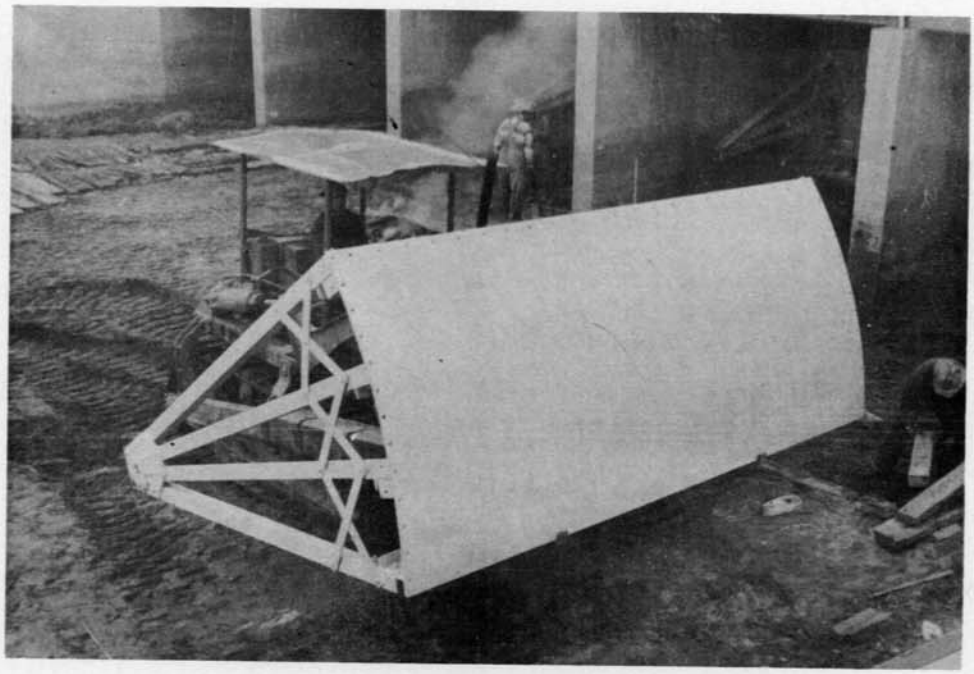
Department of the Interior
Bureau of Reclamation

OPERATION AND MAINTENANCE EQUIPMENT AND PROCEDURES

RELEASE NO. 15

January, February and March 1956



CONTENTS

INTRODUCTION

This Release, No. 15, of the Operation and Maintenance Equipment and Procedures bulletin is devoted to devices, modifications of equipment, and construction methods which have been proven by O&M people. Many thanks to those who have contributed their very worthwhile ideas.

Particular attention is called to "Repairing Damaged Hot-applied Asphaltic Linings," beginning on page 9 of this issue. The article explains the repair of short reaches of the Fort Laramie Canal, North Platte Project, which were damaged by flash floods of last summer. The repairs were made in short order by the availability and use of prefabricated asphalt membrane lining material.

The information in this Bulletin is assembled and printed in the Commissioner's Office, Denver, Colorado, by the Division of Irrigation Operations, and is circulated for the benefit of irrigation operation and maintenance people. Its principal purpose is to serve as a medium of exchange of operating and maintenance information. Reference to a trade name does not constitute an endorsement of a particular product and omission of any commercially available item does not imply discrimination against any manufacturer. 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 continued effort to reduce costs and increase operating efficiency.

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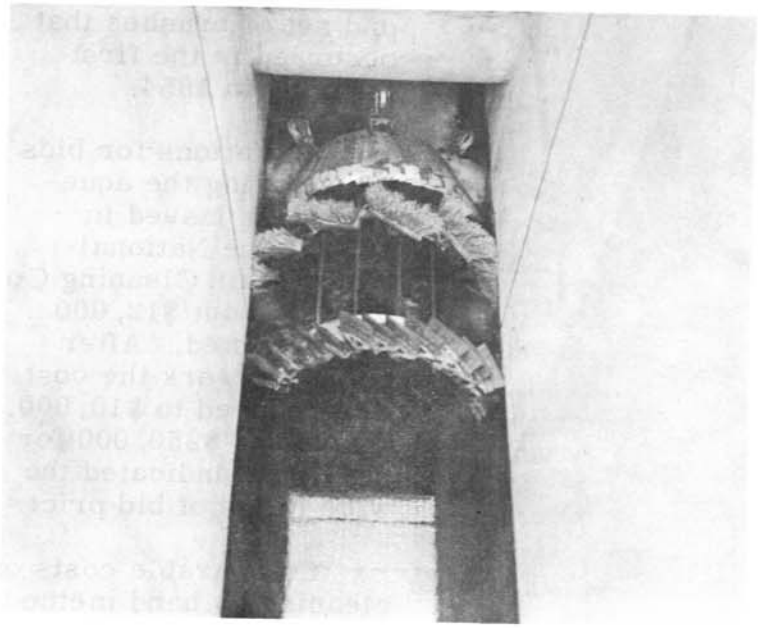
CLEANING SALT LAKE AQUEDUCT

A deposition and accumulation of slime, brownish in color and largely manganese, on the wetted perimeter of the conduit pipe and tunnels of the Salt Lake Aqueduct is repulsive in appearance and affects to some extent the potability of the water conveyed. In 1954, the Metropolitan Water District of Salt Lake City, Utah, operators of the aqueduct, engaged the services of the National Water Main Cleaning Company of New York to clean portions of the aqueduct. For the operation, the New York firm fabricated the self propelled cleaning device shown below. It was forced through the aqueduct by a small head of water, brushing the perimeter of the conduit and largely removing all the slime. The rig was used a second time in 1955.

The Salt Lake Aqueduct was constructed by the Bureau of Reclamation as a part of the Provo River Project to convey water from Deer Creek Reservoir to a point near Salt Lake City, Utah. Upon completion of construction, the system was turned over to the Metropolitan Water District for operation. The aqueduct consists of a covered conduit approximately 40 miles in length with a capacity of about 150 cfs. In addition to two concrete lined tunnels, the system is composed of 69-inch diameter concrete pipe, except where 70-inch diameter steel pipe is used at sections having high head.

Prior to cleaning with the device, the aqueduct had been cleaned by hand from the intake at Deer Creek Dam to a vent located



1,000 feet downstream from the intake. At this point the cleaning rig was lowered into the aqueduct pipe. Lifting and lowering of the rig, as shown at left, was accomplished with an A-frame hoist mounted on a 4-wheel drive truck, belonging to the Metropolitan Water District. After the rig was in place, as shown in the lower photograph, water was turned into the conduit. When the flow of water reached about 33 or 34 second-feet, in the 150-second feet capacity pipe, sufficient head was built up behind the rig to start it down the aqueduct. After the rig had started, the flow was increased and maintained at about 70 to 80 cfs.

About 25 to 30 hours were required for the cleaning device to move from the vent to the transition of the Alpine-Draper tunnel, a distance of about 21 miles, where it was removed and returned to the vent for a second run.

Location of the device as it moved through the aqueduct was detected by use of an oscillator. Twice through the aqueduct and the cleaning was accomplished.

More detail of the cleaning rig can be seen in the views shown on the following page. In the upper view, the front end of the rig is shown. In the lower view, the side of the rig. The springs which control the brushes and the laminated rubber duck squeegees permit the device to move through conduits which vary as much as 4 inches in diameter.

During the 1954 operation, two sets of brushes were used. It appears that replacing the second set of brushes (those toward the back of the device) with the squeegees, as was done for the 1955 operation, increased the effectiveness of the rig in removing the coating from the pipe. The forward set of brushes loosened the coating and the laminated, rubber duck squeegees more or less scraped it off. Also, the squeegees eliminated the wear on a second set of brushes that occurred in the first cleaning in 1954.

Invitations for bids for cleaning the aqueduct were issued in 1954. The National Water Main Cleaning Co. bid for about $12,000 was accepted. After doing the work the cost was reduced to $10,000. One bid of $250,000 for the work, indicated the wide range of bid prices.

Comparable costs of cleaning by hand methods and mechanical methods are not too reliable, the cost of hand cleaning being based on short reaches where hand methods were used. There is no information available to compare the thoroughness of the work done by hand. However, ten stations (1,000 linear feet) were cleaned by hand labor at a cost of about $5.00 per station. This compares with about $9.00 per station for cleaning with the water propelled cleaning device, in 1954, which included fabrication of the original device and about $2.25 per station in 1955. The cost for cleaning with the device is based on 1,100 stations or about 21 miles.

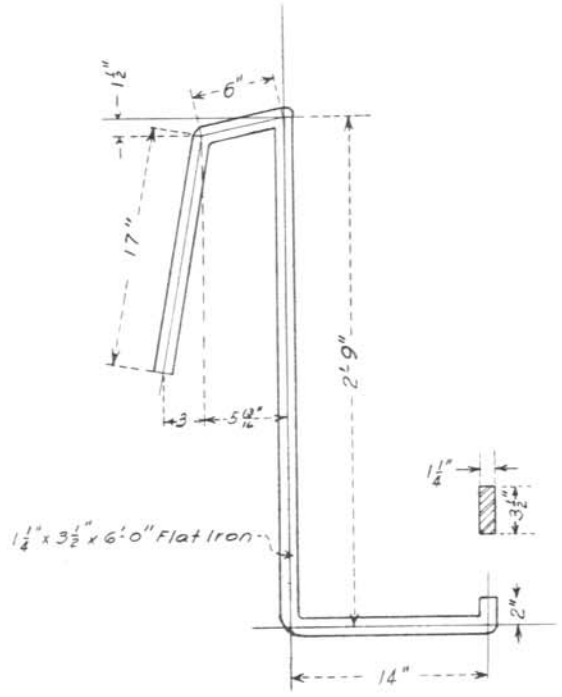
With the thought that the cleaning rig used on the Salt Lake Aqueduct has application elsewhere on closed conduit systems, this article has been adapted for the Bulletin from a report by Area Engineer P. R. Neeley, of the Bureau of Reclamation's Spanish Fork Development Office, Spanish Fork, Utah. Publication of the article in the Bulletin is with the permission of the Metropolitan Water District, Salt Lake City, Utah, and the National Water Main Cleaning Company, 50 Church St., New York 7, New York, who may be contacted for additional information. The company holds patent rights on certain features of the cleaning rig and the design and fabrication of the device used on the aqueduct was based on similar machines used elsewhere by the company.

Mr. J. A. Frank, Executive Vice President of the cleaning company directed the operation of the equipment and the cleaning operation was jointly supervised by Mr. Frank and Mr. William Hague, Chief Engineer of the Metropolitan Water District and their staffs.

* * * * *

BULLDOZER HANDLES RADIAL GATES

To facilitate removal and installation of radial gates which are too large to handle easily by hand and where hoisting devices are not available or are inconvenient to use, Henry C. Lange, Maintenance Supervisor of Irrigation Operations, Ysleta Branch of the Bureau constructed Rio Grande Project in Texas and New Mexico, devised a simple attachment for use on a bulldozer blade. The device and its use are shown on the cover and below.



The method shown was used to remove and replace five 6- by 16-foot radial gates at the Riverside Canal Headworks. Each gate had two arms attached with a radius of 10 feet each. The gates fit in back of a concrete opening and had to be removed and replaced through the back side of the structure. A timber bridge and gate operating platform directly over the gate opening prohibited the use of a dragline without first removing these structures.

The concrete apron below the gates was covered with about 2 feet of sand from the canal and river, to allow the tractor to move without damage to the concrete. By inserting the hook arms on the dozer blade under a radial gate, it was raised or lowered and moved backward or forward as required.

Prior to devising the method of handling the gates with the bulldozer, it was planned to put skid timbers under the gates and slide them out by means of snatch blocks in line with each gate using a chain block winch for vertical leverage. This winch would have had to be attached to a beam beside the bridge stringers and would have had to be placed in at least three separate positions for removing and installing the gates; an operation that would have taken considerable time. About one-half hour was required to remove each gate with the tractor and the assistance of 4 laborers who placed the blocking and guided the gates. The same time, labor and equipment was required to install the gates.

Construction:

The device used consisted of two S-shaped hooks, with the

reverse hook hung over the top of the bulldozer blade for the gate to rest on. Also two guides or supports were attached to the top of the blade for the gates to rest against while on the hooks.

Material used in the fabrication of the hooks, as shown on the drawing, consisted of two pieces of $1\frac{1}{4}$- by $3\frac{1}{2}$-inch flatiron, 6 feet long. The hooks were bent to shape and were hung over the blade on each side. Two pieces of 1-3/4- by 4-inch channel iron or lightweight steel rail, each 4 feet long were spot-welded 3 feet apart near the top of the bulldozer blade, as shown in the photograph above.

* * * * *

A USE FOR OLD TIRES

F. M. Roush, Chief, Irrigation Operations Section, Region 7, Bureau of Reclamation, passes the word along that old tires are being used to advantage by maintenance crews in moving tractors or other types of equipment with cleats or treads over paved highways. The tires are easy to transport, much more so than wood planks. A few old tires can be carried in a pickup and placed on the pavement to protect it when crossing is necessary.

Old tires also are being used to protect newly seeded areas. A few old tires thrown on the ground reduce erosion due to wind.

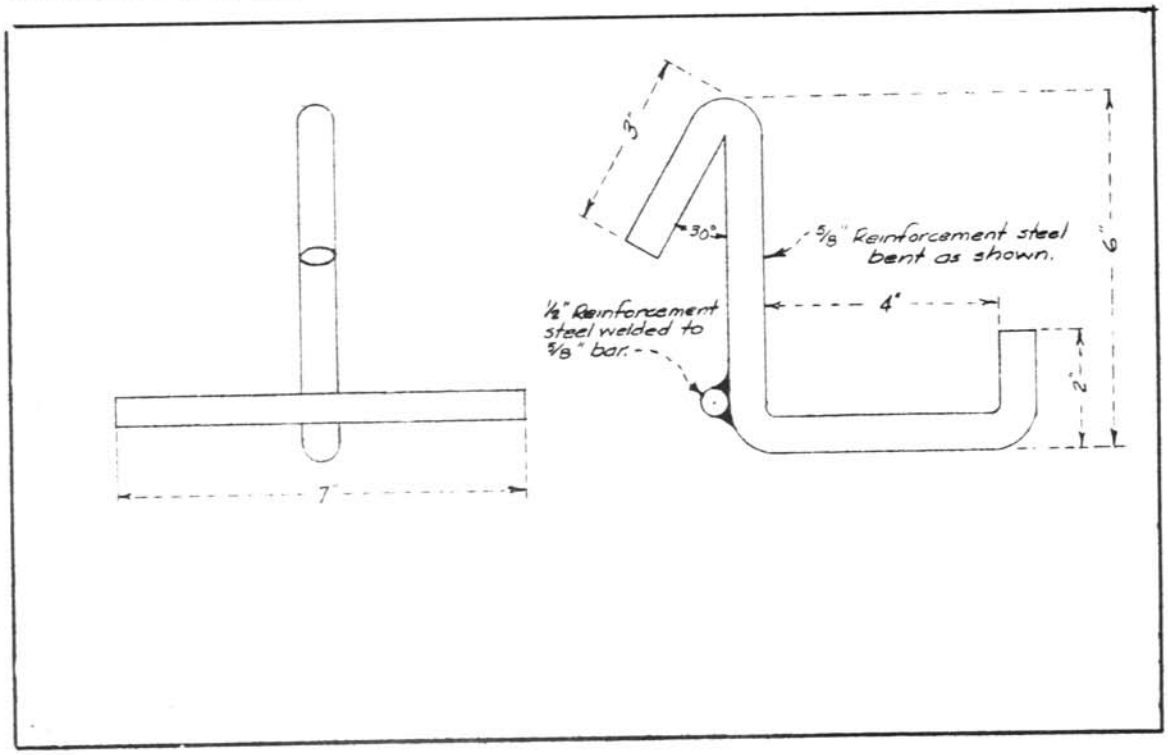
* * * * *

SPURS FOR CLIMBING CYCLONE-TYPE FENCE

A spur, or climbing device, suggested for use by operating personnel who have to enter canal or structure areas which are protected by cyclone fence were adopted by the Rio Grande Project, Texas-New Mexico. The Project Manager states the suggestion is a sound safety device as well as a time saver.

Gates are located along the canals at intervals and at the site of principal structures, but they are kept locked or may be inaccessible

in an emergency. Sets of the spurs, constructed in accordance with the drawing below, are kept in the trunks of vehicles assigned to supervisory personnel. Three or four of the spurs are used at a time on each side of the fence to be climbed.



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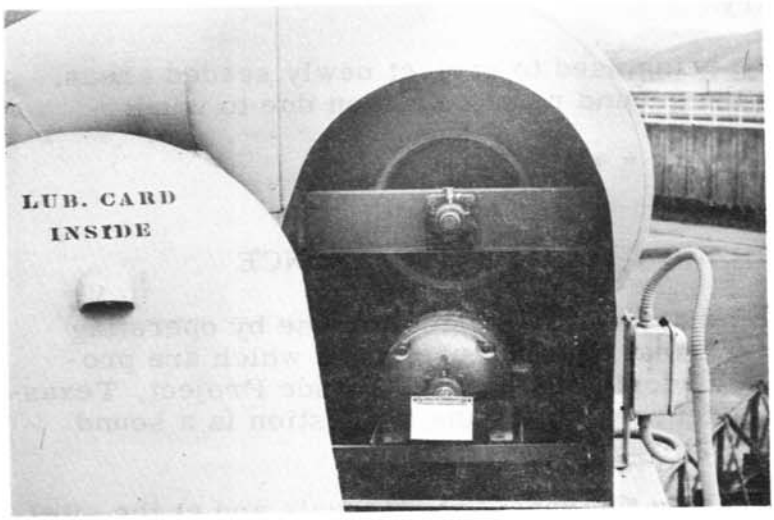
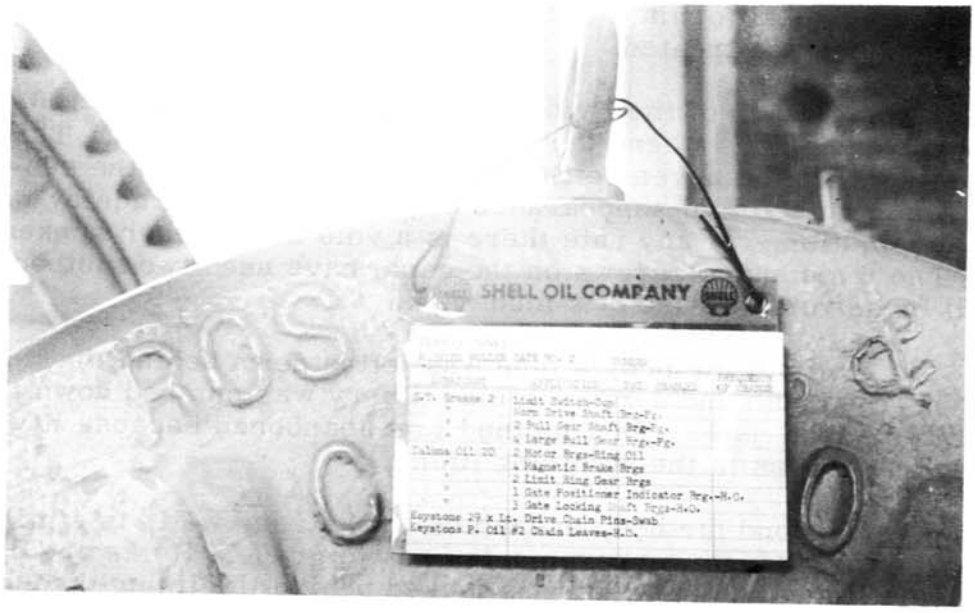
DATA CARDS ASSURE PROPER SERVICING



To insure the use of the proper type and grade of lubricant on the varied and complex equipment at Imperial Dam and Desilting works, lubrication data cards similar to that shown at left and on the following page are attached to each piece of equipment as a guide to maintenance personnel.

At left, the lubrication card is attached to the electric motor of a blower for venti-

lating a sludge pipe gallery. In the photograph below, a card is attached to the hoist mechanism of the intake roller gates. The one card includes the lubrication data for several individual mechanical features.



In addition, the Imperial Irrigation District, Imperial, California, maintains for each item of equipment, a 5- by 8-inch Maintenance Record Card. Typical of the data recorded on the card is given below. Use of the lubrication and maintenance record cards insures not only proper lubrication, but also the continuity of servicing.

110-65¢ - MAINTENANCE RECORD CARD
All-American Canal Department

Division River

Section 1

Job Roller Gate No. 1 Location A.A.C. Headworks W.O.

DATE	MAINTENANCE PERFORMED	REMARKS	INITIALS
7/24/53	Oiled chains.		JH
7/27/53	" " 30 and Penn. oil.		JH
10/29/53	" " " " " "	Cleaned all elect. and serviced.	JH
11/27/53	Cleaned old grease off - put new grease on gears. (122.H) Keystone		JH
3/23/54	Keystone 122.H didn't hold up - added 122 x lt., on chain pins also.		HWS
6/12/54	Oiled chains using Keystone No. 2 pail.		HWS
11/1 to	Bottom and ends of Roller Gate sandblasted and coated using 16 gal.		
12/8/54	Dimetcote #3 and 24 gal. (2 coats) D-3 Curing Solution. On 12/6/54		
	replaced 10 ft. of east side seal timber using R.D.F.		FEN
6/15/55	Cleaned and oiled and put new grease on the lifting chain on gate. Used		
	29 x lt. Keystone grease and #2 Penn. oil.		

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MUD-JACKING CONCRETE CANAL LINING

Mud-jacks have been used to fill voids behind concrete canal lining and sub-surface voids in canal banks on the Bureau's Central Valley Project, California. Both the Friant-Kern and Delta-Mendota canals have been so treated.

In the reach of the Friant-Kern Canal between Mile 100 and 122, there are places where the concrete lining has settled. This seemingly is due to uneven settlement after saturation of the subgrade, or to an actual disappearance of part of the subgrade by washing or dissolution. At any rate there is a void behind each sunken area. The maintenance crews on the canal have used two methods to backfill these voids by use of a mud-jack.

In the first method, a pipe was jetted down behind the lining to the desired depth and a cement-clay slurry was pumped down the pipe with the mud-jack. This method was abandoned because it was slow and dangerous to the adjoining lining.

The second method, one which works very well, is similar to that used to bring highway pavements back to grade. Holes are drilled through the lining and the slurry is jacked behind the lining through these holes.

In 1954, a threatened canal break on the Delta-Mendota Canal was avoided by drilling holes behind the lining and into the canal bank and pumping in cement grout at low pressures. The repair held until early summer 1955, when pilot wells indicated a rising groundwater table in the same area.

An active leak developed on the Delta-Mendota Canal in 1955, and was stopped, at least temporarily, by pumping a cement-silt slurry into the grout holes behind the lining with a mud-jack. A more extensive grouting program is in progress to ensure continued operation of the canal.

The easily portable equipment has been an aid in both temporary and permanent repairs.

* * * * *

REPAIRING DAMAGED HOT-APPLIED ASPHALTIC LININGS

Work included in the rehabilitation and betterment program for the North Platte Project, Nebraska, is the lining with hot-applied asphalt membrane of a number of reaches of the Ft. Laramie Canal which supplies water for the Goshen Irrigation District in Wyoming and the Gering and Ft. Laramie Irrigation District in Nebraska. Mr. Charles H. Rader, Construction Engineer, Bureau of Reclamation, is in charge of the work and has described the use of prefabricated canal lining

material to repair the hot-applied asphaltic membrane lining that had been damaged by flash floods last summer.

In many places the slopes adjacent to and above the canal are quite steep and runoff from rains is considerable, especially since this location is in an area subject to heavy rains, generally of short duration, during the late spring and early summer.

During the construction work connected with the installation of this hot-applied asphaltic membrane lining, every effort was made to provide facilities to protect the lining. This was done by building drainage inlet structures, and excavating intercepting drains to divert water to these drainage inlet structures, to culverts that carry water underneath the canal and to reaches of the canal where no lining had been installed, or was proposed to be installed.

Ordinarily, these protective measures serve their purpose very well, but obviously they can not be made to take care of extreme runoffs because of economic reasons. Then, too, intercepting drains do have a tendency to become clogged with silt from rain water runoff and by the action of the wind. Also, they are a collecting place for weeds. All too often it is easy for the officials concerned to forget about them until a heavy downpour occurrs and then it is too late.

On May 16, 1955 and again on May 25 and 26, heavy rains occurred along the Ft. Laramie Canal. Water poured over the upper embankment in a number of places, removing the gravel blanket and earth covering and tearing out asphaltic membrane lining. Typical is the view above, with more detail of a more severely damaged reach shown on the following page.

The damage to the asphaltic membrane and its protective covering was not total in many places where the water had run over the embank-

ment. In some places only a small amount of cover had been washed away and this only above normal water surface in the canal. In other cases more or less cover had been washed off the asphaltic lining without affecting it, but there were reaches where all cover and asphaltic lining had been removed from the upper embankment leaving many ragged edges of torn asphaltic lining. In no case was any appreciable damage done to the lining in the bottom or on the lower embankment of the canal. All together, there was approximately 600 feet of canal affected by the flooding.

In what may be termed normal years, irrigation water is diverted into the Ft. Laramie Canal on May 1, or soon thereafter. This year, due to the late spring, above normal spring precipitation, and shortage of storage water, no irrigation water was flowing in the canal at the time of the flood. Had water been in the canal, the damage would probably have been less severe.

Since it was so late in the season, it was necessary that repairs to the damaged lining be made as quickly as possible. It was unlikely that the small amount of catalytically blown asphalt needed

for the repair work could be obtained on short notice from the refineries at Cody or Casper, Wyoming. Luckily, a local lumber company had, a short time previously, stocked a carload of Johns-Manville asbestos Pre-Fabricated Canal Liner. It was decided to use this material because of its immediate availability and ease of handling, and because neither expensive equipment nor skilled labor is required in its installation.

For the most part it was necessary to do the subgrade preparation by hand labor. However, there were some places where a dragline excavated the ridges of material left by the flood waters. Very little filling was required since the original subgrade was little disturbed.

The subgrade was very carefully prepared to provide a smooth uniform surface free of loose earth, rock, weeds, and other undesirable material. Where the tie was made to the original undisturbed hot-applied asphaltic membrane, the membrane was carefully cleaned and rough edges smoothed out.

The Johns-Manville Asbestos Pre-Fab Canal Liner was placed in both longitudinal and transverse position, whichever method seemed to best fit the condition of the area being repaired. Generally, it was placed in a transverse position. Laps to a minimum of 3 inches were made except where pieces were greater in length than 18 feet. Then the lap was increased to a minimum of 6 inches. The lap on the previously installed hot-applied asphaltic membrane was kept to a minimum of 6 inches. Pre-Fab Canal Liner Lap Cement was used. This cement apparently does a very good job of sealing the joints.

The prefabricated lining material also was convenient to use adjacent to structures in patching the original membrane lining, as shown at left. The prefabricated material lays very nicely on a properly prepared surface that is close to being a true plane. If the subgrade surface is not reasonably smooth, there will be "fish-mouths" in too many places. These are sources of leakage, and should be avoided.

Earth cover was replaced to approximately the same depth as the cover previously placed over the hot-applied buried asphaltic membrane lining. A gravel protective blanket was also placed to the

same depth as the old blanket. It was necessary to haul in gravel since that which washed away from the slopes could not be recovered.

The use of the prefabricated material offered a ready solution to the problem at hand. It would seem in line for irrigation districts, having reaches of hot-applied asphaltic membrane lining in their canal and lateral systems, to keep this material stocked where it is not stocked by a dealer in the immediate locality.

The cost of the prefabricated material at Torrington, Wyoming, was $4.10 per roll of 36 feet, 36 inches in width. This is a cost of 34 cents per square yard not considering the lap.

The total cost per square yard for materials, placing the prefabricated lining and applying soil cover and gravel blanket was estimated by the irrigation district to be $2.64. The first impression might be that such cost is rather high. Taking into consideration that the damage to the original lining occurred on the side opposite the service roadway, thus making the damaged portions not readily accessible; that the areas affected were small in extent; and that a large portion of the cleanup was of necessity done by hand labor, the reasons for the higher than usual costs can be understood. Original installations of prefabricated membrane lining, in this area, have been made at a cost of approximately 90 cents per square yard, exclusive of the gravel blanket, where such a blanket is required.

Officials of both the irrigation districts and the Bureau of Reclamation feel that the solution to the problem of restoring the damaged lining was done in a satisfactory manner and that the restoration will give years of satisfactory service.

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OIL DIP-STICK MODIFICATION

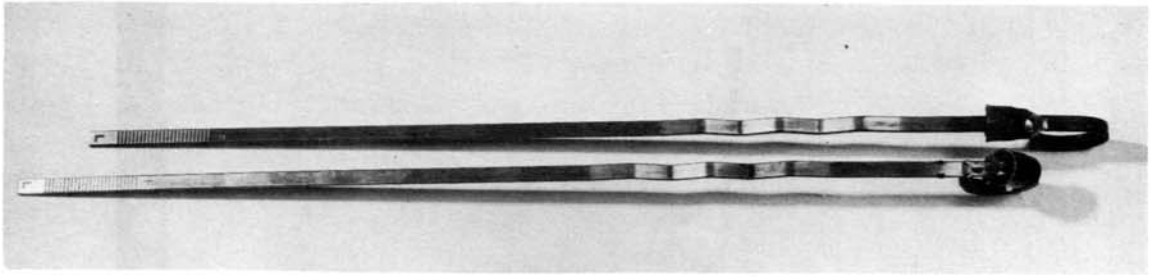
A suggested modification of the oil dip-stick on 1952 to 1954 Willys Jeep Station Wagons having F-head Hurricane engines, prevents false reading of the oil content, thus preventing extensive damage to the motor through oil shortage.

The Palisades Project Office, Bureau of Reclamation, Palisades, Idaho, is of the opinion that the suggestion is of considerable value where this particular vehicle is used, as the original, unmodified equipment was a constant source of difficulty. Mr. Horace R. Howell, Mechanic Foreman suggested that the oil dip-stick be modified by spot-welding or brazing the depth-stop and cap to the rod in the proper position so it could not be accidentally moved.

These vehicles have a four-quart oil capacity, and the crank case must be full, or the oil pump inlet is above the oil level when

the vehicle is climbing. As delivered, the dip-stick depth-stop is crimped on the rod. With use, the stop is frequently jammed past the normal position, allowing the rod to go about an inch deeper into the oil reservoir, giving a content reading of approximately 1 quart over the actual content.

The photograph below shows the problem by comparison. It was corrected by simply immobilizing the depth-stop and cap in its proper position.



The probable cost of the modification will vary depending on the shop facilities but is nominal in any case. It is estimated the dip-stick modification would not exceed five minutes of a mechanic's time.

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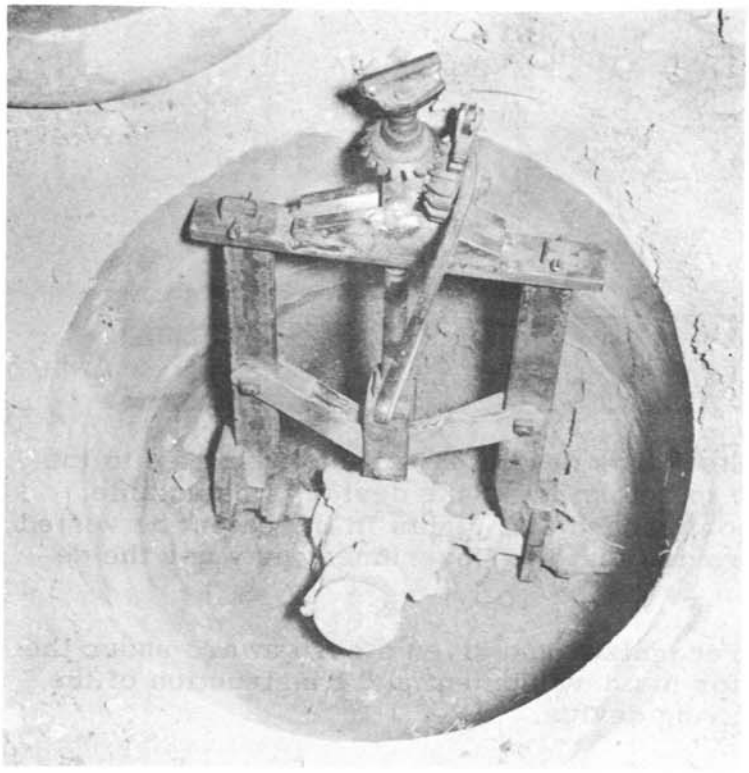
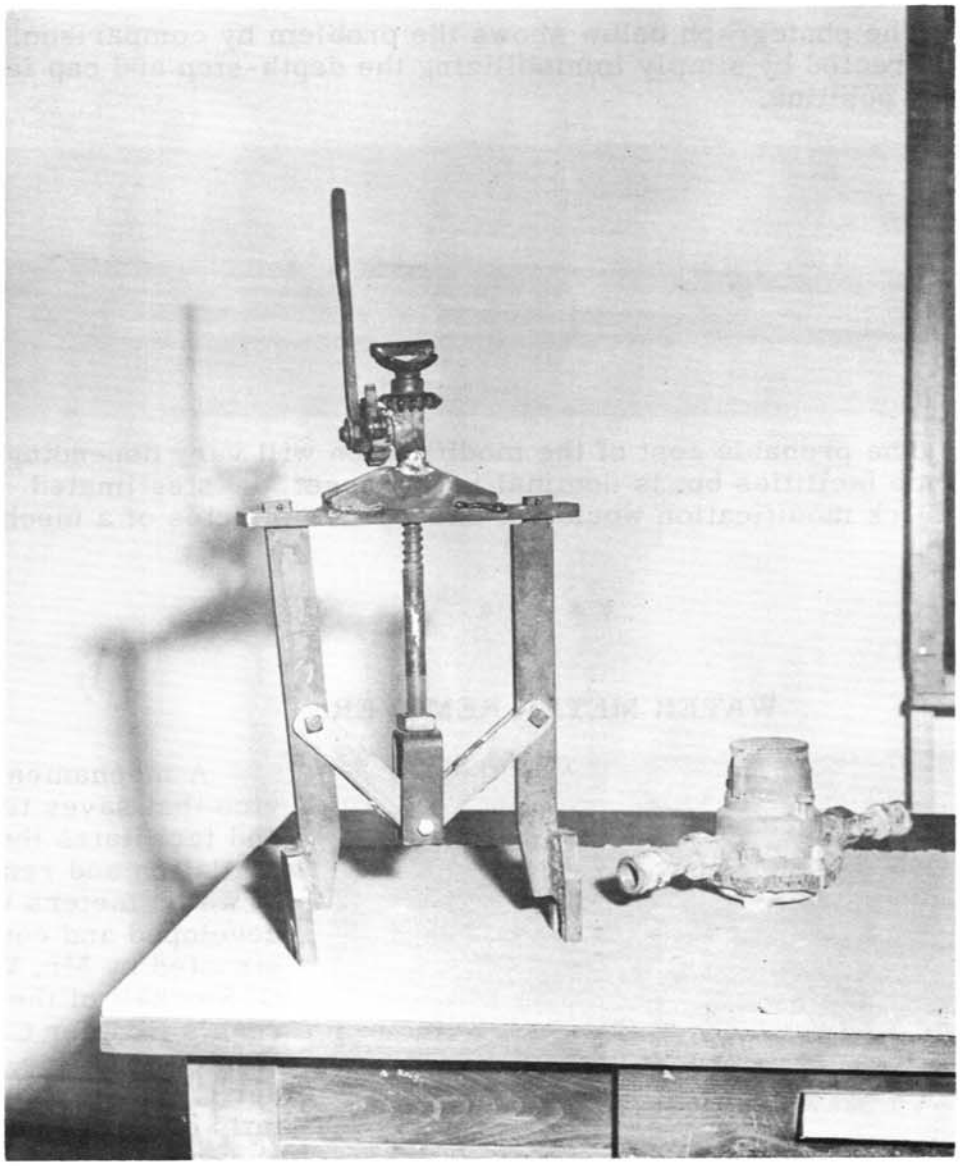
WATER METER REMOVER



A mechanical device that saves time and facilitates the installation and removal of water meters was developed and constructed by Mr. Vernon G. Stockall of the Bureau's Boulder City Municipal Office, Boulder City, Nevada. Details of the device are shown in the photographs and drawing on the following pages.

The device forces the connecting pipes from both ends of the meter, after the couplings have been loosened. The meter can then be lifted out or replaced with a minimum

of effort in a very short time without damage to the pipeline, meter, or fittings. It is constructed from parts of an old automobile screw-jack and a few pieces of steel, with a minimum of machine work. The drawing on the following page gives the dimensions of the various steel parts.



Drawings of Mr. Stockall's device have been submitted to the Bureau's Washington Office to determine if the device is patentable. The Commissioner has recommended that rights in the patent be vested in Mr. Stockall, with the proviso that the Government may use the device royalty free.

Mr. Stockall was recognized and given a cash award under the incentive awards program for his development and construction of the very convenient and time saving device.

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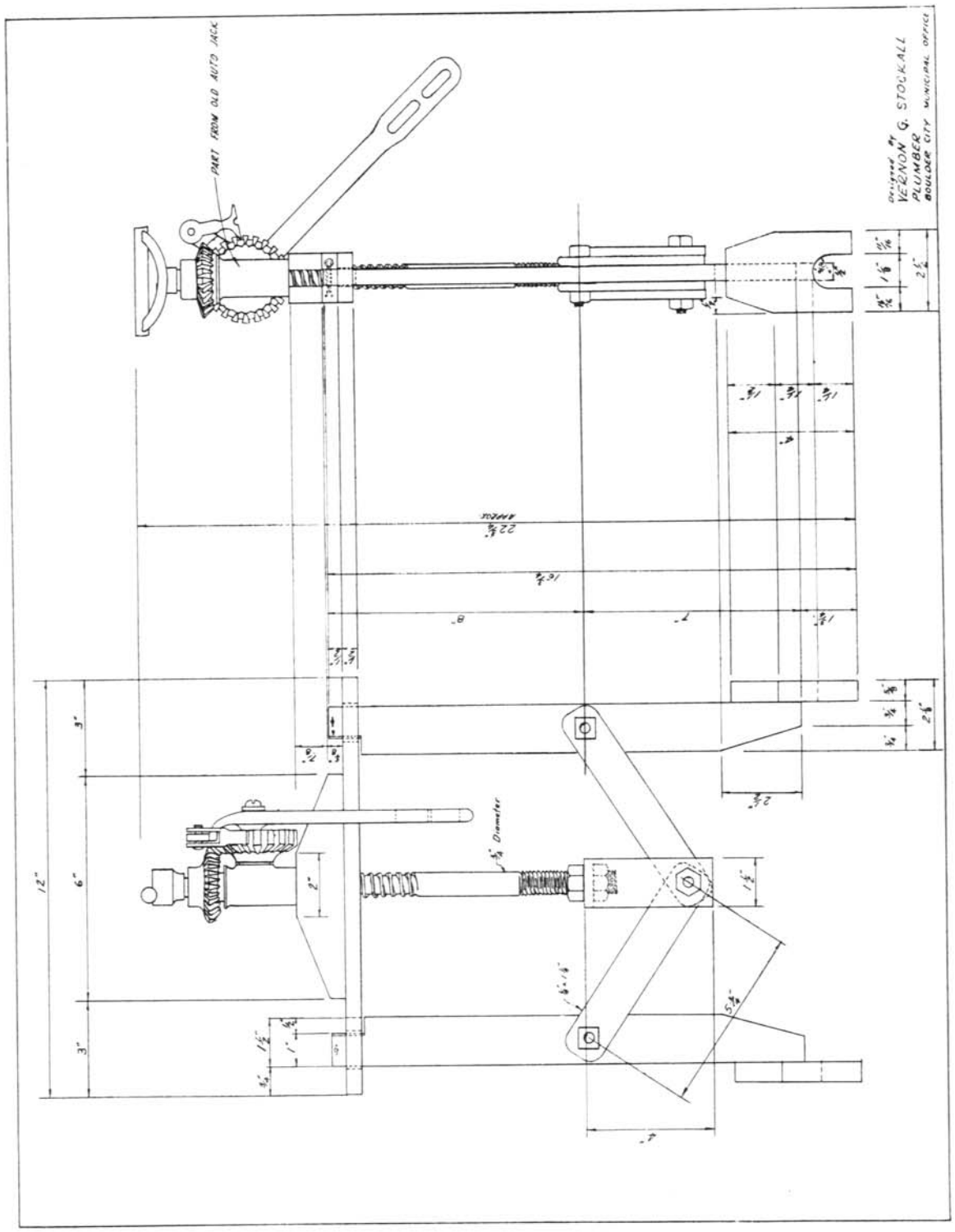
PART FROM OLD AUTO JACK
Original by
VERNON G. STOCKALL
PLUMBER
BOULDER CITY MUNICIPAL OFFICE
22½" APROX.
Diameter
12"
6"
3"

* * * * *

IMPROVING MUFFLER SERVICE

Some factory-furnished mufflers for vehicles are crimped to the inlet pipes. As there is often no hanger near this point on some vehicles, the muffler breaks down at the connection between the inlet pipe and the muffler with very little off-pavement use.

Experience on the Palisades Project, Idaho, with Willys vehicles, indicates that the vehicles equipped with mufflers of this type break down after about one week of construction or survey use, whereas a welded muffler lasts relatively indefinitely. The project recommends the purchase of replacement mufflers, similar to the one shown, which eliminates the fault by having a formed neck for attachment to the inlet pipe, or one that has a welded connection provided.

Mr. Horace R. Howell, Mechanic Foreman on the project, suggests that mufflers furnished on new equipment and for replacement that are crimped to the inlet pipe, can be improved by welding a bead around the inlet pipe where it enters the muffler. The arrow on the photograph indicates the place at which the bead should be placed. Mr. Howell states the welding or brazing can be done by a mechanic in about 15 minutes.

The suggestion is advantageous for safety as well as economic reasons; leaking mufflers are definitely a safety hazard.

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