Floatless Liquid Level Control System was studied extensively. This system is used in many industrial pump reservoir applications. The District chose this system over the float system for the following reasons:

1. Electrode system has no moving parts, greatly reducing maintenance problems.

2. Electrode system permits stilling well construction to be very simple and inexpensive.

3. No enclosure is needed on stilling well.

4. Accuracy compares favorably.

5. Bulk of electrical equipment may be located at the motor control box with only electrodes located at stilling well. This equipment can be located at any distance from the electrodes.

Mechanization of Gate Hoists

Like the remote system, the automatic gate control system was designed and installed in two steps. The first step was to mechanize existing gate hoists, which were radial type with gear ratio of 96:1, with two gates mounted side by side at each check, as shown in the photograph at the top of the following page. The most feasible and economical method of motorization proved to be the use of double-shaft horizontal-gear motors, located between the two gate hoists driving 10 to 18 feet of shafting, as shown in the photograph at the bottom of the next page. A 1/4 horsepower-gear-motor rotating at 87.5 rpm driving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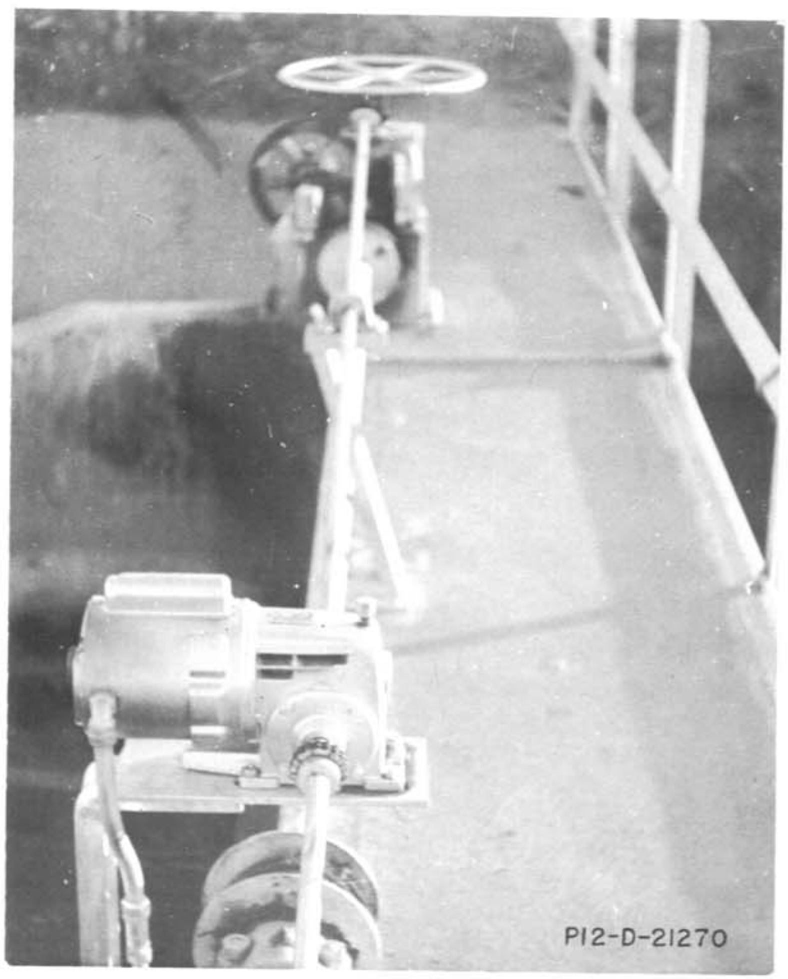
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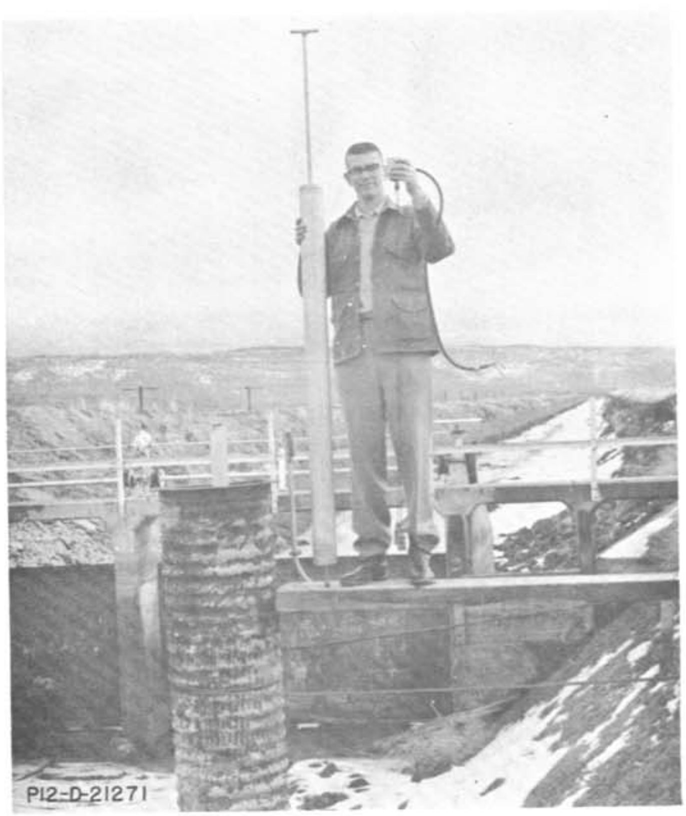
through a worm and worm gear (ratio 10:1) moves each gate simultaneously at a vertical lift rate of 0.14 feet per minute. The slow speeds involved proved to be beneficial both mechanically and from an operation standpoint. Smooth operation at these slow speeds was provided with the shaft of 1-inch diameter supported at 6-foot spans. A rotary limit switch was connected directly to a horizontal shaft on the gate hoist to limit the gate movement to a fully-closed and fully-opened position.

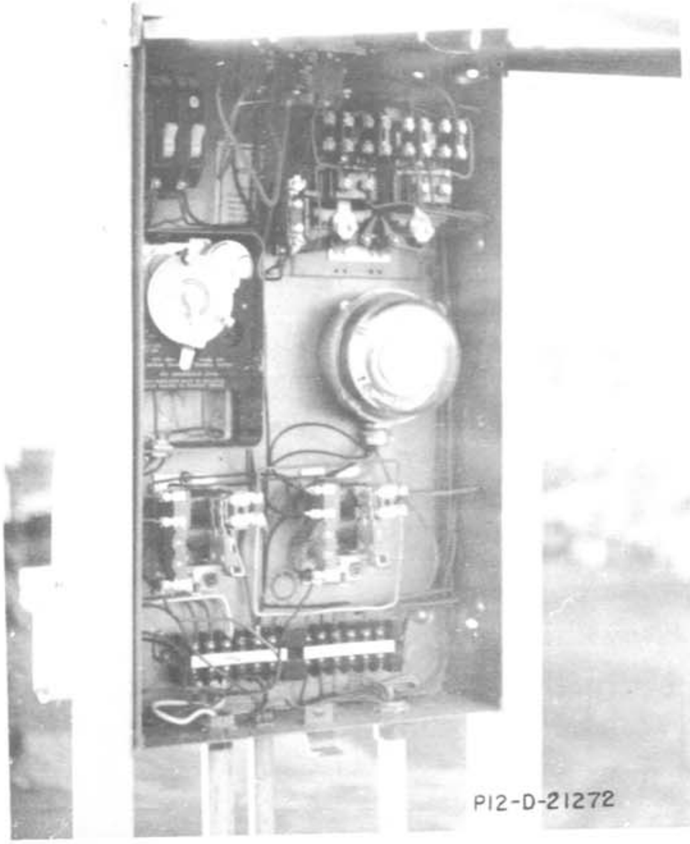
Cost of purchasing and installing gear motor, magnetic reversible starter, limit switch, mounting pedestals, gear train, and miscellaneous wiring and fabricating necessary to mechanize the gates amounted to $900 per check.

Electrical Equipment

The second step was to select and install the necessary electrical equipment to operate the motorized gate so as to keep the water above the check at a desired elevation, varying less than 0.10 feet. The essential features are shown in the general view of the check and gates in the photograph at the top of the previous page. The corrugated metal pipe stilling well near the right bank upstream from the 550 cfs check contains the electrodes. The control cabinet on the right of the check operating deck, houses the electrical operation and control equipment.



In the photograph at left, more detail of the stilling well assembly can be seen. The electrode holder containing two shielded electrodes are being held at the right with electrical cable attached. The electrode holder is watertight and needs no enclosure. The electrodes fit into the 4-inch diameter aluminum tube which also acts as a second stilling well. The tube containing the electrodes may easily be moved vertically on the bracket mounted in the corrugated pipe stilling well in the foreground, and the desired water level above the check selected. An important safety feature of the floatless control system is that the electrode circuit is on the secondary side of the induction relay, thus the



electrode circuit current is generated within the relay and has no connection with the power line.

In the photograph at left, an automatic check control box is shown with the main circuit breaker at top left, the magnetic reversible starter at top right, time clocks for lights in left center, adjustable timer in right center, and floatless electrode induction relays on the bottom.

Operation

Referring to Diagram 2, on the following page, operation of the automatic control system can be best described under 3 water level conditions:

1. When Water Level Raises Enough to Make Contact with Upper Electrode. Normally open circuit between electrode U and ground is closed causing secondary side of induction relay U to energize. This closes contacts energizing "up" side of the magnetic starter. Gate moves up in time intervals controlled by a synchronous motor operated cycle timer. Timer may be set to desired percentage of running time. In other words, a three-minute timer set to run 50% of the time will cause the gate to move up for 90 seconds, stop for 90 seconds, then move upward again. The controlled movement will continue until gate has opened enough to lower water level so that upper electrode is clear of water.

2. When Water Level is Contacting Lower Electrode and is Below Upper Electrode. This is the operating level. Under these conditions both induction relays remain open and gear motor remains at rest.

3. When Water Level Drops Below Lower Electrode. Normally closed circuit between electrode D and ground is then opened causing secondary side of induction relay D to de-energize. A spring closes relay contacts energizing "down" side of magnetic starter. Gate will continue to move downward as controlled by timer until water level raises, immersing Electrode D, again putting system to rest.

AUTOMATIC CHECK CONTROL

SCHEMATIC DIAGRAM - TULELAKE IRRIG. DISTRICT

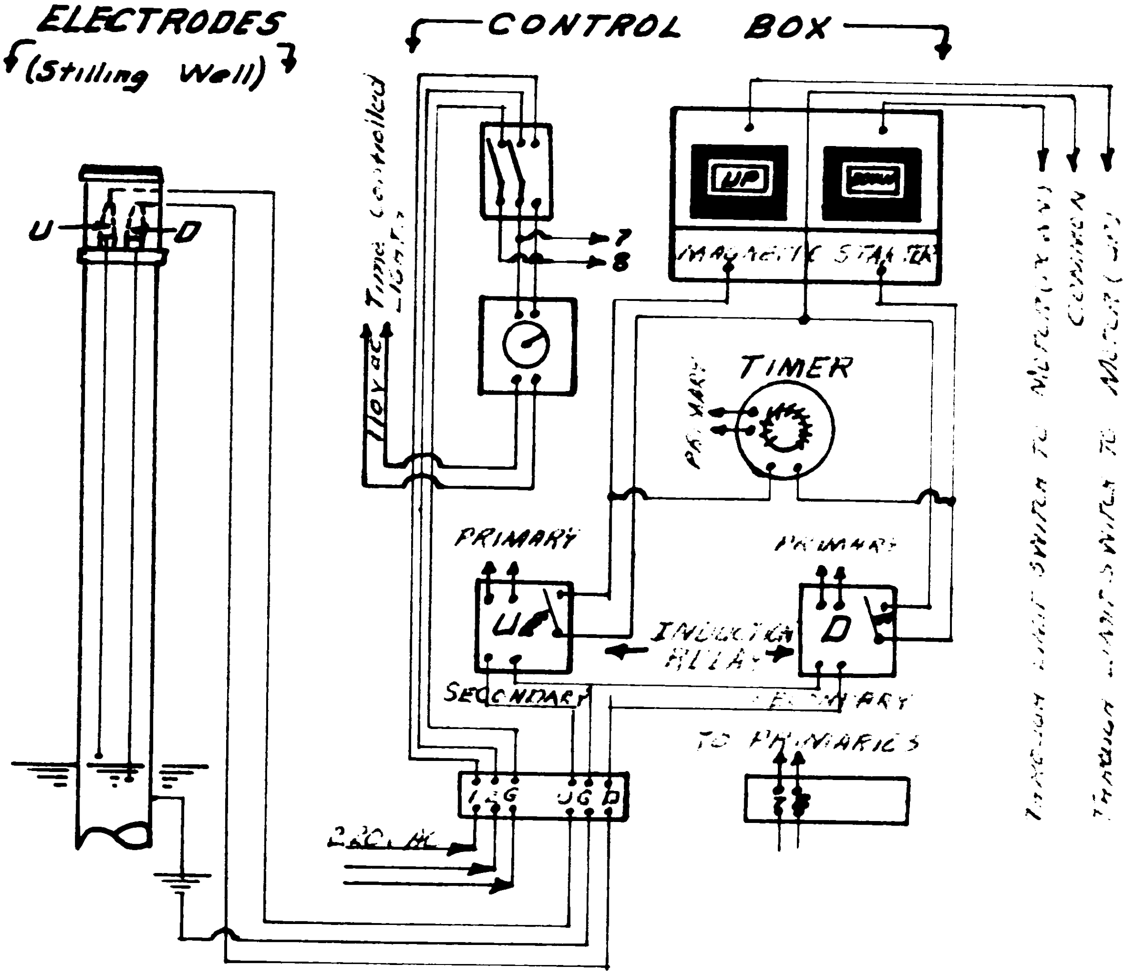


DIAGRAM No. 2

Experience during last season's operation showed that the combination of rate of gate travel and flow under gate were such that time delay is probably unnecessary to prevent the gate from hunting. The only apparent advantage obtained was a reduction of running time. The floatless liquid level control equipment with accessories was purchased and installed at a cost of $100 per installation.

The District has found that installation of these automatic checks has provided several benefits:

1. Nearly constant water levels are maintained, providing more constant flows into laterals and into the farm headgates.

2. Planned changes in flow through checks are more rapidly made than is possible by manual gate regulation.

3. The time required by operating personnel to adjust gates is eliminated, resulting in substantial savings to the District.

4. Rate of filling or emptying canal can be more easily and precisely controlled.

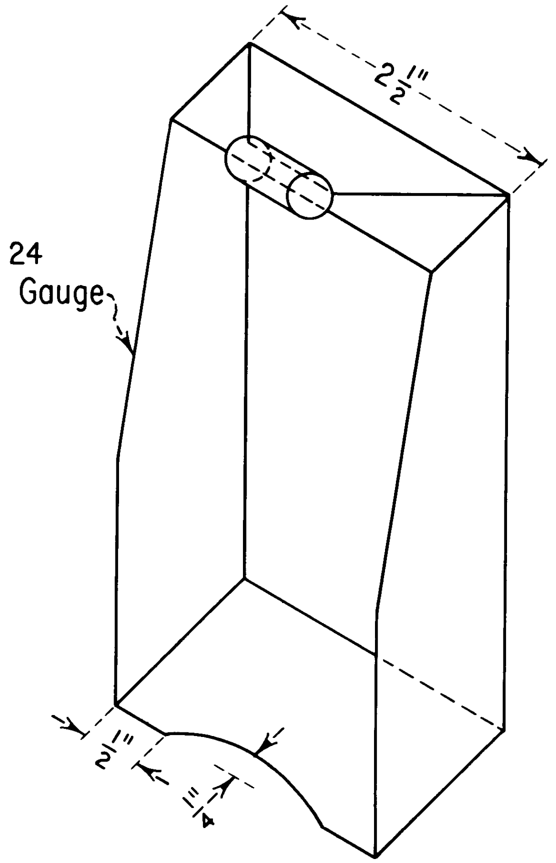
* * * * * *

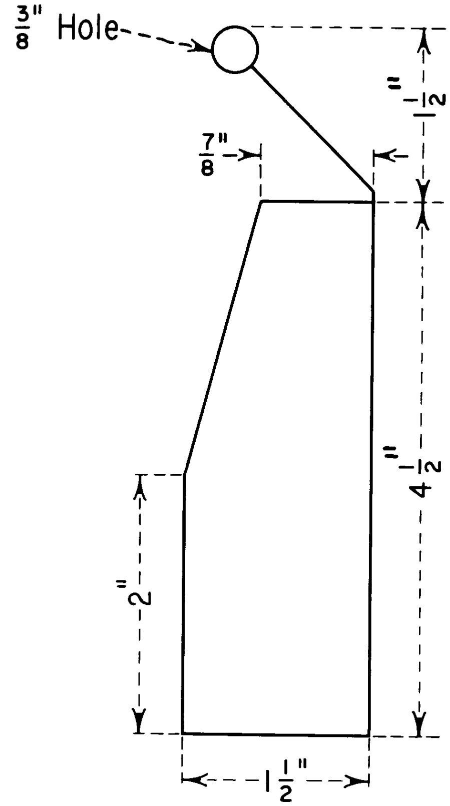
PROTECTIVE COVER FOR PADLOCKS
(Suggestion R1-59-109)

Considerable difficulty has been encountered during the winter months in unlocking padlocks on the Palisades Switchyard facilities in Idaho. Moisture from snow and rain collects in the lock tumblers and around the shackle and then freezes making it necessary to heat the lock before it can be removed. Joseph A. Fisher, Powerplant Operator, suggested a cover to protect the padlocks on the disconnect, selector, and ground switches, thus preventing this condition and saving considerable time in performing emergency switching which could prevent a prolonged outage. It also speeds-up routine switching and eliminates the unpleasant task of thawing padlocks.

The cover is held in place by a pin in the switch operating handle swivel which will allow it to swivel vertically only. During operation of a switch, the cover can be raised, the padlock removed and with the switch operating handle raised, the cover is held in the raised position and rotates with the handle. Upon completion of the operation, as the handle is lowered, the cover will drop down over the padlock.

In the sketch on the following page the dimensions and two views of the cover are shown.





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FILLING GROOVES IN CONCRETE LINING

The excellent manner in which grooves in the concrete lining of the Putah South Canal, Solano Project, California, were routed, cleaned and filled by contract in a minimum of time has prompted Project Construction Engineer, H. E. Horton, Winters, California, to outline the procedures followed so that they may be applied to similar work elsewhere.

The grooves were cleaned by sandblasting, regardless of whether the groove was to be routed. The contractor did an excellent cleaning job using No. 1 Monterey sand, a 200-pound capacity sand pot and a 210-cfm mobile air compressor. The cleaning operation was rapidly accomplished with as much as 10,000 lineal feet of groove being cleaned in an 8-hour day with only two operators.

The first groove routing was done using an air saw with an 8" cutting stone. This proved to be very slow and was abandoned after experimenting for two days. A small, light-weight, high-speed air-powered chipping gun was used next; but with the conventional wide-point chisel considerable spalling of the concrete was noted. This method was discontinued. The next system tried as shown on the cover page of this issue of the bulletin, was the same as above but instead of using the chisel, a 1-1/2" bushing head was cut down to about 1/4" at the tip and 3/4" at the top. The chipping gun was held at about 60° from the slope of the groove and no spalling was evident. The high speed of the gun effectively removed the concrete and deepened the grooves to the desired depth.

After completing the sandblasting and routing of the grooves a mastic pump was set up and this phase of the contract was started. The mastic was Government-furnished.

At first only a small mastic pump was used in a 5-gallon container; this was not very successful due to time lost transferring the mastic from the large 55-gallon drums to the small 5-gallon can.

The contractor then brought a large air-powered pump. This pump was mounted in a tripod high enough to fit into a 55-gallon drum as shown in the photograph above. It was found that by redesigning the tip of the pipe on the end of the mastic hose from round to a slot, much better penetration of the mastic into the grooves was obtained.

By using a "Y" connection in the hose line, two lead lines were possible. A third air connection supplied air for cleaning the grooves immediately ahead of the mastic guns as shown in the photograph at left.

In a high percentage of the grooves the lining was cracked to subgrade. After the mastic had set for a few days, tests were made to determine the depth of mastic penetration in these very small cracks. In most cases the mastic had penetrated the crack to the subgrade, and in all cases much below the bottom of the groove.

During most of the time this work was in progress the air temperatures during the day were from 80° to 100°. In the canal prism the temperature was much higher due to sun reflection from the white pigmented compound used for curing the concrete canal lining and to lack of air circulation. It was noted that the mastic pumped much easier and smoother when the temperature was high. If this work were to be done when the temperature was low, it would probably be necessary to use some system of heating the mastic before using.

As the mastic was applied it was left slightly irregular in the grooves, due to the reciprocating pump action; after a few weeks, inspection of the work showed the mastic to be almost level in the grooves and nearly flush with the concrete along the sides of the grooves. At no place was the mastic showing any indication of sagging, flowing or pulling away from the concrete.

Mastic used conformed to that presently required by Bureau specifications for "Sealing compound, rubberized, Cold Application, Ready-mixed, for Joints in Concrete Canal Lining", February 25, 1960, given on the following page.

It was necessary to route 9,194 feet of groove. Mastic was placed in 68,304 feet of groove, using 1,248 gallons, a yield of 54.73 feet of groove per gallon of mastic. The time allowed on this contract was 60 calendar days; the contractor started work on August 19 and completed the work on October 8, 1959, using only 86.7 per cent of the contract time.

The cost of the mastic delivered to the job site was \$1,903.73, or \$1.525 per gallon. The total cost of the contract, including the cost of the mastic, was \$12,083.63 or \$0.1769 per lin.ft. of groove. However, this unit figure is not entirely representative, since only 9,194 lin.ft. of groove were routed, while all the grooves were sandblasted. The bid prices are not necessarily indicative of the true cost of each item, as the contractor admitted that the routing of grooves, was underbid. However, we understand informally that while the contractor made no large profit, he definitely did not lose money on the overall job.

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SPECIFICATIONS
for
Ready-Mixed, Rubberized, Cold Application, Sealing Compound for Joints in Concrete Canal Lining

1. Scope. This specification covers a cold-applied, ready-mixed compound for use in sealing joints in concrete canal lining.

2. Material. The compound shall be resilient and adhesive material capable of sealing joints in concrete effectively against the infiltration of moisture throughout repeated cycles of expansion and contraction. The compound shall be a ready-mixed, homogeneous blend of asphalt, virgin synthetic rubber, inert filler and suitable solvents. The consistency of the compound shall be such that it may be readily applied at 70° F either by extrusion from a caulking gun or by troweling into the joints without the use of additional solvents or adulterants. The composition shall be such that the material will not flow from the joints after placing.

(a) Performance requirements

(1) Penetration.--The sealer when subjected to the test specified in 3(b) shall conform to the penetration requirements given on the next page:

At 32° F (after removal of solvent), 200 g, 60 sec., not less than 1.0 cm.

At 77° F (as sampled), 150 g, 5 sec., not less than 2.75 cm.

At 77° F (after removal of solvent), 150 g, 5 sec., not more than 2.20 cm.

(2) Flow.--The sealer shall not show a flow in excess of 0.5 centimeters when tested as specified in 3(c).

(3) Bond.--The sealer shall not fail in adhesion or cohesion when tested as specified in 3(d). Five cycles of extension and

recompression constitute the test for bond. The development at any time during the test procedure of a crack, separation, or other opening which is at any point over 1/4-inch deep in the sealing compound or between the sealing compound and the mortar block, shall constitute failure of the test specimen. The depth of the crack, separation, or opening shall be measured perpendicularly to the side of the sealing compound showing the defect. The failure of at least two test specimens in a group of three representing a given sample of sealing compound shall be cause for rejection of the batch or lot represented by the sample.

(4) Adhesion to concrete.--The sealer shall be of such nature that it will adhere to dry, dust-free concrete or to damp concrete free from surface moisture.

(5) Separation and settling.--The sealer shall show no separation or settling when tested as specified in 3(e)

(b) Composition requirements

Ingredients	Required percent by weight	Test method
Rubber	5.0 minimum	See subparagraph 3(f)
Filler (inert)	35.0 maximum	ASTM D 147-41
Nonvolatile matter, excluding inert filler and rubber	40.0 minimum	See subparagraph 3(g)
Water	3.0 maximum	ASTM D 95-58

3. Tests

(a) A batch of approximately 1,200 grams is necessary for these tests.

(b) Penetration.--The sealer shall conform to the requirements of 2(a)(1) when tested in accordance with the procedure described in Federal Specification SS-R-406c, Method 223.12, Section 5. Evaporation of solvent shall be performed as described in Section 7.5 of Method 223.12. Placement of the sealer in the container shall be performed in such a manner as to avoid entrapment of air.

(c) Flow test.--The sealer shall conform to the requirements of 2(a)(2) when tested as described in Method 223.12, Section 6.2, of Federal Specification SS-R-406c.

(d) Bond test.--The sealer shall conform to the requirements of 2(a)(3) when tested as described in Method 223.12, Section 7, of Federal Specification SS-R-406c, except that the opening between the mortar blocks for placing the filler shall be 2- by 2- by 1/2-inch.

(e) Separation and settling.--The sealer shall conform to the requirements of 2(a)(5) after being stored at 120° F for 72 hours in a 3/4-full closed container, 2.75 inches in diameter (1/2-pint can).

(f) Rubber content.--Manufacturer's certification or formulation showing that the material contains the specified amount of virgin synthetic rubber, shall be furnished with each batch or lot of sealer sampled.

(g) Nonvolatile matter.--Weigh about 10 grams of the sample in a weighed flat-bottomed metal dish about 5 to 8 cm in diameter. Heat the dish with its contents in an oven maintained at 105° - 110° C (221° - 230° F), for 24 hours, cool and weigh. From the weight of the residue left in the dish and from the weight of the original sample taken, compute the percentage of nonvolatile matter, correcting for the rubber and filler content.

4. Test samples. The contractor shall submit a representative 1-quart sample of the sealer for preliminary tests and approval. The sample shall be submitted at least 30 days before the material is to be used. The Government reserves the right at any time to further sample and test the material received on the job by the contractor.

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CARRIAGE FOR CURRENT METER
(Suggestion No. R1-59-202)

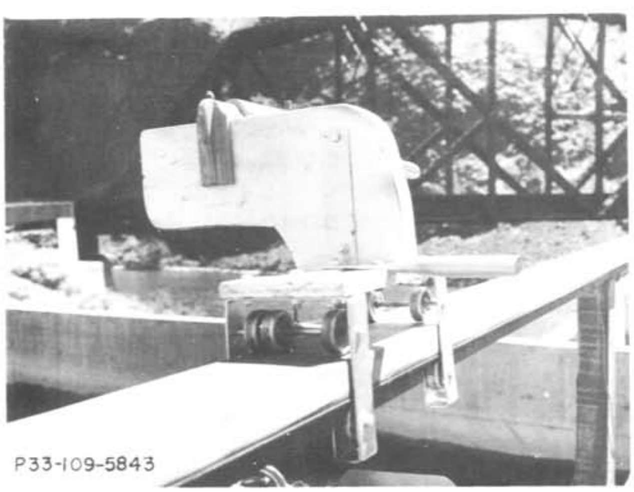
There are several Yakima Project canals, ranging from 900 to 2300 cfs. capacity, in which the velocities range from 5 to 10 fps. These are measured with current meters, suspended from cables with 30 to 50 pound lead weights below the meter to hold it in place in the swift flowing water. The cable by which the meter is lowered into the water is handled by special type of reel. This device was designed primarily for use of cable way gaging stations, where the operator mounts the reel on the cable car for making current meter measurements.

The standard method of measuring canals with handline, 30# weight, and stayline was found to be inaccurate, due to the high velocities encountered at three canals and to the very rough surface at Roza intake. As all these canals are concrete lined, levels were run so the depth could be computed from the gage readings. However, it was difficult to feel the bottom with the 30# weight for setting the meter to the bottom depth of observation. Using the hand line with a stayline the larger cable takes the shape of a large bow in these high water velocities and makes it very difficult to set the meter accurately for the bottom observations. Use of a 50# weight on a handline is too laborious to handle in high velocities. Hence, this method of using the Canfield reel with the small steel cable and stayline would make conditions allowing for more accurate measuring. Distribution of storage costs is based on the results of these measurements.

In adapting the Canfield reel for use on a canal gaging bridge, the hydrographers devised a metal stand, upon which to mount the reel, with a footing which the operator stood on to counterbalance the weight of the equipment. This method of handling the meter and lead weight in swift flowing water was not only awkward but extremely dangerous to the hydrographer who had to counterbalance both the weight of the measuring equipment and the force of flowing water, as well as manipulate himself and equipment across a wet or icy gaging bridge.

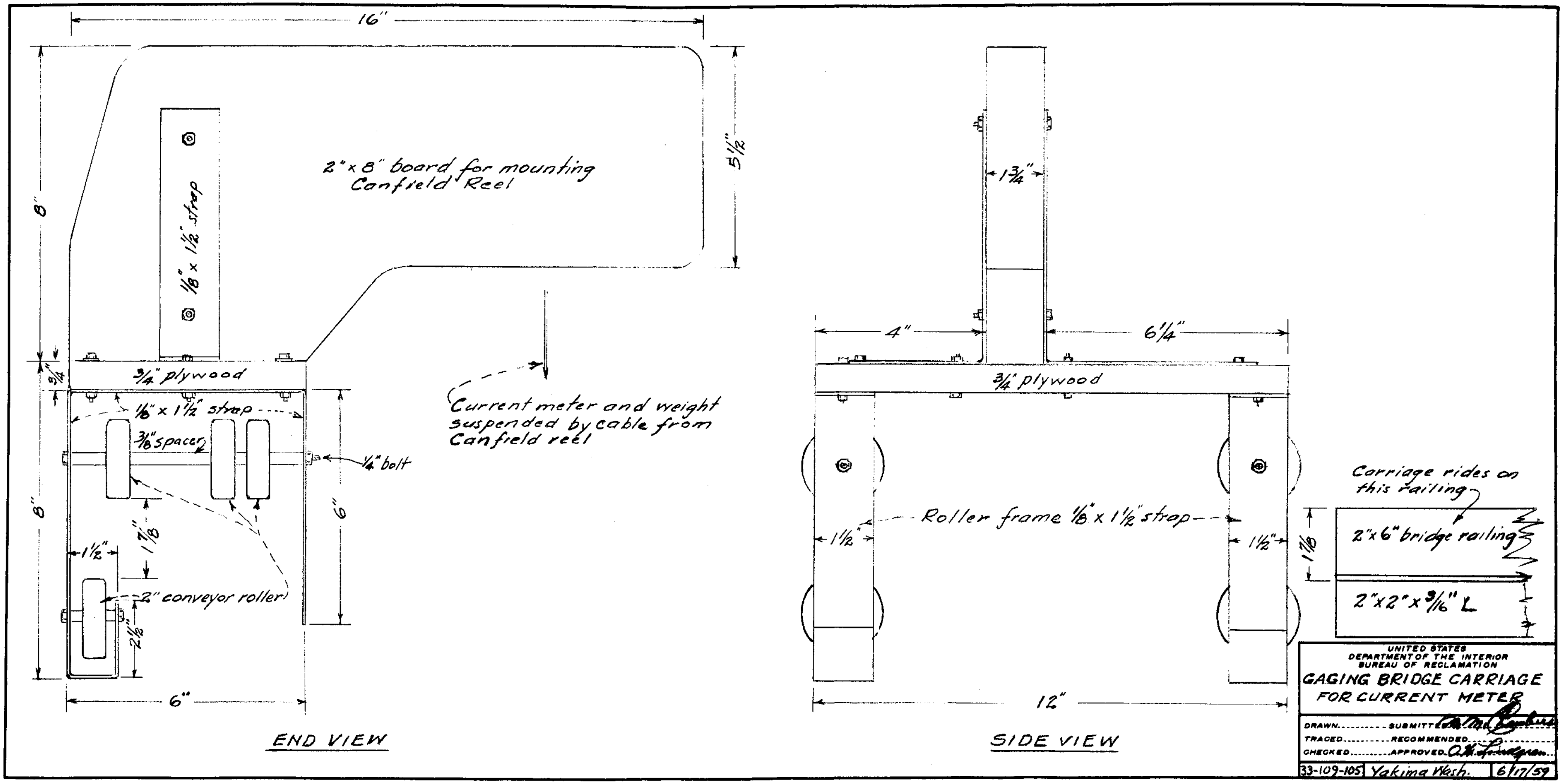
P33-109-5840

Because of this hazard and a desire to improve gaging methods, Mr. Mont M. Chambers developed the roller-type carriage shown on Drawing 33-109-105 on the following page. The carriage as shown on the left is made to ride on top of a 2x6" timber railing and fitted with rollers to permit easy movement across the bridge. A 2"x8" wooden arm forms the part upon which to mount the Canfield reel. This is shown in more detail in the photograph in the lower left.



P33-109-5843

The advantages of using this equipment are many. The operator is free to move about as he pleases, the water depth readings and setting of the meter at required depths can be accomplished more simply and accurately, and the device facilitates recording notes and moving the meter to measuring positions. Elimination of the extreme safety hazard which existed under the former methods used is the greatest advantage.



16"
8"
5½"
2" x 8" board for mounting Canfield Reel
⅛" x 1½" strap
¾" plywood
¾"
⅛" x 1½" strap
⅜" spacer
¼" bolt
Current meter and weight suspended by cable from Canfield reel
1⅞"
1½"
2" conveyor roller
2⅛"
6"
END VIEW
1¾"
4"
6¼"
¾" plywood
Roller frame ⅛" x 1½" strap
1½"
1½"
12"
SIDE VIEW
Carriage rides on this railing
1⅞
2" x 6" bridge railing
2" x 2" x 3/16" L
UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF RECLAMATION
GAGING BRIDGE CARRIAGE
FOR CURRENT METER
DRAWN.......... SUBMITTED
TRACED.......... RECOMMENDED
CHECKED.......... APPROVED
33-109-105 Yakima Wash. 6/17/59

GPO 838758