WATER OPERATION AND MAINTENANCE

BULLETIN NO. 112

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IN THIS ISSUE

UNITED STATES DEPARTMENT OF THE INTERIOR
Water and Power Resources Service

The Water Operation and Maintenance Bulletin is published quarterly for the benefit of those operating water supply systems. Its principal purpose is to serve as a medium of exchanging operation and maintenance information. It is hoped that the reports herein concerning laborsaving devices and less costly equipment and procedures will result in improved efficiency and reduced costs of the systems for those operators adapting these ideas to their needs.

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

Any information contained in this bulletin regarding commercial products may not be used for advertisement or promotional purposes and is not to be construed as an endorsment of any product by the Water and Power Resources Service.

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Division of Operation
and Maintenance Technical Services
Engineering and Research Center
Denver, Colorado 80225

San Luis Unit, Water and Power Resources Service's Central Valley Project, California. Shown in the picture is the Dos Amigos Pumping Plant and San Luis Canal near Los Banos, California. This plant contains six pumping units that lift water 38 m (125 ft) to reach 2 of the San Luis Canal. From that point on, gravity pulls the water southward.

On November 6, 1979, the Bureau of Reclamation was renamed the Water and Power Resources Service in the U.S. Department of the Interior. The new name more closely identifies the agency with its principal functions–supplying water and power.

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WATER OPERATION AND MAINTENANCE BULLETIN NO. 112

June 1980

INTRODUCTION

The construction of a moss return drain has proven to be the solution to the handling problem of large concentrations of pond weed and algae from pumping plant operating decks and yards. See page 1.

Would you like to have a look at what's at the bottom of your well? Now you can! The article, starting on page 8, tells you how.

The article on page 13 describes the effectiveness of a sawdust dispensing device in temporarily sealing leaks in stoplogs, canal linings, or gates for purposes of cleaning and painting.

The application of a permanent sealant to edges, seams, and pinhole cavities of bridge girders before painting has resulted in effective rust prevention. See article beginning on page 16.

The article on page 19 makes you aware that "Your Hands Are Vulnerable." Protect them and they will serve you a lifetime.

TRAVELING WATER SCREEN DRAINLINE[1]

Recognizing a problem during the early planning stages of a project usually ensures that appropriate consideration will be expended toward providing an acceptable solution. This was the case when canalside pumping plants were planned for lifting water from the Coalinga Canal located in California to a closed conduit for sprinkler irrigation. It was well known that algae growth or moss must be removed from the canal water prior to entering the conduit system to prevent plugging of sprinkler heads. The device selected for accomplishing this objective was a traveling water (moss) screen, which was installed between the canal turnout structure and pumping units. The device consists of a screen constructed on a rotating belt assembly, backwash pumping equipment, and chute for transporting moss and wash water from the screen assembly. The wash water and moss are separated by stationary screens, with the water returning to the pumping plant sump. The moss requires removal by hand from the stationary screens.

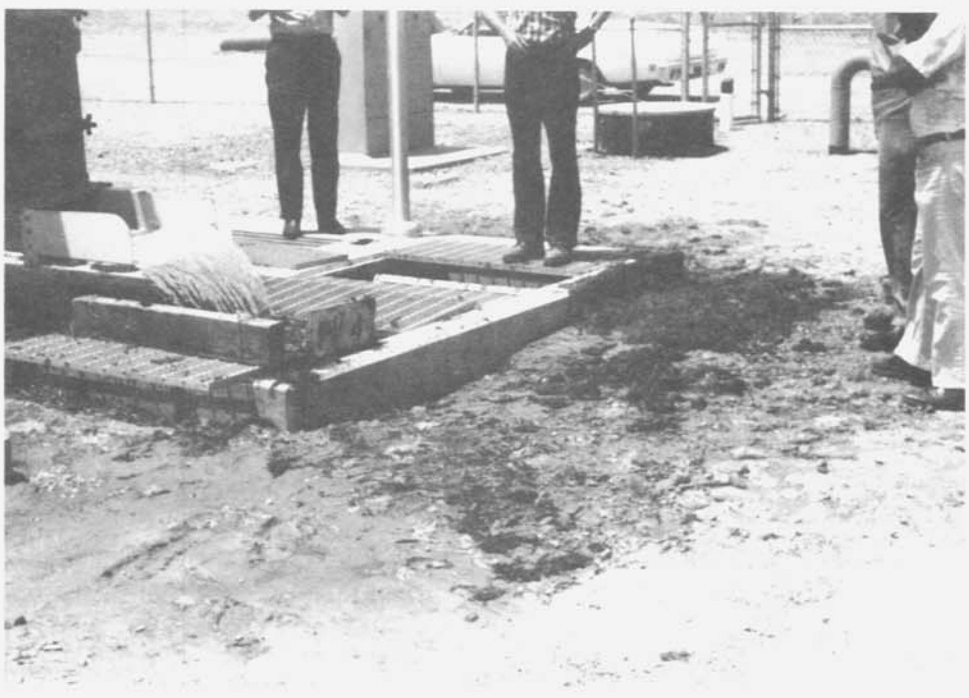

Figure 1. Traveling water screen assembly at far left and wash water and moss entering sump drain. Note debris removed from stationary screens and saturated yard.

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[1] Material for this article was provided by the Fresno CVP Construction Office, Water and Power Resources Service, Fresno, Calif.

The system provided for moss removal was well conceived. Algae and moss have been prevented entry into the pipeline laterals, thus assuring more trouble-free nozzle performance. However, as often is the case, the solution to the problem proved to be a bitter pill to swallow. The concentration of moss and algae in the San Luis and Coalinga Canals was underestimated, resulting in an exceptional volume of debris accumulating on the stationary screens at far too frequent intervals. Eventually, the screens completely plug, flooding the pumping plant area.

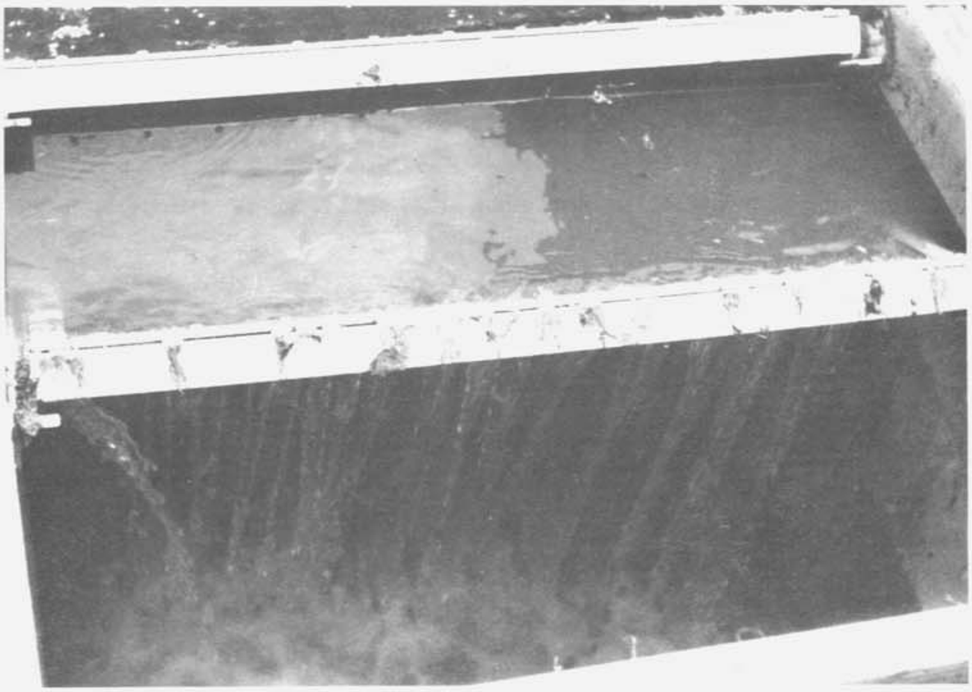

Figure 2. Traveling water screen sump drain. Stationary screens are almost totally plugged.

Many hours of physical labor were required for removing the debris and for cleaning the stationary moss screens by hand. The debris removed had to be stockpiled within the plant's fenced area, causing objectionable odors when wet and then removed out of the yard by hand for burning.

The first approach tried by project personnel to help alleviate the debris problem was the installation of a mechanical conveyor. The conveyor intercepted the discharge from the traveling water screen discharge chute prior to the flowing water contacting the stationary screens. This procedure improved the situation at the stationary screens, but only moved the debris to a new location, which still required cleaning and continued the odor problem. A more acceptable solution to the problem was needed.

Mr. Robert Ray, of the Fresno Construction Office, had followed the unacceptable operational and maintenance situation from the start. Finding an acceptable solution to problems had been a specialty of Bob Ray during his career with the Service, and he didn't let us down now! Bob designed and constructed a moss return drain that provided a 100-percent solution without any additional mechanical or energy requirements. The drain simply intercepts the wash water and moss from the discharge chute of the traveling water screen and transports the flow back to the main canal, see figure 3. The drain bypasses the stationary screens, thereby eliminating the operation and maintenance problem of moss removal.

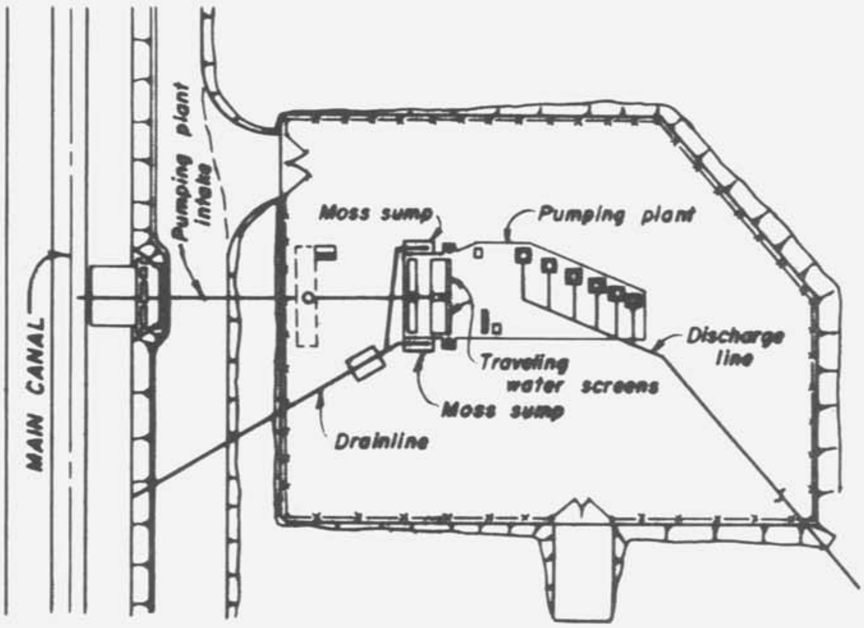

Figure 3. Moss return drain.

Construction of the moss return line required some imaginative thinking on Bob's part. He decided the best approach would be to insert a trough in the stationary screen sump pit to capture the wash water and moss. Figures 4, 5, and 6 show the procedure used to convert a 380-mm (15-in) PVC pipe into a trough. Figures 7, 8, 9, and 10 show the completed installation.

The moss return drain system has been installed at all Service-constructed pumping structures along the Coalinga Canal and at two San Luis Water District relift plants. Improved operation and maintenance of these structures have resulted, and further use of the moss return drain at similar sites along the San Luis Canal is being considered.

A solution to remove large concentrations of pond weed and algae from the San Luis and Coalinga Canals for 2 or 3 months during the summer is still being studied by the Service and State Department of Water Resources. A mobile crane with a drag bucket presently casts the removed moss on the slope outside of the operation and maintenance road.

Figure 4. Applying heat to 380-mm (15-in) PVC pipe to allow forming a trough without cracking

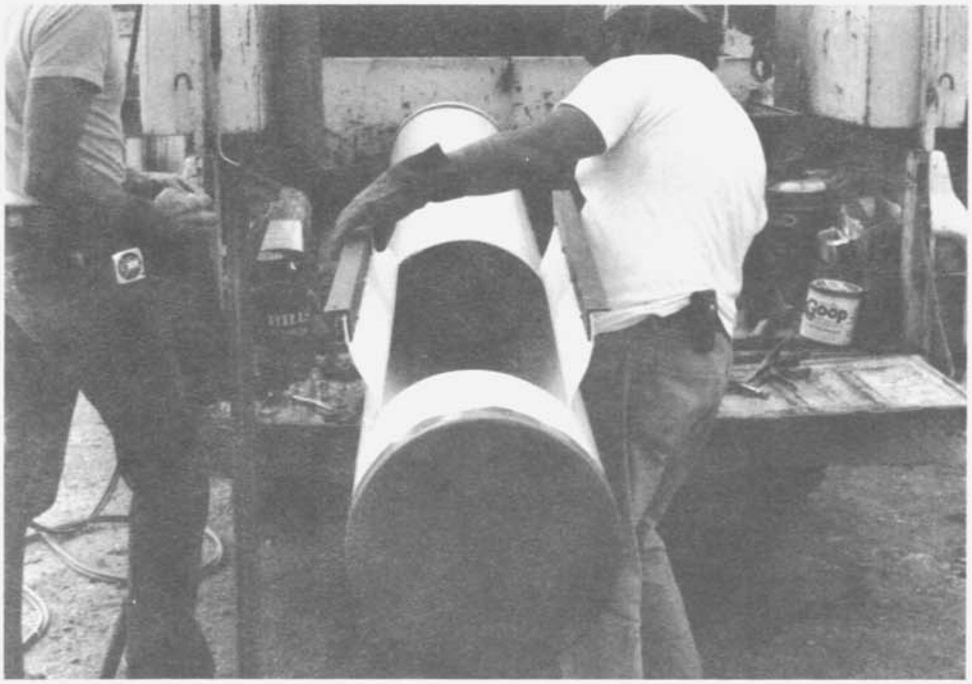

Figure 5. Shaping the trough and attaching angle iron supports.

Figure 6. PVC pipe and opening for entry of wash water and moss.

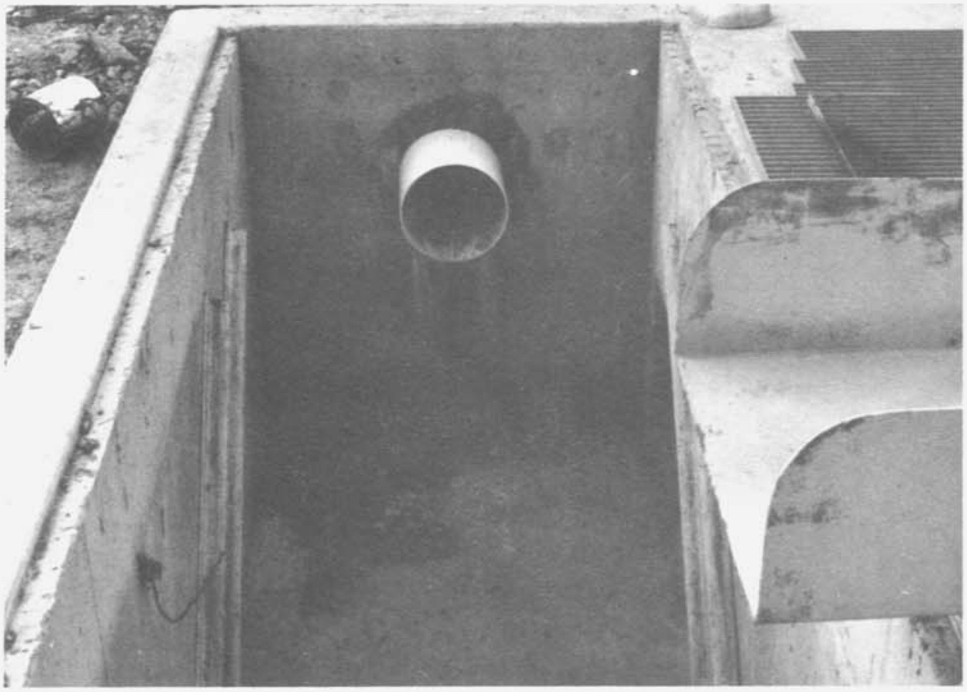

Figure 7. Drain sump at plant with stationary screens removed. Chute from traveling water screen in right foreground and moss drainpipe exposed in center.

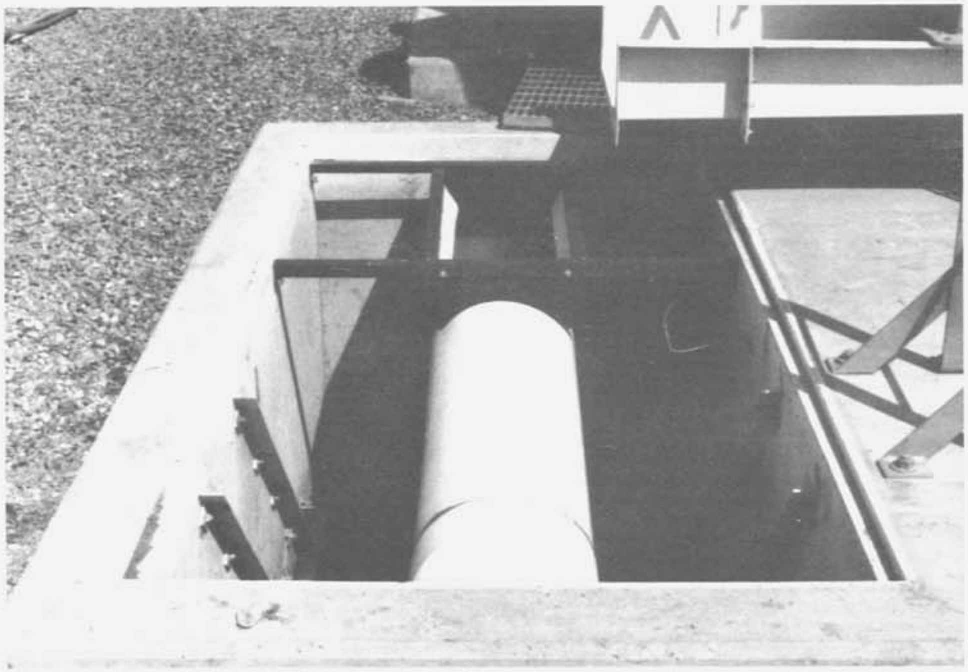

Figure 8. Moss drain trough and pipe installation in sump.

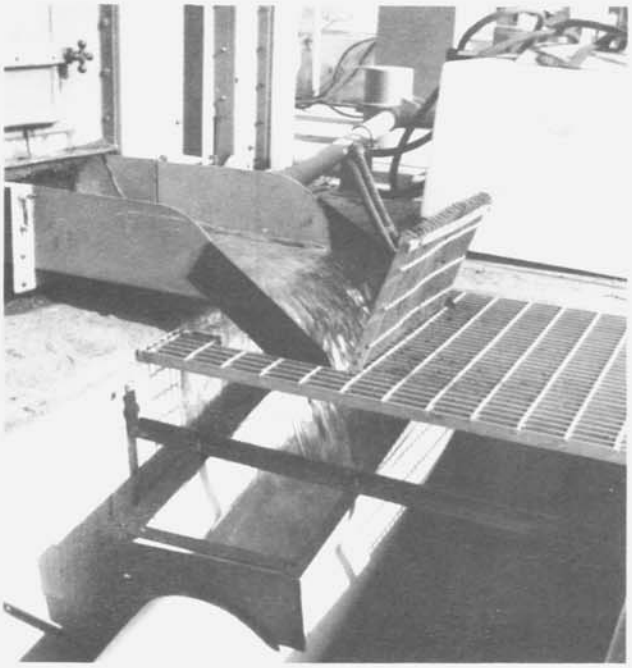

Figure 9. Wash water and moss entering drain trough.

Figure 10. PVC drainpipe returning wash water and moss to main canal.

TV CAMERA LETS YOU LOOK DOWN A WELL[2]

Is your water table dropping? Did your well's output decline this summer? Have you ever drilled a new well and then wondered if you got your money's worth?

All these questions could be answered if you could just "have a look at what's at the bottom of the well." Now you can do just that.

Since the early 60's well drillers have been able to lower TV cameras into wells, but that early equipment was bulky and costly due to the multicable systems in use. But recently, technology has caught up and now a single-cable, relatively simple method of monitoring your wells is practical. Originally designed for sewerline inspections, today's TV equipment is finding increased use in the irrigation industry as more and more growers are having a look at their wells.

Doug Cushman, Blackfoot, Idaho well driller, has been "shooting wells" for the past 4 or 5 years, and he said business is increasing.

Figure 11. Doug Cushman, Blackfoot, Idaho, monitors between 50 and 100 wells each year.

"We shoot between 50 and 100 wells each year with our TV setup," Cushman explained. "When I first started, I had to travel quite a ways to find enough business, but lately we have been kept busy closer to home, an indication that the practice is catching on."

[2] Reprinted by special permission of Editor, Irrigation Age, from January 1980 issue, by Charles Henry.

Cushman said there are a variety of reasons why a grower may want to monitor his irrigation well. Most often, he said, it's because of some kind of trouble–the water table has dropped, the well has stopped producing, or flow is decreased.

"There may be some question about the casing or a driller wants to look for lost tools or maybe the water quality (sand and gravel in screened area) is down," Cushman explained about the need for shooting a well.

In one case Cushman described, lightning had hit a well and blown a 200-mm (8-in) hole in the screening allowing the gravel pack into the well. The irrigator was blaming the well driller for not doing a complete job, so Cushman was called in to monitor the well. The resulting TV inspection not only revealed the exact nature of the problem, but exonerated the driller and the power company in the eyes of the grower.

Cushman said he receives a lot of calls from drillers who have had casings slip under a ledge or migrate down a hole. In these cases, he explained, the TV camera can show immediately where the casing is resting and how it can best be fixed without throwing a lot of good money after bad down a hole.

"Although most of our work is on wells in need of repair, we are getting more assignments on new wells. It is a good way for a driller to show a customer that the job has been done correctly so that any problems later cannot be blamed on a poor drilling job. At the price of wells today, more growers and drillers are looking for this kind of assurance."

Figure 12. The "eye" that makes viewing the bottom of an irrigation well possible.

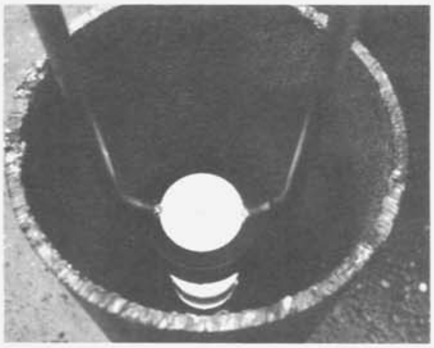

Figure 13. With its light on, the camera enters a well casing after being positioned.

TV monitoring also has value to a pump owner who is selling the property and to prospective buyers, Cushman said. A record of a well's condition before sale insures again that problems that develop later cannot be anticipated and blame does not fall back on the seller. A seller can prove, through the TV tape, that the well is exactly what he says it is in the selling agreement, Cushman explained.

Figure 14. Once the van is backed up to a well, camera and light (located in front of lens tube) are lowered with this L-boom and winch.

All of Cushman's equipment is housed in a modified van. Vehicle changes include an L-arm to pivot the camera over the well and play out the cable, a special alternator system to supply power for the camera and the cable winch, and homemade controls so one man can work the camera cable and monitor the well at the same time.

Cushman takes advantage of the latest advancements in television taping technology to provide low-cost copies of every well he shoots for a permanent record. Two television sets in the van enable the operator, plus the well owner or driller, to view the well as the camera descends.

A 150-mm (6-in) well is the minimum size possible, Cushman said, and he can monitor wells as large as 1200 to 1500 mm (48 to 60 in). The camera can also be used in flooded mine shafts and sewers, although Cushman never does sewers because he does not want to contaminate his equipment. His current equipment allows him to go as deep as 520 m (1700 ft), although new rigs have a 760-m (2500-ft) capacity. All filming is in black and white because color requires a multicable conductor network which is bulky and expansive.

With the black and white system, a single conductor on a 6.35-mm (1/4-in) line handles both video and the light source. The light, which hangs just ahead of the camera lens, is adjustable from the van so that the light can be turned up or down depending on the clarity of the water in the well. Cushman said his equipment can handle 93 °C (200 °F) water and artesian heads up to 126 L/s (2000 gal/min). Any more pressure than that simply flushes the camera back out, he said.

From the time he arrives at a well, Cushman can be set up and rolling in 10 to 15 minutes. He said most wells can be shot within the 1-hour time range of the tapes. The camera is completely controlled from the truck, so it can stay in one zone as long as necessary to give the operator a thorough look at any one area.

A visual readout on the TV screen records the exact depth in feet as the camera descends. The picture transmitted from the well is a complete 360° view of the hole at about a 45° angle, Cushman explained. Descent rate can be varied, but it normally takes about 1 hour to reach 240 m (800 ft). However, it only requires 5 minutes to come out of the well.

Cushman always makes a video tape of the well, but will erase the tape after viewing unless the customer wants a copy, which is optional. The tapes are standard home video cassettes and can be played back on any home television set. In addition, the tapes have audio capability, so a running commentary can be made as the camera descends. In addition to the audio record, the operator keeps a written log for each foot of the well that is recorded by the camera.

Cushman can control the camera enough to swing it from side to side in the casing and it can even be twisted to move from one casing to another. Whenever he encounters a section of well where the chances of losing the camera are great, he will only proceed after a customer assumes the risk of paying for a lost camera. Cushman said he has worked under this agreement several times, but has yet to leave a camera in a well.

Rates may vary from company to company, but Cushman charges a flat fee of $250 per well plus $.25 per mile to and from location and $25 per hour while running or editing the tapes. A grower can purchase his own tape copy for an optional $40. However, a complete viewing and written log is supplied with every well. Additional charges include $150 for a second day at the same hole or $150 for a second well on the same day. Thus, shooting a normal well once will cost between $250 and $500 for most jobs, Cushman said.

Cushman also offers fly-in service since all his equipment can be packaged to go by commercial air transporation. A 12-V alternator is all that is needed at the well site to effectively run the system. Cushman did some work in Colorado using a hand winch after flying to the well site.

"We don't succeed in every job," Cushman said. "Sometimes well conditions are so bad that we just don't get the picture we want. We can see in oil and in really murky conditions, but we have had rare occasions when we couldn't get a picture. In one case there was so much broken and twisted debris in the hole we couldn't go any farther, even though the customer knew his problem was in that last 1.8 m (6 ft) that we couldn't reach."

Cushman also said the TV camera is not a good way to check for crooked holes since the cable hangs up on one side or the other and makes retrieval difficult.

Cushman can begin shooting a well within 24 hours of the well's last activity, once debris and silt have settled out to give a clear picture. He said they almost always come away with a better understanding of the well after a viewing.

"We had one job where a driller had been fishing for lost tools for over 2 months," Cushman related. "We had them spotted and out in an hour with the camera system. We can even find migrating waters, which indicate a second water table, and may mean an irrigator has more water than he first thought. A driller can utilize these second water tables and give an irrigator more water than what he had from his old well."

On two occasions Cushman has found water with air that moved down to the water table and prevented a pump from working to capacity. In both cases the irrigator was saved expensive second guessing as to his well's problem.

TV monitoring of wells will increase, Cushman concluded, as equipment advancements bring the cost of the system down and as the price of wells goes up.

"The TV camera can save a lot of time and frustration that goes along with not beng able to see the bottom of that hole," Cushman said.

* * * * *

SAWDUST DISPENSING DEVICE[3]

Water and Power Resources Service personnel at the South Platte River Projects Office were required to install stoplogs for unwatering the five 6.1- by 5.2-m (20- by 17-ft) gates at Olympus Dam for cleaning and painting the metalwork. After the stoplogs were in place, there were numerous leaks that allowed water to splash or spray on the gates. It was necessary to eliminate the leaks so the cleaning and painting could be accomplished in a dry environment.

It is common practice among water conveyance maintenance crews to use sawdust to seal leaks in stoplogs, canal linings, or gates. Previous methods were to simply keep shoveling sawdust onto the water above the leak until some of it sunk and plugged the holes, no matter how deep the water. Since the sealant material is very light, less than 1 percent ever sank to become effective. To solve this problem, a cylinder was fabricated from a 762-mm (30-in) piece of 152.5-mm (6-in) diameter 6.35-mm (1/4-in) steel pipe with a hinged flap door on both ends. The bottom flap is held in a closed position by a spring-type latch. After the cylinder has been filled with sealant material, it can be lowered to the bottom by a rope. The bottom flap door can be opened by lightly tapping the trigger device (spring-type latch) against the bottom. The dispenser can then be laid on its side to release the sealant from the bottom or raised to any level where sealant is required. The top flap door is controlled from the surface with a line or, for more positive control, a small diameter rod hinged to the flap door could be used. The rate of sealant released can be controlled by the opening of the top flap door.

This device is very efficient because it allows the release of the sealant material where needed and in the quantity desired which makes most of the sealant material effective.

Photographs and a drawing of the device are shown on the following pages.

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[3] Material for this article was taken from suggestion SPRP-79-9 by Dean W. Barnes and Arthur W. Kinsey, South Platte River Projects Office.

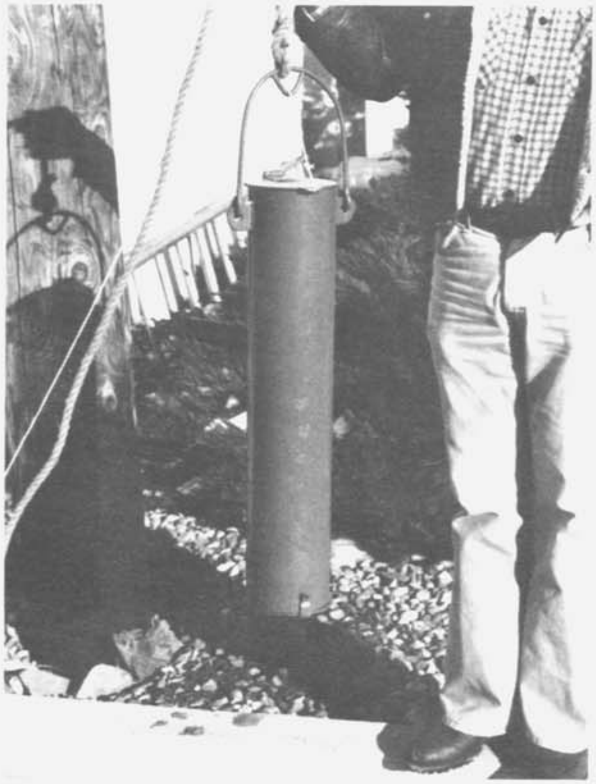

Figure 15. Sawdust dispenser with both flap doors closed, loaded and ready to be put into service.

Figure 16. A. W. Kinsey is holding sawdust dispenser with both flap doors open, as it would appear while releasing the sealant material.

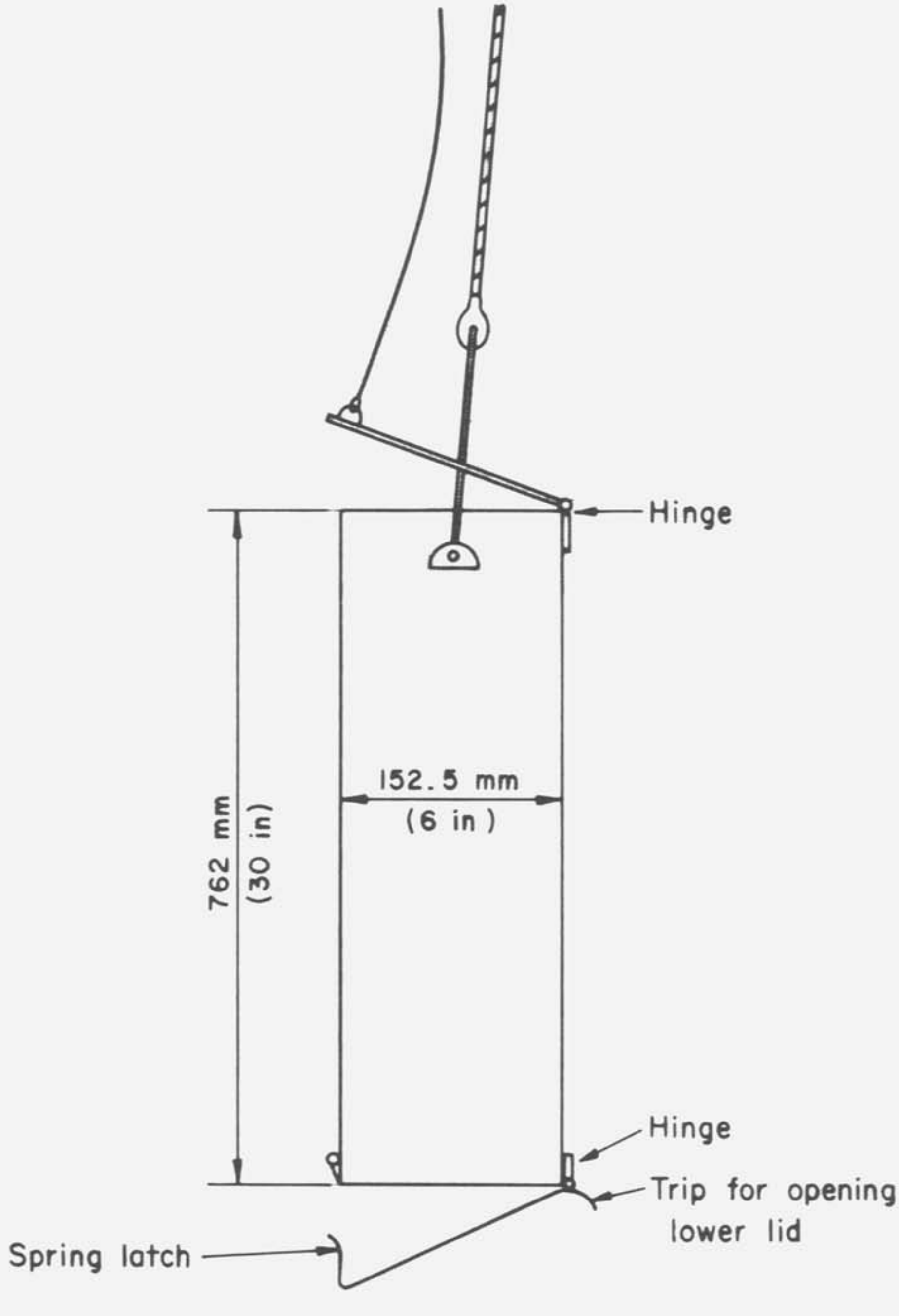

Figure 17. Sawdust dispensing device.

SEALANT HELPS OVERCOME BRIDGE GIRDER CORROSION[4]

Near Nitro, West Virginia, a large bridge carrying Interstate 64 across the Kanawha River presented a particularly challenging maintenance problem. Box girders supporting the structure showed excessive corrosion, especially on edges of the steel plates comprising the girders. Paint continually peeled, allowing the substrate to rust.

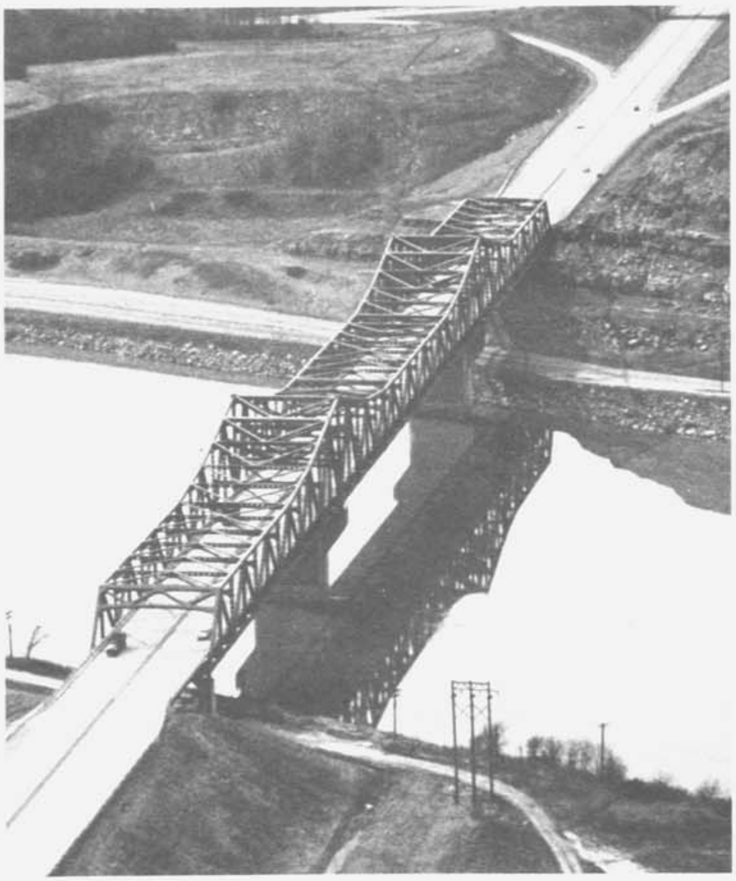

Figure 18. Bridge carrying Interstate 64 across the Kanawha River.

Engineers for the West Virginia Department of Highways determined that almost all deterioration occurred on the edges of the girders, which had been fabricated by riveting overlapping steel plates and welding the resulting seams. Striations and pinholes were common in the welded edges. Such cavities cannot readily be protected by conventional

[4] Reprinted by special permission of the Editor, Public Works, from March 1980 issue.

spray painting since the imperfections in the welded seams are not totally filled, but are merely "skinned over." This creates pits beneath the surface which fill with solvent vapors from the drying paint. Eventually, the expanding vapor produces bubbles in the paint film. When these bubbles finally burst, the original cavity is exposed to attack by the elements.

Even in an atmosphere containing nothing more chemically active than water, failure of the paint film would occur and would result in rust formation. The Kanawha Valley, however, is a center of chemical manufacture and its atmosphere bears traces of many pollutants, some of them corrosive. These pollutants help to cause deterioration of the protective paint layer and when the steel is exposed, they accelerate the corrosion process.

Since the root of the paint failure and corrosion problem lay in the cavities in the weldments, the highway engineers decided to attack the problem by filling them with a permanent sealant. They chose Sikaflex-la caulk, a permanently flexible polyurethane sealant, to cover all exposed seams and produce a smooth, pit-free surface. Sikaflex-la is a product of Sika Chemical Corporation, Lyndhurst, New Jersey.

Figure 19. Workmen use 0.31-kg (11-oz) cartridges of caulk to seal voids in prime coat prior to completing bridge painting project.

Although this caulk is usually applied without a primer, the decision was made in this case to use a thin coat of vinyl base primer before gunning on the elastomeric one-part sealer. Primer application, made immediately after sandblasting, protected the steel substrate from interim corrosion until the sealant could be applied. In addition, the primer gave extra assurance of long-term adhesion of the sealant to the corroded girder edges.

Test Installations

Initial tests were made to evaluate the coating system. Sample joints were sandblasted, primed, and sealed, using tubes of sealant from stocks of a local distributor. These tests were necessary not only to demonstrate the feasibility of applying Sikaflex-la under conditions existing on the bridge, but also to convince all interested parties of the efficacy of the process. One of the most interested observers was the bonding company which was responsible for getting the job done properly after a previous contracting firm had failed.

When test installations passed inspection, full-scale work began. Applicators continued to use 0.31-kg (11-oz) cartridges of caulk, carrying spare cartridges in their pockets as they scaled the girders. After application of the sealant, a coat of conventional corrosion-resistant paint was sprayed on, covering both the sealant and any primer that remained exposed. The project was completed in 1979.

Long service is expected of the Nitro bridge coating system. The troublesome pits are filled with a sealant designed to stand up in such applications for many years without being affected by extremes of temperature, ultraviolet exposure, or by flexing and expansion. Since the sealant's adhesive qualities are excellent and it exhibits great cut-and-tear strength, the engineers and contractors anticipate no need for attention, other than routine inspection and maintenance, for years to come.

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YOUR HANDS ARE VULNERABLE[5]

by S. J. Park

What's the most versatile and valuable tool available to industry? Easy–the human hand.

However, because the hand plays such an active and important role in our daily lives, it has become the part of the body most frequently injured in work accidents. Hand injuries account for 20 to 25 percent of all industrial accidents. It seems that too often a hand gets into the wrong place at the wrong time!

The types of hand injuries are as numerous as the tasks they perform. However, most fall into one of these general categories: cuts, abrasions, thermal burns, chemical burns, and electrical shock.

Some causes, such as mechanical hazards, are easy to identify, while others, such as chemical hazards, are more difficult to recognize.

Of course, the best way to control these hazards is by changing equipment or processes so the problem is eliminated or reduced to an acceptable level. When we guard moving parts, insulate heat sources or install interlocks, hazards are removed or reduced. However, if change cannot eliminate or reduce a hazard, hand protection is needed.

Generally when finger dexterity is necessary, gloves are chosen. They are available in a wide variety of materials that offer protection against cuts, abrasions, chemicals, heat, and other hazards.

Gloves must not be looked upon as a cure-all for hand injuries. They can prove hazardous themselves if worn around machinery that has revolving shafts and spindles, drills, inrunning rolls, and gears.

Therefore, in addition to training your people on how to select, fit, care for, inspect, and store gloves, they must know when to wear them and when to leave them in their lockers.

Here is a list from the Encyclopedia of Occupational Health and Safety of hand hazards and the types of gloves that offer protection from each hazard:

Heat.–Leather, aluminized fabric, glass fiber
Flame.–Leather, fire-resistant duck, aluminized fabric, glass fiber
Sparks.–Fire-resistant duck, leather, glass fiber
Hot Metal Splashes.–Leather, fire-resistant duck, glass fiber, aluminized

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[5] Reprinted from Industrial Supervisor, February 1980.

Moisture and Water.–Natural and synthetic rubber, coated fabric, coated glass fiber, plastic

Mild Acids and Alkalis.–Rubber, plastic, synthetic fabric, coated glass fiber

Strong Acids and Alkalis.–Natural rubber, plastics

Petroleum Products and Organic Solvents.–Plastics, synthetic rubber, coated glass fiber

Chips, Abrasives.–Fabric, coated fabric, leather

Cuts and Blows.–Leather reinforced with steel, metal mesh, mesh and molded plastic

Electricity.–Leather gloves over rubber gloves for flash burns, lineman's gloves to prevent shock.

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GPO 856-716