WATER OPERATION AND MAINTENANCE

BULLETIN NO. 75

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UNITED STATES DEPARTMENT OF THE INTERIOR

BUREAU OF RECLAMATION

The cover page of this bulletin may look strange to you. Since 1964, the bulletin has been published as the "Irrigation Operation and Maintenance Bulletin." However, the new name beginning with this issue will be "Water Operation and Maintenance." This we feel will better reflect the purpose for which the material contained is directed. Irrigation is only one part of the activity and responsibility with which people on water supply projects are now concerned. Very few of these projects can remain purely irrigation oriented. Project operators are now concerned with the water supply for municipal and industrial purposes; they must administer recreational areas; provide for fish and wildlife benefits; and soon, if not already involved in the enhancement of the environment.

The "Water Operation and Maintenance Bulletin," will continue to be published quarterly, for the benefit of people concerned with these broader responsibilities. Its principal purpose will continue as a medium of exchanging operation and maintenance information. It is hoped that the material in this and future issues will result in improved efficiency and reduced costs of the systems for those operators adapting the 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 will continue to be shown. All Bureau offices are reminded to notify their Suggestions Award Committee when a suggestion is adopted.

* * * * *

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

COVER PHOTO:

Installing concrete pipe on the San Luis Unit, Bureau of Reclamation's Central Valley Project, California. Photo P805-243-1176 NA

UNITED STATES DEPARTMENT OF THE INTERIOR * BUREAU OF RECLAMATION
Rogers C.B. Morton — Ellis L. Armstrong
Secretary — Commissioner

WATER OPERATION AND MAINTENANCE
BULLETIN NO. 75

January 1971

INTRODUCTION

A great deal of time and effort has been spent in an attempt to find better and more economical methods of fixing leaks in concrete pipelines without shutting down long reaches of the system for repairs. The article starting on page 1, presents the result of such a study made to alleviate this problem in California.

The application of herbicides on irrigation projects and efforts being made to permit their continued use, are discussed in an article to be found on page 17, entitled "Pesticides and Current Environmental Standards."

Carbon monoxide gas is a creeping killer, as pointed out in a two-page article starting on page 19.

The installation of outriggers on older line trucks is a suggestion submitted by two employees of the South Platte River Project in Colorado, and an article with illustrations on this subject can be found on page 21.

"Cleaning Concrete-lined Laterals," is the title of the last article on page 24. Personnel of the San Angelo Project, Texas, handled a difficult job with a small, lightweight flat-bottom dragline bucket, specially designed and fabricated for the specific purpose of cleaning silt deposits from their concrete-lined laterals.

CONCRETE PIPE JOINT LEAK REPAIR

Introduction

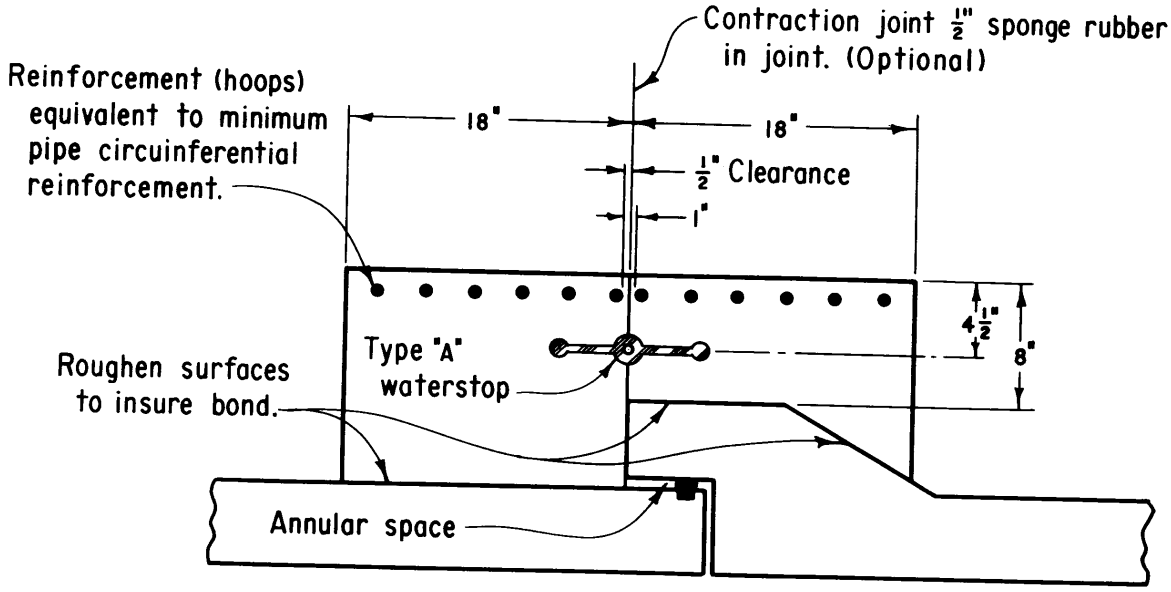
Considerable time and thought has been given to economical methods of repairing concrete pipelines without taking them out of service, and a study aimed at stopping leakage from concrete pipe joints without taking the water out of the pipelines of a distribution system on the Central Valley Project was conducted in 1970. The study was made by the Fresno Construction Office of the Bureau of Reclamation which is responsible for the construction of the many miles of pipelines on the Westlands Water District Distribution System of the San Luis Unit, Central Valley Project, California. Photograph 1 below, shows the installation of a 27-inch pretensioned pipe in a trench that has been excavated to accommodate placement of a 2-inch grout layer prior to the compacted backfill.

Photograph 1. Photo P805-243-1177 NA

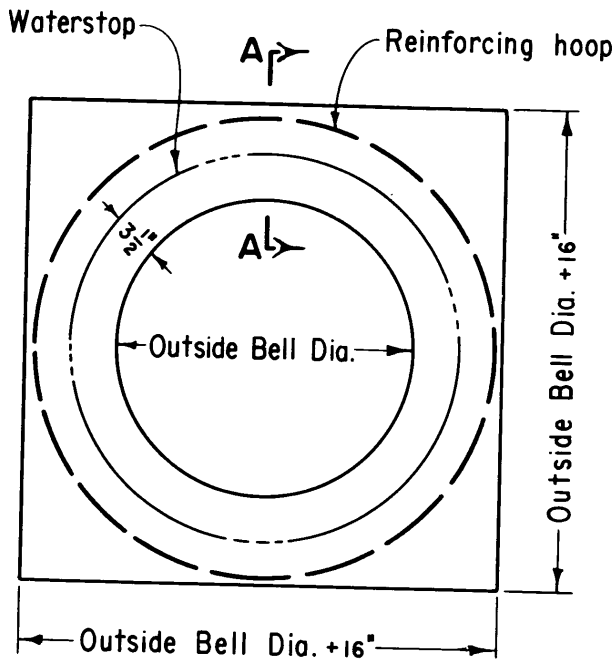
Reinforced concrete encasements as shown in Figure 1 on the next page, were being utilized to repair leaking pipe joints. Since this method made it necessary to drain the pipeline downstream and immediately upstream from the leaking joint, there are times when there is serious interference with irrigation schedules. Also the concentrated weight of the concrete encasement on the saturated ground about the joint can cause settlement of the repaired joint and aggravation of the problem at not only the joint under repair, but also at adjacent joints.

Experimental Repairs

Two different types of leak repair rings were designed and tested by personnel of the Construction Office staff at one of the pipe supplier's



SECTION A-A



The outline of this section need not be rectangular but the minimum crossection shall be as shown in Section A-A.

NOTES

Fill the annular space between the bell and pipe with a flexible, compressible material to prevent mortar from filling the joint.

Coat contraction joint with sealing compound to prevent bond.

The leak shall not be flowing at the time of concrete placement.

REFERENCE DRAWING

Rubber waterstops_____40-D-2867

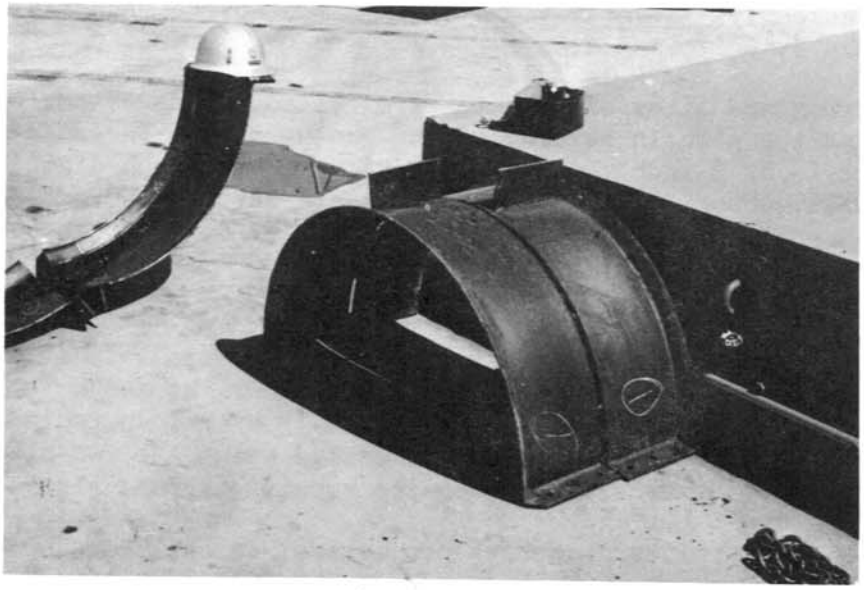
FIGURE 1

plants in Fresno, California, using their hydraulic testing facilities. Rings for the tests also were fabricated in Fresno by a local manufacturing company. In addition to the standard 13/16-inch-diameter pipe gaskets, gaskets of other rubber materials of different sizes and composition were tested. Some were donated by a representative of one of the West Coast rubber companies. Others were fabricated especially by a local parts company.

Two 33-inch diameter, 100-foot head, 12-foot lengths of reinforced concrete pipes were set up for the tests. A 4-1/4-inch section was cut out of the usual gasket for the pipe joint to simulate a pipe leak. This will be apparent in several of the photographs illustrating test procedures.

Spigot End Repair Ring

The first steel ring tested was one that could be clamped about the spigot end of the pipe. This ring is shown in Photograph 2 below, and in the drawing in Figure 2, page 5. "Come-a-longs" were used to pull the ring against the gasket to seal the joint, as shown in Photograph 3 on the next page. Two ears were welded on the semicircular rings in order to draw the ring against the gasket to compress it. With the gasket in place and the ring clamped, the pipes were filled with water and the pressure was slowly increased, At 20 psi the pipe began to leak. The leak occurred between the gasket and the face of the bell. Experimentation indicated that even if sufficient compression of the gasket could be developed to prevent leakage small settlement of the pipe would relieve the pressure on the gasket on one side of the ring enabling a leak to reoccur. This ring was therefore abandoned.



Photograph 2. Photo CN805-243-1167 NA

Photograph 3. Photo CN805-243-1169 NA

Bell End Repair Ring

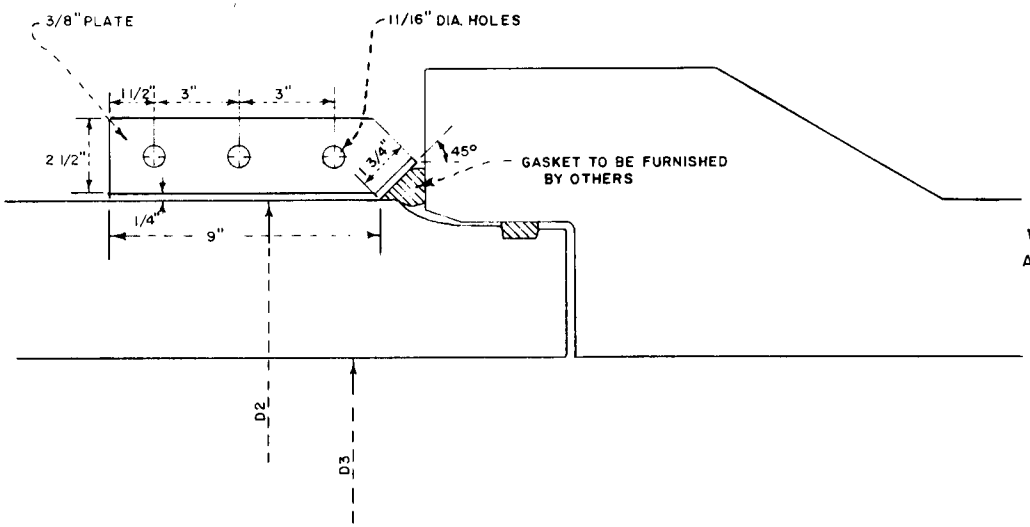
The second ring shown in the drawing in Figure 3, page 7, was then tested. An attempt was made to install the semicircular bell rings, but they dug into and stretched the gasket at the ring connections, Photograph 4, page 9, making it impossible to clamp the ring about the pipe. To remedy this problem, the ring was cut into four 90° pieces for easy assembly. Several views of this four-piece ring are shown in Photographs 5, 6, 7, and 8.

Several types and sizes of gaskets were tested. Some of these can be seen around the pipe in several of the photographs. Included in the tests were 1- by 2-inch rectangularly shaped and 2-inch-diameter gaskets of soft rubber, and four rubber gaskets having a durometer hardness of 40 and diameters of 1-1/2, 1-11/16, 1-7/8, and 2 inches.

Tests

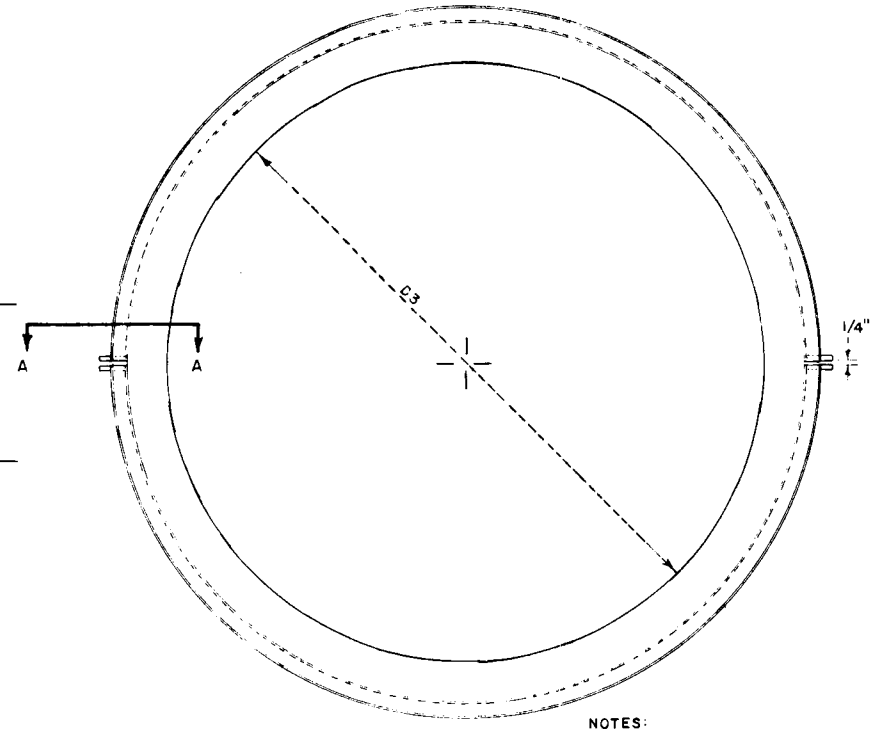
In making the test, a standard gasket was cut to simulate a leak before the two pieces of test pipe were pulled together, as shown in Photograph 9. Two standard 13/16-inch, and one 1- by 2-inch rectangular-shaped soft rubber gaskets were first tested using the two-piece ring. These failed from extrusion between the repair ring and pipe.

Because of its excellent cohesive properties, it has been hoped that the soft rubber gasket could be used. In repairing a leak the gasket must be welded together about the pipe, see Photograph 10. The soft



SECTION A-A

DIMENSIONS	
D2	
D3	



FRONT VIEW OF SPIGOT OF PIPE

NOTES:
RING MATERIAL - ASTM A36 STEEL
COATING - COAL TAR EPOXY PAINT, SEE SPECIFICATIONS ATTACHED.
FURNISH 6-5/8" DIA X 3" HIGH STRENGH BOLTS

ALWAYS THINK SAFETY

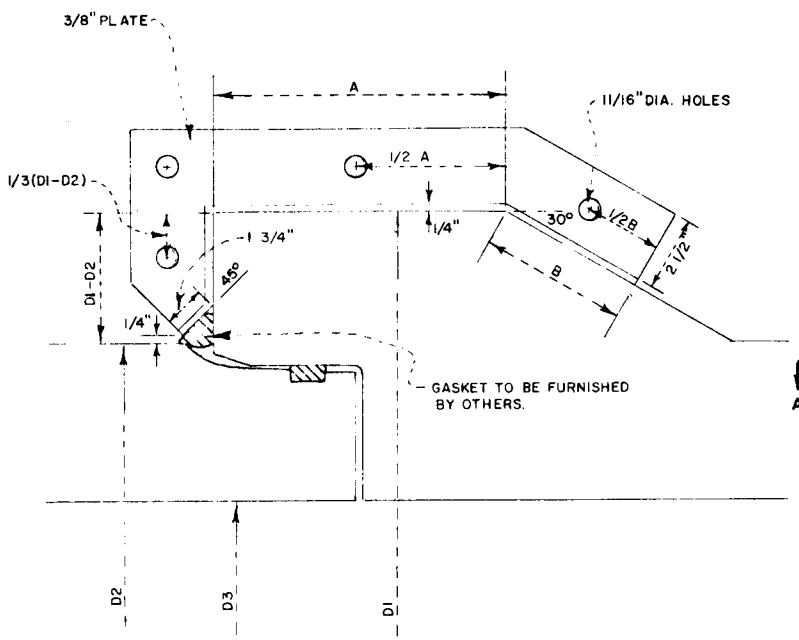
UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF RECLAMATION

CONCRETE PIPE STEEL SPIGOT RING
LEAK REPAIR

DRAWN SIG SUBMITTED
TRACED RECOMMENDED
CHECKED APPROVED

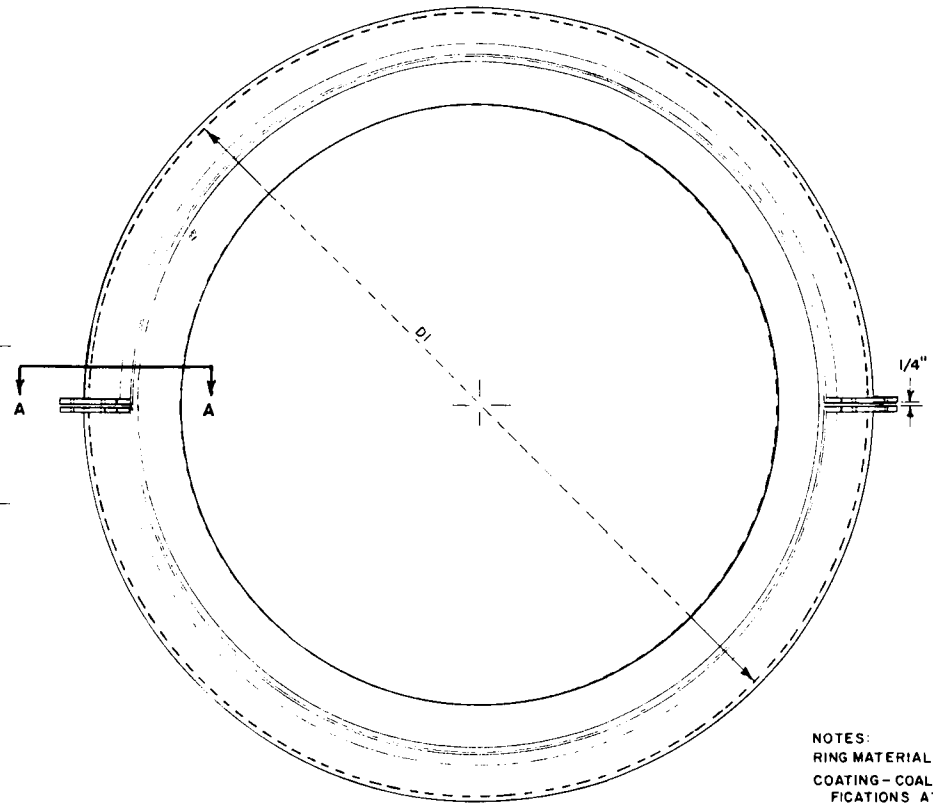
Fresno, Cal. Apr. 20, 1970 805-243-2186

Figure 2



SECTION A-A

DIMENSIONS	
D1	
D2	
D3	
A	
B	



FRONT VIEW OF BELL OF PIPE

NOTES:
RING MATERIAL - ASTM A36 STEEL
COATING - COAL TAR EPOXY PAINT. SEE SPECIFICATIONS ATTACHED.
FURNISH 8 - 5/8" DIA. X 3" HIGH STRENGH BOLTS

ALWAYS THINK SAFETY

UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF RECLAMATION

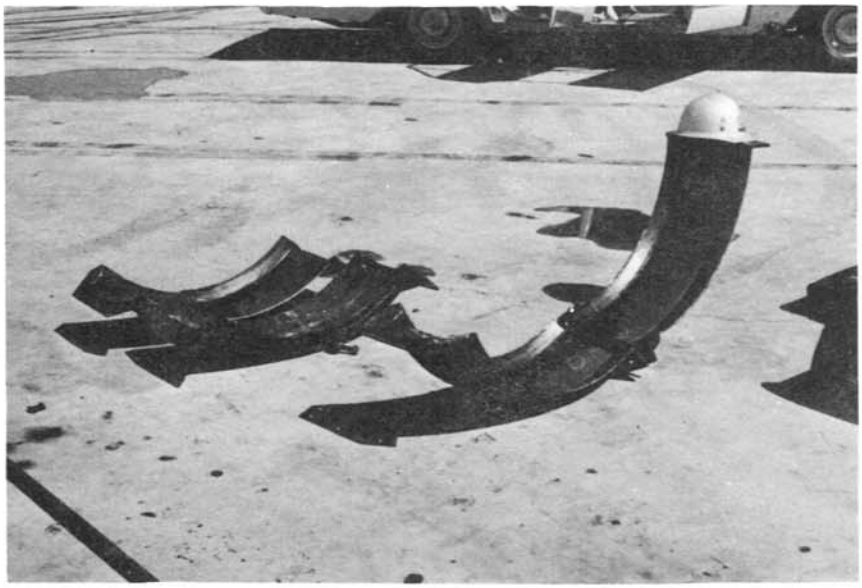
CONCRETE PIPE STEEL BELL RING
LEAK REPAIR

DRAWN SIG SUBMITTED
TRACED RECOMMENDED
CHECKED APPROVED

FRESNO, CAL. APR.10,1970 | 805-243-2185

Figure 3

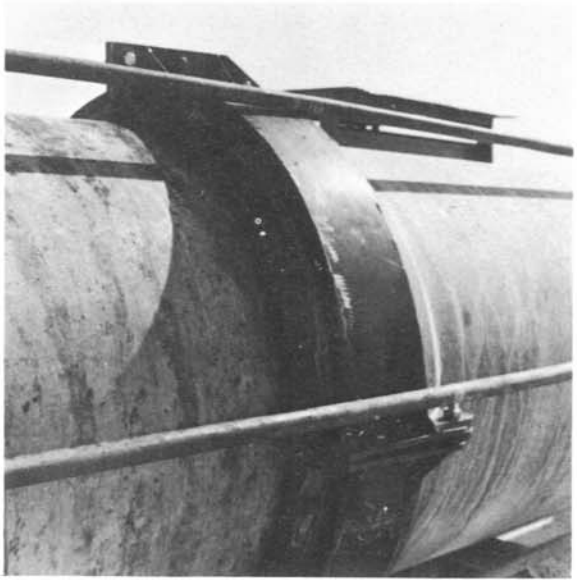
Photograph 4. Photo CN805-243-1190 NA



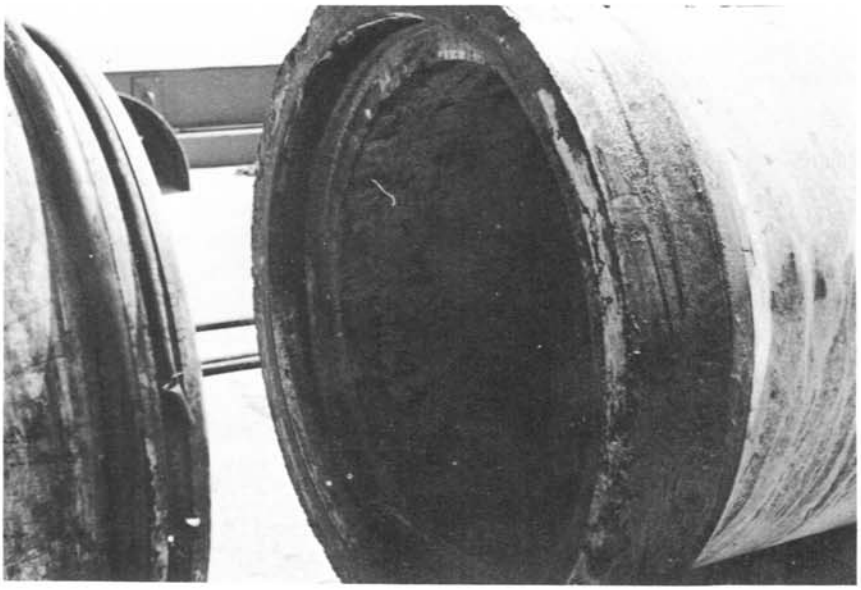
Photograph 5. Photo CN805-243-1170 NA

Photograph 6. Photo CN805-243-1177 NA

Photograph 7. Photo CN805-243-1175 NA



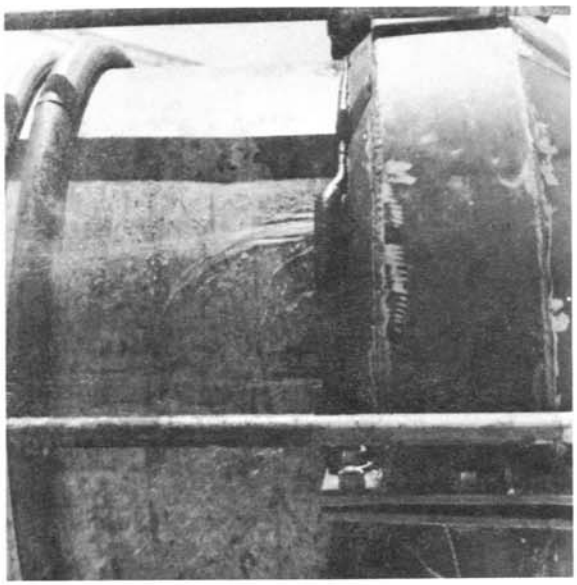
Photograph 8. Photo CN805-243-1192 NA



Photograph 9. Photo CN805-243-1172 NA

Photograph 10. Photo CN805-243-1176 NA

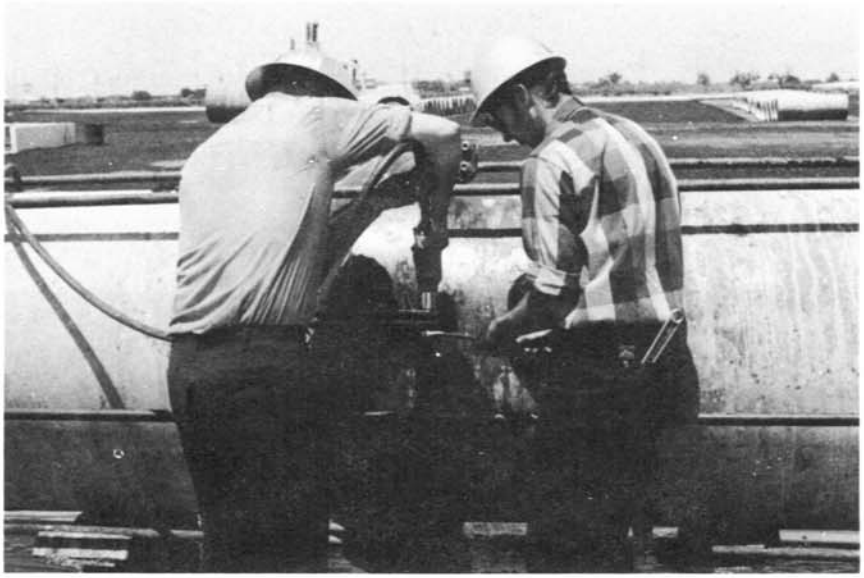
rubber could be pressed together without gluing to form a continuous ring. The 2-inch-diameter soft rubber gasket was tested next. A pressure was raised, the gasket extruded from beneath the ring, Photograph 11 below. At this point the soft rubber materials were abandoned.



Photograph 11. Photo CN805-243-1195 NA

The 1-1/2-inch-diameter, 40-durometer gasket was tried. Fifty-two psi was developed without a leak. However, it was believed that the next size gasket would better fill the gasket area. Accordingly, the 1-11/16-inch-diameter, 40-durometer gasket was used. In this test it was decided to simulate as closely as possible the conditions of a real leak in the field. Since the tension rods had to be in place in order to put the pipe under pressure to simulate leak conditions, and the ring could not be put on the pipe with the tension rods in place, the ring had to be put loosely

about the pipe before the tension rods were fastened. The ring was held loosely about the pipe with one bolt in each of its four connections. A pressure of 25 to 30 psi was the maximum pressure that could be developed with the pipe leaking. The ring was gradually tightened about the pipe, Photograph 12, beginning with the set of bolts closest to the shoulder of the bell. This moved the ring back along the bell exerting a lateral and downward pressure on the gasket. The bolts were progressively tightened around the pipe keeping the flanges equi-distant apart. The tightening was continued until the leaking stopped. The pressure on the pipe gradually increased from 25 psi as the ring was tightened to 52 psi at the stoppage of the leak, Photograph 13 on the next page.

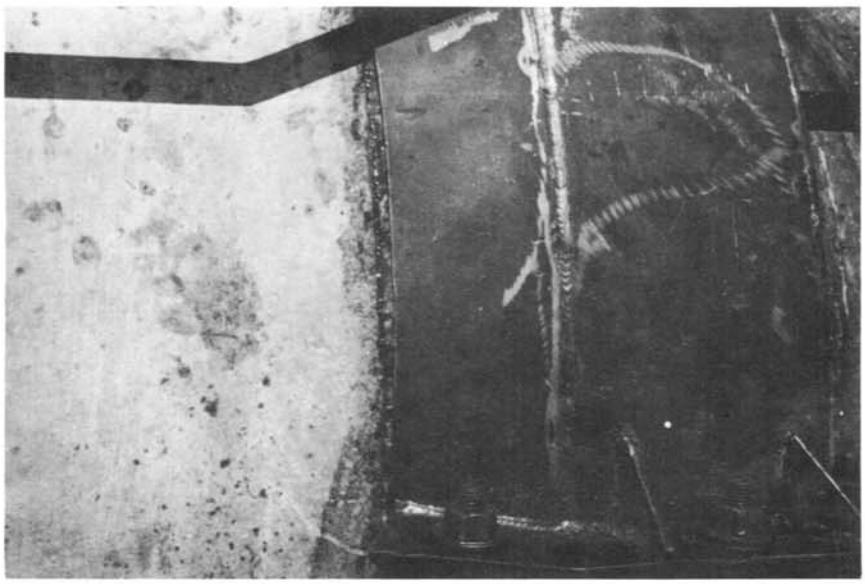


Photograph 12. Photo CN805-243-1182 NA

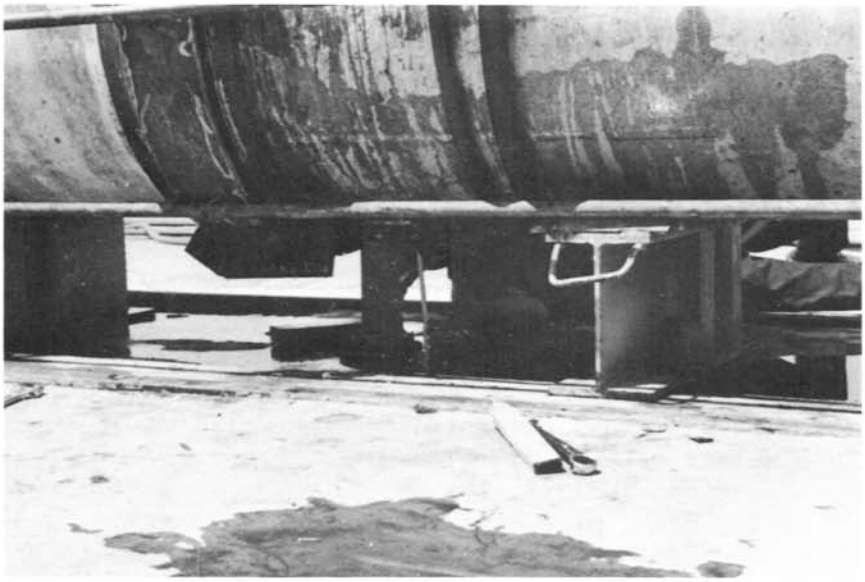
While the pipe was under pressure, it was jacked up in the middle in order to simulate settlement. The pipes were jacked to the point of maximum deflection; that is, the spigot of the one pipe bore against the bell of the other pipe. As shown in Photograph 14 on next page, no leakage occurred.

Comments

1. It is important that the conical lip of the ring which compresses the gasket be a standard size for all sizes of rings made so that the



Photograph 13. Photo CN805-243-1187 NA



Photograph 14. Photo CN805-243-1188 NA

same size gasket can be used. The compression of the gasket is a function of the volume under the lip.

2. The ring should be made in three pieces instead of four. This will eliminate the need for the installer of the ring to get under the pipe.

3. The ring should be provided with a protective coating at the time of manufacture. Since a smooth, aesthetic finish in unimportant and only a reliable protective coating is necessary; sandblasting and a coal-tar epoxy coating should be sufficient.

4. The installation time to put the ring on the pipe was only one-half hour.

5. A comparative cost analysis of concrete encasement vs bell ring repair is given below. The prices for the concrete encasement and repair and for excavation and backfill were furnished by the construction company, making repairs on pipe that was in service on the project. The prices for the bell ring fabrication were quoted to us by the same company that fabricated the rings for the tests.

COST ANALYSIS

	Concrete Encasement		Bell Ring	
Pipe size	With excavation and backfill	Without excavation and backfill*	With excavation and backfill*	Ring fabrication
33"	$1,000	$400	$ 910	$310
42"	1,150	500	1,030	380
51"	1,500	600	1,335	435
60"	1,500	720	1,270	490
78"	1,650	900	1,350	600
90"	1,700	970	1,380	650

* Add from $50 to $100 for coating ring and $50 for labor to install ring and coat bolt connections.

6. How much the bell ring eliminates the concentrated load of a concrete encasement is apparent from the comparison on the next page.

WEIGHT COMPARISON

Pipe size	Concrete encasement, lbs*	Bell ring, lbs
33"	6,500	170
42"	9,200	230
51"	11,300	310
60"	13,900	390
78"	20,800	550
90"	25,400	675

* Weight used for concrete - 140 pcf.

Summary

Our tests on the bell leak repair ring show it to be an acceptable type of repair. The ring was cut into four pieces to facilitate installation. The proper gasket for the pipe tested appeared to be one having a diameter of 1-11/16 inches, and a 40-durometer hardness.

The following advantages and disadvantages can be listed for this repair ring:

Advantages:

1. A pipe leak can be repaired without taking the pipeline out of service.

2. Once the ring has been fabricated, the repair can be performed in 1 day.

3. The concentrated weight at the pipe joint is reduced by 97 to 98 percent.

4. Cost of this repair looks favorable. The cost analysis indicates it to be less expensive than the present repair method.

Disadvantages:

1. The dimensions of the bell of the pipe should be measured to ensure the proper size ring is made. This requires the pipe be uncovered to get these measurements.

2. It will take from 5 to 7 days to have a repair ring fabricated. It requires from 3 to 5 days to repair a leak using the concrete encasement method. However, consideration should be given to the fact that in most cases repair of a leak, when it is small, is delayed for as much as 4 or 5 weeks because water delivery to farm lands can not be interrupted during critical delivery periods. In such cases, there is ample time to get the bell ring fabricated.

* * * * *

PESTICIDES AND CURRENT ENVIRONMENTAL STANDARDS 1/

Herbicides continue to be used in the operation of irrigation and drainage projects in many parts of the United States, but just where we stand in the use of these chemicals in the future remains to be determined. Many agencies are working on the problem of pesticide use and the Bureau of Reclamation has joined them in conducting research and in field monitoring of pesticides to determine their fate when used in or near water and to obtain information necessary for registration of the herbicides for continued use. The number of herbicides in use and the amount of money, time, and research facilities required to obtain the necessary data make it impossible to obtain all the information needed in a short time. Studies being conducted or planned are described in this article.

Continuation of Current Registration

To permit continued use of the herbicides important to economical pest control, the Bureau of Reclamation has requested the Pesticides Regulation Division of the Environmental Protection Agency to extend some existing zero tolerance or no residue registrations beyond December 31, 1970. Extensions were requested on herbicides for control of algae and pondweeds in lakes, ponds, and irrigation distribution and drainage systems and for control of broadleaved weeds and grasses on canal and drainage ditchbanks. Included were the following herbicide use patterns:

Acrolein for use in irrigation canals, drainage ditches, and ponds.

Copper sulfate pentahydrate for use in impounded water such as lakes, ponds, and reservoirs.

2,4-D for use in lakes and ponds for control of emerged marginal weeds, floating weeds, and submerged weeds.

Dichlobenil for use in ponds, reservoirs, and lakes.

Diquat dibromide for use in canals, lakes, and ponds for control of submerged weeds.

Diuron for use in irrigation ditches.

Endothall for use in irrigation and drainage canals, lakes, and ponds.

Monosodium acid methane arsonate for use on drainage ditchbanks.

Monuron for use on irrigation and drainage ditches.

1/ By John E. Knoll, Engineer, Water Operations Branch, Division of Water and Land Operations, Commissioner's Office, U.S. Bureau of Reclamation, Washington, D.C.

Silvex for use on lakes and ponds for control of emerged and submerged weeds.

Petroleum solvents for use on irrigation and drainage ditchbanks and in irrigation and drainage water.

Xylene for use in irrigation water and on canal and pond bottoms.

Needed Research

The existing registrations of many of the above herbicides contain restrictions on their use or the use of the water, or irrigation facilities after treatment. These restrictions make it impractical to use herbicides in normal irrigation operations according to label directions. Therefore, research and monitoring studies are needed to provide information to remove these restrictions where possible.

The Bureau of Reclamation has prepared a petition for registration and request for tolerance for 2,4-D amine for control of weeds on irrigation canal banks. It will be submitted to the Environmental Protection Agency's Pesticides Regulation Division early in 1971. The studies to support this registration have been conducted in cooperation with the Agricultural Research Service which obtained crop residue data and the Federal Water Quality Administration which financed part of the studies.

Reclamation has requested the Food and Drug Administration to exempt copper sulfate and xylene from the requirement of a tolerance when used to control algae and aquatic weeds in irrigation distribution systems. These requests are based on research and experience in the use of these chemicals.

Studies on the fate of acrolein in irrigation canals were conducted in 1970. An analysis of the samples collected in the field studies is being made at the Engineering and Research Center in Denver. This material may be used to support an application for registration or it may be provided to a manufacturer to be used for that purpose.

Reclamation has also monitored the residue of an organic arsenical compound in irrigation water when used to control weeds on irrigation ditchbanks. The data from this monitoring were provided to a herbicide formulator for its use in applying for a registration.

The Bureau of Sport Fisheries and Wildlife and the Corps of Engineers are also researching the fate of pesticides in aquatic sites. They are working on petitions for registration of 2,4-D and silvex in lakes and ponds and two petitions have been submitted to the Pesticides Regulation Division. Also, the manufacturer of endothall has submitted a petition for its registration for use in aquatic sites.

* * * * *

CARBON MONOXIDE--CO--THE CREEPING KILLER 1/

This won't be news to you, but carbon monoxide (CO) is a real killer. In fact, because it's so hard to detect, it creeps in and kills far more people each year than any other gas does, probably more than all other gases put together.

Carbon monoxide is very common. All you need to do to make it is to burn anything containing carbon--wood, clothing, coal, gasoline, and particularly so if they are burned without enough air.

Carbon burns first to carbon monoxide which, if it gets enough oxygen, burns to carbon dioxide. But the carbon monoxide has to be hot to burn so if it gets away from the fire before the oxygen reaches it, it stays carbon monoxide.

That's why it's so dangerous to damper the ordinary room type gas heater. You're likely to get carbon monoxide. If you go to bed with one of these heaters burning without a good vent, you may never wake up. A good many people die that way every year. Electric room heaters are far safer.

You can't smell carbon monoxide. It has no taste, either. It won't even tickle your nose or lungs or make you sneeze. If you breathe much of it, you just get drowsy and pass out. Unless you're rescued, you die.

When you can smell the exhaust from your car or when it's irritating, you're burning some oil or getting some breakdown products of the gasoline. You aren't smelling carbon monoxide, but there is some there.

Carbon monoxide is <u>not</u> a poison. It kills by depriving a person of oxygen. The same thing happens in drowning or in choking to death.

The human machine runs on oxygen. The function of the red blood corpuscle is to absorb oxygen from the air breathed in by the lungs and carry it all through the body where it is used. But these corpuscles greatly prefer carbon monoxide. They'll absorb it about 300 times faster than they'll absorb oxygen.

That means that if there's only a little carbon monoxide in the air a person breathes--say 1/10 of 1 percent or so--his blood soon becomes so loaded with the carbon monoxide that it can't carry enough oxygen for his needs and he passes out. You can't safely breathe more than one-tenth of that amount--100 parts per million--all day. Even that little will give some people a headache.

1/ Reprinted from the Reclamation Safety News, Third Quarter 1970.

There's one good thing about carbon monoxide. If it doesn't kill a person, he'll practically always recover, usually overnight or so, in fresh air. It doesn't ordinarily cause any continuing injury, either. In a very few reported cases, however, persons overcome by carbon monoxide suffered some permanent brain damage. Brain cells die very quickly if deprived of oxygen.

Every gasoline or diesel engine gives off carbon monoxide--lots of it. You can't fix these engines so they won't. So if you must run them indoors, hook their exhausts up to an exhaust system designed for the purpose or at least run the exhausts outside. Also, have good ventilation to take care of any leakage.

It's important, too, to remember that any fire or fuel-heated furnace or oven may give off carbon monoxide. In fact, almost all furnaces do. That's why furnaces and ovens indoors should be hooked up to suitable stacks or exhaust systems or have smoke pipes of their own.

Fires that get plenty of oxygen seldom produce much smoke. So be very suspicious of a smoky fire. It's probably giving off plenty of carbon monoxide.

Carbon monoxide indicators that measure the amount of this gas in the air should always be used to show whether or not it's present in tanks or other closed spaces that might contain carbon monoxide.

Masks are available that will protect a person against up to 2 percent carbon monoxide by means of chemicals that absorb it. For higher concentrations than 2 percent, the supplied-air type of equipment is necessary. In any case, when dealing with carbon monoxide in any amount, a man must <u>know</u> what he's doing if he's to avoid trouble.

The know-how of safety with carbon monoxide is a good thing to take home with you. If you do use either a portable gas or oil heater, fasten it down and run a smoke pipe outdoors. Fix it so it can't be dampered off, and make sure it always has a good draft.

Another thing, if you have an attached garage, make sure your automobile exhaust can't get into the house.

Finally, if you have any other gasoline engine like the usual power lawn mower, don't ever tune it up indoors. That's strictly outdoor work.

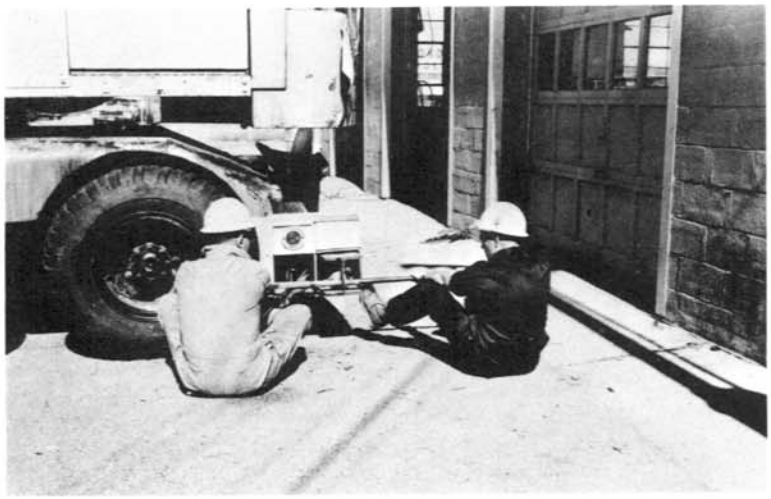
* * * * *

> A man should never be ashamed to say he has been in the wrong, which is but saying in other words that he is wiser today than he was yesterday.

OUTRIGGERS ON OLDER LINE TRUCKS
(Suggestion No. R7-69S-1)

The following suggestion was jointly submitted by Gerald W. Kasten and Donald J. Kennedy, of the South Platte River Projects Office, Loveland, Colorado. This idea for extending and retracting outriggers on older line trucks and truck cranes will save a considerable amount of time and physical effort.

When extending or retracting the outriggers on some older line trucks and truck cranes it requires at least two men to physically move the heavy I-beams into and out of position. Photograph 1 below shows the old method of extending outrigger arms, and Photograph 2 shows how the outrigger arms were retracted.

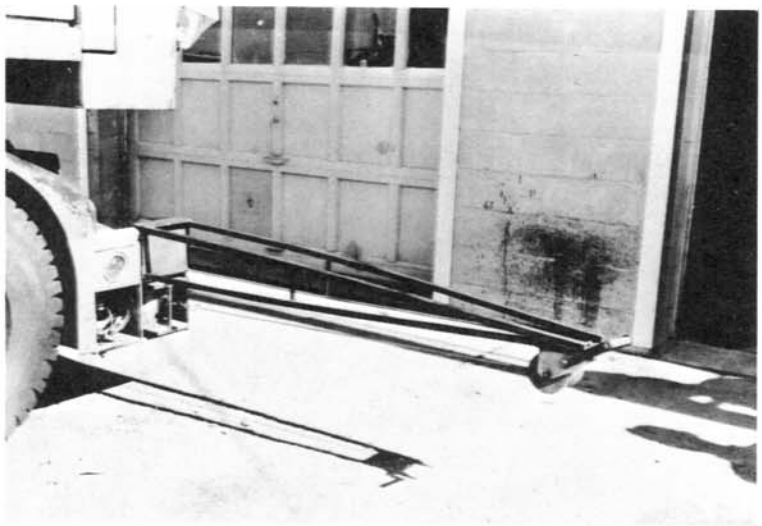


Photograph 1. Photo P245-713-4174 NA

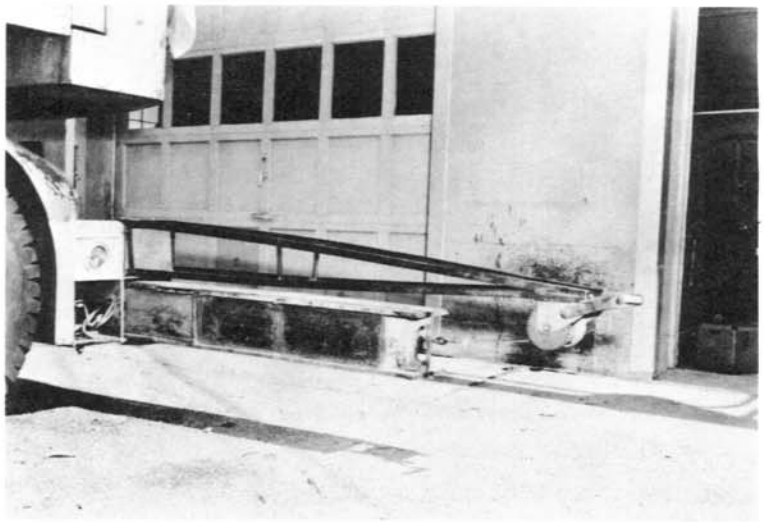
Photograph 2. Photo P245-713-4175 NA

This is time consuming and hazardous due to uneven ground and the makeshift rigs, jacks, and prybars that are used to free the sticking I-beams in the tubes.

The device designed and fabricated by Mr. Kasten and Mr Kennedy calls for a 1,000-pound-capacity winch mounted on the end of a boom which fits over the end of the tube as shown in Photograph 3 below. The bracket and winch used to extend outrigger arms are plainly seen. A wire rope extends from the winch and is connected to the eye in the beam. One man can then extract the beam from the tube as seen in Photograph 4. The bracket and winch is shown with the outrigger in an extended position.

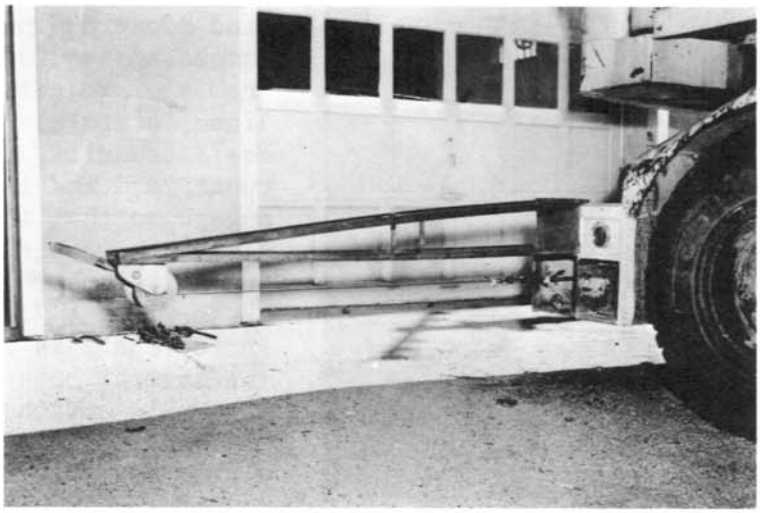


Photograph 3. Photo P245-713-4176 NA



Photograph 4. Photo P245-713-4177 NA

When retracting the beam, the boom and winch are mounted on the opposite end of the tube and the winch is attached to the beam through a short length of wire rope connected to the back side of the outrigger beam as shown in Photograph 5 below. The bracket and winch are in position to retract the outrigger arm. The retracted outrigger beams are shown in Photograph 6, which also shows the retracting cable, ready for road travel.



Photograph 5. Photo P245-713-4178 NA

Photograph 6. Photo P245-713-4179 NA

If further information regarding this suggestion is desired, please write to: Project Manager, South Platte River Projects Office, P. O. Box 449, Loveland, Colorado 80537.

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CLEANING CONCRETE-LINED LATERALS

Photograph 1. Photo P825-D-68615

Photograph 2. Photo P825-D-68616

The small, lightweight flat-bottom dragline bucket shown in Photograph 1 at left, was fabricated in the project shop on the San Angelo Project to remove wind blown and partially compacted sand and silt from the projects concrete-lined laterals. The bucket has a capacity of one-third cubic yard and is light enough so that it will not damage the concrete lining in the lateral.

Photograph 2 is a view of the lateral being cleaned with this attachment. After cleaning, the soil is leveled with a motor patrol and the top of the lateral is then reseeded with native grasses in an attempt to prevent further wind and water erosion of the soil.

If further information is desired regarding this suggestion please write to: Regional Director, Bureau of Reclamation, Attention: Code 5-400, Amarillo, Texas 79105.

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GPO 833-916