

Department of the Interior, Bureau of Reclamation

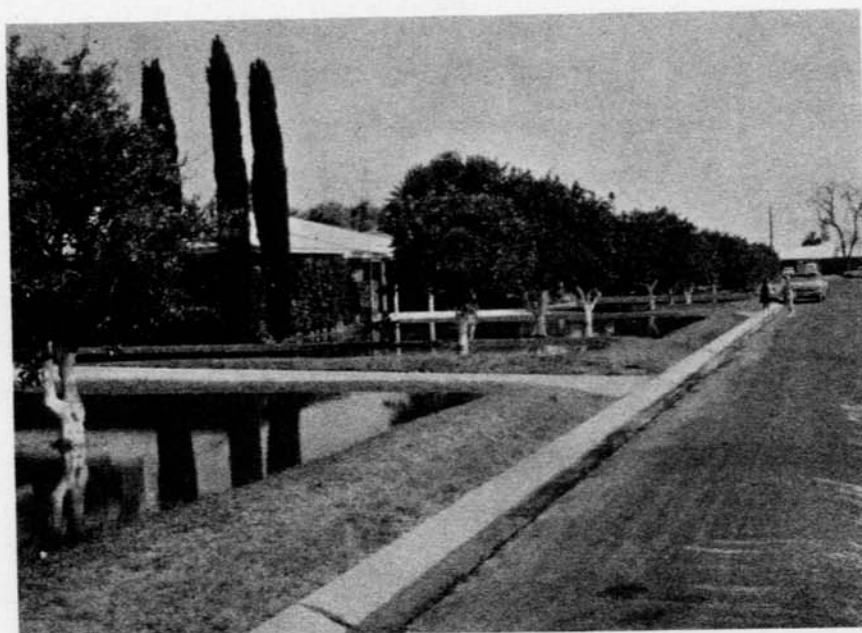
# IRRIGATION OPERATION AND MAINTENANCE

BULLETIN NO. 55

January, February, March 1966

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SCANNED

3-8-02

**In This Issue:**

**Irrigation Service to Urban Areas on the Salt River Project**

**How to Spot and Correct Trouble in Wire Rope Boom Supports**

**Save Battery with Cold Weather Starting Aids**

**Weed Rake**

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The Irrigation Operation and Maintenance bulletin is published quarterly, for the benefit of irrigation project people. Its principal purpose is to serve as a medium of exchanging operation and maintenance information. It is hoped that the reports herein concerning labor-saving devices and less costly equipment and procedures, developed by resourceful project people, will result in improved efficiency and reduced costs on the systems of 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 Bureau offices are reminded to notify their Suggestions Award Committee when a suggestion is adopted.

\* \* \* \* \*

Division of Irrigation Operations  
Office of Chief Engineer  
Denver, Colorado



P25-D-52144 NA

A perfect irrigation--not a drop in the street.

IRRIGATION OPERATION AND MAINTENANCE  
Bulletin No. 55

JANUARY, FEBRUARY, and MARCH 1966

INTRODUCTION

The conversion of irrigation lands to subdivisions surrounding our cities has created problems for many of the organizations operating our project irrigation systems. A good example of the problems that must be considered are found on the Salt River Project which surrounds what has become the metropolis of Phoenix, Arizona. An article by J. Frank Chambers, Manager of the Irrigation Services Department of the Salt River Valley Water Users' Association, beginning on page 1 of this issue of the bulletin, explains the methods used and procedures followed on the Salt River Project in delivering water to the subdivisions and individual homeowners. For the excellently prepared discussion of the problem, we wish to thank Mr. Chambers, as well as Mr. Henry Shipley, Assistant General Manager, and Mr. R. J. McMullin, General Manager of the project water users association. In transmitting the article, Mr. Shipley states:

"This report, due to its complexity, may discourage irrigation districts; however, once getting into it, it isn't that difficult. The only recommendation I have to make is that if possible, the cost of this type of service should be set up at a higher rate than the conventional farm assessment cost. Again, this factor would be controlled by the existing by-laws of the organization.

One factor which was not mentioned in this report is the establishment of improvement districts to provide irrigation facilities. This has been done in our area in some instances by subdivisions when the sub-divider did not provide irrigation facilities. The people organized an improvement district, which made it possible to obtain a bond issue for the construction of the necessary irrigation facilities.

The monthly cost of sprinkling a lawn during the summer months for the average lot would run from \$15 to \$30. The monthly cost from using irrigation water would be approximately \$2."

In addition to the above article, there will be found beginning on page 13, a very interesting discussion on "How to Spot and Correct Trouble in Wire Rope Boom Supports," by R. O. Kasten, Manager, Wire Rope Products, Product Engineering and Development, Sheffield Division, Armco Steel Corporation. Tests being made of wire rope on a specially developed machine also are described.

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A timely article "Save Battery with Cold Weather Starting Aids," is included in this issue of the Bulletin, page 18; and a weed rake developed by V. Carrol Donner of the Bureau of Sport Fisheries and Wildlife, page 20, is described.

## IRRIGATION SERVICE TO URBAN AREAS ON THE SALT RIVER PROJECT

By

J. Frank Chambers, Manager, Irrigation Services Department

### History

Early in 1951 we felt the first major impact resulting from the urbanization of farmlands in our Project. At that time it became very apparent that we must revise our system of water distribution to include the needs of Residential Subdivision lots in addition to our Municipal and Farm accounts. Because of the size of the Project and the large number of users to be served and the additional service to be provided, we split the distribution operations into five separate distribution areas; each serving approximately 50,000 acres, each with a field office and a Watermaster in charge, plus the necessary zanjero<sup>1</sup> and clerical manpower to provide the necessary service to the users. At this same time, we also set up our Subdivision Operations headquarters.

It was imperative that an efficient method of scheduling irrigation water for subdivision lots be devised. Where previously we had served an 80-acre farm account, we now found as many as 320 subdivision accounts, each with its individual water right and irrigation facilities. After a long and thorough study, we found that a method of scheduling these lots and small acreages by groups, in sequence, was the answer. As a result, our present schedule board system was placed in operation.

Currently, we are serving over 30,000 residential lots, whose individual acreage ranges from 0.20 acre to 5.00 acres, mostly less than 1 acre. In doing so, we maintain 1,200 schedule boards, each as centrally located in the subdivision as possible.

### Municipal Accounts

The Project has municipal contracts with five cities and towns within its boundaries which allows them to pay the assessments and other charges on lands not using water, which are usually urbanized lands. The prorated share of water for these lands is diverted into their domestic water system.

The majority of the area, however, is composed of residential lots and the greatest user of project water for domestic purposes is the city of Phoenix which in 1964 paid the assessments and other charges on 35,000 acres. Under the terms of the contracts all domestic water must be delivered within the boundaries of the Salt River Reservoir District.

<sup>1</sup>/A spanish word used in the Southwest to denote one who controls the delivery of water.

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## Water Rights

Water is appurtenant to the land on the Project regardless of land use, which means that all urbanized lands retain the same basic water rights as farmlands. As each subdivision lot is sold, the prorated share of the original acreage water right is assigned to it.

The quantity of water is prorated on an acre-foot basis; the quantity available is dependant on the supply.

## Schedule Boards

Whenever it appears to the subdivision office that there are a sufficient number of active irrigation accounts in an area to warrant establishing a schedule board, then, a field check is made. The section plat of the area is taken to the field and the actual irrigation facilities of the subdivided area are checked and noted on the plats, such as, tile lines, valves, and diversion boxes, shown as Exhibit I on page 8. The person checking all these details then begins to coordinate all of the information. The information should contain the name of the subdivision, the board location, the location of the delivery gate, the necessary time to allow for filling the ditch and the sequence or printing order of all accounts. After all of the necessary changes in records is completed, a new board as shown in Photographs No. 1 and 2 on page 3 is installed.

## Ordering

Subdivision accounts are scheduled every 14 days, April through September, and every 28 days, October through March. The sheets are removed from the boards on the morning of a given day and returned to the board by 5:00 p. m. the following day with the individual time assigned. When the sheet is returned to the board for the current run, the sheet for the following run is posted beneath, allowing the user to determine his time for one run and to sign up for the next run with only one trip to the board.

All subdivision water needs are included in the regular water order for the farms and city needs daily. The zanjeros are notified by the Water Transmission Supervisor when they can pick up the water in the heads of the laterals which they operate.

Subdivisions are grouped as evenly as possible throughout the 14- and 28-day schedules. An average of 85 boards per day are scheduled during the 14-day schedule, and 42 per day during the 28-day schedule. For those accounts over 1 acre, occasional special runs are granted between schedules.



P25-D-52142 NA

Photograph No. 1



P25-D-52143 NA

Photograph No. 2

## Scheduling

After the schedule sheets are removed from the boards by the schedulers, they are returned to the subdivision officer where they are checked for credit balances, maximum orders allowable, notices of a delay, or a cancellation due to construction, etc.; each order is then tabulated to arrive at a total order for each subdivision.

When the total hours required for each subdivision is determined, the orders are then telephoned to the appropriate Water Distribution Field Office and, then is picked up by the zanjero and included in his total orders for the day. He determines the on and off time for each subdivision and calls it back to the schedulers, who then break the total hours down into the individual assigned time. The sheets are then returned to boards, which completes another cycle for this group of subdivisions.

## Delivery

The zanjero delivers on schedule to the established Association delivery point, just as he does with farm deliveries.

## Measuring

We use two types of measuring devices: The Clausen-Pierce Weir Rule and a Calipre, or Meter Probe, depending on the type of facilities. The normal amount of water delivered to subdivisions is 50 miners inches.

## Clearing Accounts for Service

This is one of the most difficult and exacting duties of the Water Accounting Office. The payment of the annual assessments entitles the user to a certain amount of water and all water above the amount must be covered by additional payments. All payments of assessments and additional water charges must be made in advance of the delivery of water and, as a protection to the user who may have his land leased, great care must be exercised that no delivery be made until the account has been released for service.

At the same time, it is imperative to avoid unnecessary delay between the clearing of the account in the office and its clearance in the Distribution Field Office or the Subdivision Section Office. As a result, the Water Accounting Office furnishes the Distribution Offices and the Subdivision Office, at least once a day, with a record of each account which has been cleared for service that day.



## Accounting for Water Delivered

It is vital to the welfare of the Salt River Project that all water available be carefully conserved and that none be wasted. Therefore, a system of Water Accounting was installed many years ago, whereby, daily reports are received from every point of diversion on the entire Project to its final distribution--the user. From the daily reports, we compile a Monthly Water Balance Report and a Water Delivery Record which shows the actual Canal and Lateral loss in making the deliveries to the users.

The annual assessment charge for water delivered is prorated on an acreage basis, plus, accounting costs for each shareholder, i. e., assessment per year for 0.20 acre--70 cents. Accounting costs may vary from \$5 to \$10 per account. Figure 1 below is a typical assessment statement.

SALT RIVER VALLEY WATER USERS' ASSOCIATION										CASHIER'S STUB			PLEASE FILL IN BELOW					
THIS IS YOUR ACCOUNT NO. ASSESSMENT STATEMENT										ENCLOSE THIS STUB WITH REMITTANCE			PAID BY					
CN	LAT	GATE	USER	SEC	TNSP	RNGE	TYPE ACCT.	C.C.	BILLING STATUS	CN	LAT	GATE	USER	SEC	CITY	ZONE	STATE	
1	14	0	090	102026	1	2N	2E	24	9	00	1	14	0	090	102026			
LT. 9&10EXE19BK6 VISTA INC. ESTS.													MAILING ADDRESS					
LAND DESCRIPTION													CITY ZONE STATE					
JOHN DOE 2501 W AUGUSTA AVE. PHOENIX, AZ 85013													PROPERTY ADDRESS					
RETAIN THIS PORTION FOR YOUR RECORDS													<input type="checkbox"/> PLEASE CHECK IF ABOVE IS CHANGE OF ADDRESS					
INST SEASON	ENTRY	DUPLICATE	MO	DAY	YR	ASSESSMENTS AND OTHER CHARGES	STAT	INST	SEASON	OFFICE USE ONLY	MAIL	REL.	BUY	N & A.	OWR			
65	W.D.FEE	12	6	4		10.00	7	25	65	10.00	<input type="checkbox"/>							
65	ASSMNT.	12	6	4		.70		30	65	.70	<input type="checkbox"/>							
DELINQUENT 30 DAYS AFTER DUE DATE										0	20	10.70	<input type="checkbox"/>					
ACRES WATER RIGHT										0	20		<input type="checkbox"/>					
TOTAL AMOUNT										AMOUNT PAID			CASHIER					
PENALTIES AND INTEREST, IF ANY, WILL BE FIGURED WHEN PAYMENT IS MADE. WATER SERVICE WILL BE DISCONTINUED DEC. 31, IF FIRST INSTALLMENT IS UNPAID.													OFFICE USE ONLY					
													C.C. T.A. NO. YEAR PUMP					

Figure 1

## Operation and Maintenance of Facilities

The Project's point of obligation is the established delivery point, which is normally the high point along the perimeter of each 160 acres, or each quarter section. The Project is responsible for maintaining and operating the facilities to this point.

Beyond the delivery point, the system is termed "private" and is jointly owned by all who are served by it. Operation and maintenance beyond this point is their responsibility. Although there is no legal obligation beyond the established delivery point, considerable time is spent by Subdivision Section personnel within the subdivision areas in advising and assisting the users.

In the event a private delivery ditch is in need of maintenance or repair, or if a private pipeline or stand box is broken, a notice is posted on the schedule board informing the users that no water will be delivered until the maintenance or repair has been completed. A copy of a typical notice is shown as Exhibit II on page 9.

### Customer Service

A centralized Irrigation Customer Service Office is in operation from 6:00 a.m. to 10:00 p.m. daily. The office is staffed with the necessary manpower to handle the load. They receive and handle, or route, requests and complaints pertaining to all phases of irrigation. In addition, they have complete information concerning the status of all irrigation accounts, such as assessments or charges; also, the total water delivered to date, the amount of water which can be purchased, plus the current credit balance, etc. The type and volume of work handled by the Customer Service Office is illustrated by the monthly report shown as Exhibit III on page 10.

The effects of urbanization are very evident in this area, since the majority of the calls received by the Customer Service Office pertain to subdivision accounts. When advice by telephone will not suffice, field personnel is dispatched to assist the customer.

### Educational Programs

Many educational aids are provided for the urban customer. A form letter and a booklet, "Irrigation For Small Acreages," is distributed. The booklet states briefly how subdivision irrigation operates, and the form letter, Exhibit IV on page 11, answers some of the questions that the users may have.

Evening meetings also are arranged with groups in new areas, whenever possible, so that a project representative can explain irrigation using plats and charts of the area.

### New Methods in Progress

Prior to January 1, 1965, all subdivision water orders were scheduled manually, as previously described. At the present time, we have about 50 percent of our subdivision scheduling converted to computer, which results in greater efficiency and a reduced manpower requirement. A copy of the schedule as printed by computer is shown as Exhibit V on page 12.

## SUMMARY

The rate of urbanization growth in our Project has been very consistent during the past 10 years. In 1955, our total urbanized area amounted to about 25,000 acres, compared to approximately 70,000

acres at the end of 1964, an average of 4,500 acres per year going from farm to urbanized lands.

For many years prior to our present system of water distribution to subdivided lands, the Association offered what was known as "Special Service for Subdivisions." The Association assumed the full responsibility for the operation and maintenance of all private facilities within the subdivision, plus the actual delivering and irrigating of each lot. The cost of the service was prorated over each lot. Finally this cost increased to over \$50 per year per lot. The Association, finally, discontinued this type of service. Now, the individual does his own irrigating according to the established schedule on the board, or hires a private irrigator.

We extend an open invitation to all who may be suffering from urbanization pains. With many years' experience back of us, we believe we have most of the answers and can provide a prescription which will give some relief. This we can do in a couple of days if you have the time to visit our Subdivision Office.

With our present schedule board type of delivery for small acreage users, we have been able to handle the organization of farmlands and feel that we will for years to come. Photograph No. 3 below and on cover of this issue of the Bulletin is an example of the subdivision irrigation.



Photograph No. 3





IRRIGATION SERVICE DEPARTMENT STATISTICAL REPORT

EXHIBIT III

MONTH July - 1964

ACCOUNTING & COLLECTING DIVISION

Account Number Changes	10
Address Changes	186
Cancelled Accounts	2712
Deed Transcripts	3514
Name Changes	730
New Accounts	2861
Photostats New Subdivisions	10
Plats Processed	8
Receipts Posted	2934
Secretary Deed Transfers	185
Sequence Changes	59
Splits & Combines	22
Title Company Checks	1401
Title Company Searches	2776
Transfer City Accts To Reg.	66
Transfer Reg. Accts To City	2635
Water Deliveries	14833

IRRIGATION CUSTOMER SERVICE DIVISION

Customer Contacts Field	147
Customer Service Counter Contacts	117
Customer Service Office Contacts	81
Customer Service Telephone Contacts	9971
Mail Processed	318
New Schedule Boards Set Up	3
Off The Board Water Orders	167
Subdivision Accts Corrections & Adj.	157
Subdivision Accts Released For Service	28089
Subdivision Individual Deliveries	60097
Schedulers Mileage	6992
Supervisor Mileage	3938
Total Schedule Boards	1408
Counter Receipts Processed	351

CUSTOMER SERVICE REQUESTS

Dirty Ditch	0	Permits For Structures	38
Floodings	0	Repair To Structures	0
Free School Applications	1	Right of Way & Claims	0
New Structures	0	Splits & Combines	12
Miscellaneous	4	Water Delivery	4

Total Customer Service Requests 59

Submitted: *Patricia A. Chausse*

Date 8-3-64

MAILED TO NEW CUSTOMERS

## SALT RIVER PROJECT

P. O. BOX 1980  
PHOENIX 1, ARIZONAVICTOR I. CORBELL, PRESIDENT  
FLOYD N. SMITH, VICE-PRESIDENT  
R. J. McMULLIN, GENERAL MANAGER

TO ALL PROPERTY OWNERS IN THIS AREA:

In an effort to assist you in the ordering and the application of your irrigation water, and perhaps answer some questions you have, we submit the following items of information:

The Salt River Project delivers water to the high point of each 1/4 section (160 acres) of land. From this point, all irrigation facilities are owned by all who receive water from them. Any maintenance is the responsibility of this group. The delivery point for your area is 46th. St. & Garfield, and the number of the Project gate that serves you is 1 - 6 - 27. Please refer to this number when contacting us regarding your delivery. This will assist us in locating your account without delay.

The schedule sheet you sign for water is located at 44th. St. & McKinley. Please note the two printed dates at the top of this sheet. We will remove it from the board by 7 AM on the first date, and return it with individual time assigned by 7 PM on the following day. When the sheet for one schedule period is returned to the board, the sheet for the next schedule period is posted beneath it. You can check your time for one irrigation and sign for the next with only one trip to the board.

It is your responsibility to divert the water to your lot from the person preceding you at the start of your irrigation time. This includes making any necessary changes in irrigation facilities required to direct the water to your property.

Adherence to the schedule is necessary, for only one person is scheduled to receive water at a given time. Taking water off schedule will deprive a neighbor or contribute to flooding.

We wish to bring to your attention that you are responsible for the water during your assigned time. If you neglect to contain the water within your property you could be held liable for damage. Do not order water unless you will be home to direct its application or make arrangements with someone else to do so.

If, during your irrigation period, you are not receiving the proper flow of irrigation water, check the system from your lot to the aforementioned Project delivery point. If it appears insufficient water is coming through the gate and into your system, call 273-5275. A representative will be dispatched to determine the difficulty and will make necessary arrangements to rectify the situation.

If properly handled, irrigation water is a great blessing in our arid valley. If improperly handled, damaged property and streets can result. Your cooperation in putting our limited water supply to beneficial use will be appreciated by the community.

Thank you,

Salt River Project  
Residential Irrigation Division

KMCC:mr

**SALT RIVER VALLEY WATER USERS ASSOCIATION  
IRRIGATION SCHEDULE SHEET  
(PRINTED AND SCHEDULED BY COMPUTER)**

**NOTICE**

PLEASE REFLECT TO YOUR ACCOUNT NUMBER WHEN REQUESTING SERVICE  
IF YOUR NAME OR ACCOUNT NUMBER DOES NOT APPEAR ON THIS SHEET CALL 273-5691

FOR EMERGENCY AFTER 5 P.M. CALL 273-5275

NAME	SERVICE ADDRESS	ACRES	TYPE OF ACCT.	YOUR ACCOUNT NUMBER		DITCH REF. SEQUENCE	YOUR ORDER NUMBER	DATE		ON TIME		OFF TIME			
				EN	LATERAL			MONTH	DAY	MONTH	DAY	MONTH	DAY	MONTH	DAY
BONNIE LEA ANX	19 2N 35		2	130	390	981316									
CAMPBELL E 19TH AV															
HEAD 050															
DELIVERY GATE	17TH AVE&CAMELBACK SW		1	130	390	981316									
DITCH TIME							15	4 20	11 45	A	4 20	12 00	A		
BOGAN ROBERT J MARG	4542 N 15TH DR	.20	24	130	390	083506	12				NO ORDER				
NEWMAN JAMES ALAN	4540 N 14TH DR	.20	24	130	390	083696	14				NO ORDER				
HERSHFIELD W N	4518 N 18TH DR	.40	24	130	390	083686	36				NO ORDER				
MC WILLAN R W	4512 N 18TH DR	.20	24	130	390	083736	44				NO ORDER				
TENNYSON NEIL A&M C	4502 N 18TH AVE	.20	24	130	390	083326	58	30	4 20	12 00	A	4 20	12 30	P	
KUNSELMAN K	4501 N 18TH DR	.40	24	130	390	083756	60	1	30	4 20	12 30	P	4 20	2 00	P
HENSLEY J	4508 N 18TH AVE	.20	24	130	390	084516	62	40	4 20	2 00	P	4 20	2 40	P	
GUETSCHOW E J	4512 N 18TH AVE	.20	24	130	390	083906	66	40	4 20	2 40	P	4 20	3 20	P	
HAMPEL N M	4517 N 18TH DR	.20	24	130	390	083776	68	40	4 20	3 20	P	4 20	4 00	P	
HULSEY W J	4518 N 18TH AVE	.20	24	130	390	083426	70	40	4 20	4 00	P	4 20	4 40	P	
TIRRELL S L	4521 N 18TH DR	.20	24	130	390	083726	72	40	4 20	4 40	P	4 20	5 20	P	
STRINGHAM E S	4526 N 18TH AVE	.20	24	130	390	083236	78	30	4 20	5 20	P	4 20	5 50	P	
HUNTER V L	4532 N 18TH AVE	.20	24	130	390	083596	82	30	4 20	5 50	P	4 20	6 20	P	
CAPNECCHIA S	4539 N 18TH DR	.20	24	130	390	083526	88	40	4 20	6 20	P	4 20	7 00	P	
SMITH F G	4540 N 18TH AVE	.20	24	130	390	083306	90	45	4 20	7 00	P	4 20	7 45	P	
RACKERS V H	4542 N 18TH AVE	.20	24	130	390	083166	92	30	4 20	7 45	P	4 20	8 15	P	
BOHLMANN L S	4539 N 18TH AVE	.20	24	130	390	083136	98				NO ORDER				
DITCH TIME								15	4 20	8 15	P	4 20	8 30	P	
SELHAY J	4507 N 18TH AVE	.20	24	130	390	083226	104	30	4 20	8 30	P	4 20	9 30	P	



## HOW TO SPOT AND CORRECT TROUBLE IN WIRE ROPE BOOM SUPPORTS

By R. O. Kasten<sup>1</sup>/

Wire rope used for boom supports on shovels, cranes, clamshells, draglines, and backhoes are usually neglected during periodic maintenance checks at times. Even though boom support ropes are not thought of as operating ropes--bending over and around sheaves and drums--it is vital that they be given regular inspections. Understanding the factors that cause wear, and knowing what to look for is the key to the problem.

Vibration is one of the prime causes of failure in boom suspension ropes. When working efficiently, a machine is constantly picking material up, and dropping or unloading it. This cycle of loading and unloading produces vibrations of some amplitude and frequency in the boom support ropes. These vibrations progress through the ropes to the fitting, and then to the machine frame. The vibrations are dampened at the fitting, and it is here that most failures in boom pendant supports occur.

Another condition--also difficult to control--is overloading. A safety factor of five is generally recommended for boom support ropes. Often though, an equipment manufacturer may design them to a lower safety factor. Thus, if the equipment is loaded beyond the recommended limits, the boom suspension ropes may be severely overloaded. This does not mean they will fail immediately, but it can definitely limit the service life of the ropes.

One type of failure that can often occur in boom pendants is the break up of the independent wire rope core (IWRC). The needlelike pieces visible in the center of the photograph shown on the following page are what remains of a conventional core after a rope has been subjected to extreme vibration and overloading.

As the IWRC breaks up, it no longer supports the outer strands of the rope. Without proper core support, the outer strands bear against each other, elongate excessively, and wear prematurely.

The answer to these problems, of course, is careful, systematic inspection. Do not neglect them when going over the other ropes on your equipment.

<sup>1</sup>/Mr. Kasten is manager, Wire and Wire Rope Products, Product Engineering and Development, Sheffield Division, Armco Steel Corp. The article is reprinted from Engineering and Mining, April 1964, by permission of the Editor.



In impact fatigue machine, this rope had a relative service factor of 280.

Operating conditions vary so much that it is difficult to establish a boom support retirement procedure. The number of loading and unloading cycles can change from 1 hour to the next. A machine may be digging harder because an operation is behind schedule; or it may be working in severe weather conditions. The life of boom suspension ropes will vary with any one of these factors.

But, by regularly inspecting ropes, making a notation of broken wires and other irregularities, you can get a good idea of how they are holding up. Take them apart when they've been retired from service so that you can check the condition of the core.

#### Steps to Follow

Here are some of the things that should be checked during a scheduled inspection:

1. Clean away the lubricant in the valleys between the strands and look for broken wires near the base of the socket.
2. Inspect the rope at the base of the end fitting where it is bent around a thimble and spliced to the main body of the rope. The splice itself, including a hand splice, mechanical splice, or friction grip should also be checked.
3. Remove the lubricant from the valleys between the strands on the main body of the rope and check for broken wire.
4. Once the inspections have been completed, relubricate those areas where lubricant was removed before returning the rope to service.
5. If two wires are broken, the rope should be removed from service. After a boom pendant has been taken down, cut off a

short piece of rope near the fitting and open. Carefully check the inner wires and count the number broken. This is also a good time to check the condition of the independent wire rope core. Even though variation in operating conditions make it difficult, it may give you some idea of when to retire a boom support rope.

When you remove a boom hoist rope from service, follow the same procedure in checking the internal condition of the rope. Cut the rope at a spot that has been in contact with the sheaves, or at a point near the end fitting which attaches to the boom or frame.

6. Another recommendation on boom hoist ropes. Periodically move the point at which the rope contacts the sheaves. This can be done by cutting off a short length from the tiedown end, providing there is sufficient extra length on the drum end. Rotating the sheaves 90° at the same time will also change their point of contact with the rope.

A number of ideas are currently being investigated that show promise for lengthening the service life of boom suspension ropes. Here are some that are being studied:

1. Field conditions on boom suspension ropes are being simulated with the aid of a new impact fatigue machine. The relative factors and illustrations of failures shown in photographs on the following pages were developed in tests conducted on this equipment.
2. A new independent wire rope core which is more flexible and has greater compression resistance has been designed and tested. It gives better support to the outer strands and also has higher resistance to vibrational fatigue.
3. Coated wires are being studied for use in independent wire rope cores.
4. Better lubrication methods are being investigated for use in wire rope production and also during field servicing operations.

All of these developments, it is hoped, will contribute to the production of an even higher quality product.

In spite of this work, however, a sound inspection program will always be the heart of a safe, efficient operation. Don't ever think that a boom support rope won't wear out because it doesn't operate over sheaves and drums. It does operate--but in a different way.

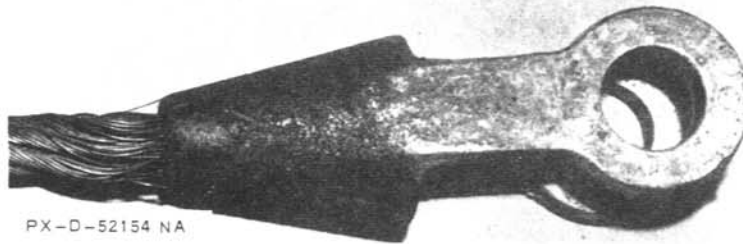
Next time you're checking your equipment, take a good close look at the boom pendants as the machine picks up and releases a load. You will be able to see how the rope rotates and works at the area near

the end terminals. It is this action which can cause rope failure unless you set up careful and systematic inspection procedures. Boom pendant supports on your machines deserve the same periodic attention given the other operating ropes. This and other problems simulated on the testing equipment are shown below.



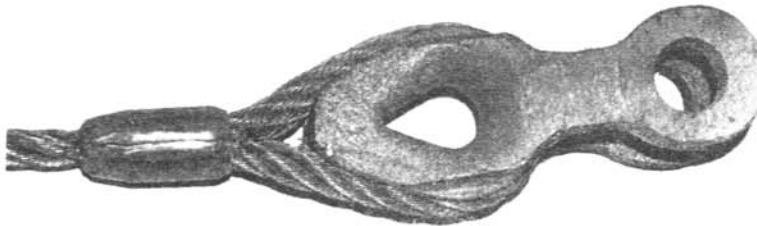
PX-D-52153 NA

Most boom pendants will fail in the zone next to the base of the swaged socket.



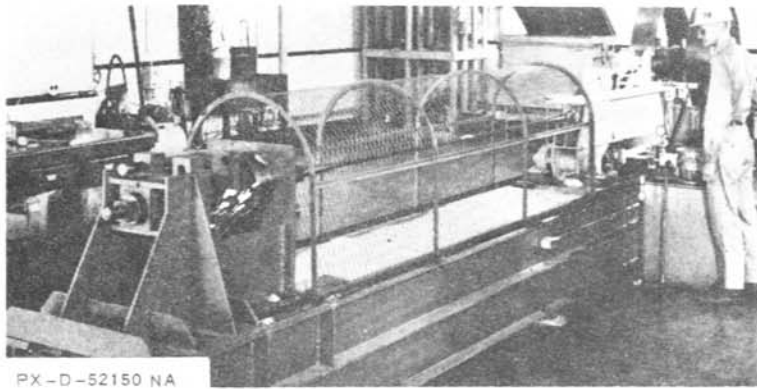
PX-D-52154 NA

Conventional zinc sockets did not perform very well in impact fatigue tests.



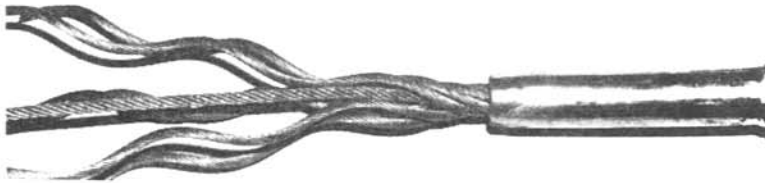
PX-D-52155 NA

Failure on ropes with Flemish eye splices began near the end of the pressed ferrule.



PX-D-52150 NA

Field service conditions were simulated in impact fatigue unit.



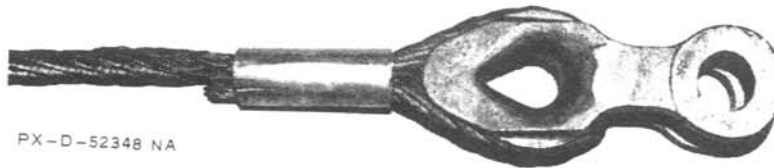
PX-D-52151 NA

Independent wire rope core remained intact after testing to 315 factor.



PX-D-52152 NA

With a conventional eye splice, failure occurs where the first tucks are made.



PX-D-52348 NA

On return loop ropes, failure occurred at the base of the load-supporting sleeve.



Ropes with wedge sockets fail on the live end near the base of the socket bowl.

\* \* \* \* \*

### SAVE BATTERY WITH COLD WEATHER STARTING AIDS<sup>1/</sup>

Diesels depend on the heat generated in compression to ignite the fuel. In cold weather, drag caused by stiff, cold oil, reduces the cranking speed. Compression heat produced is absorbed into the cylinder walls and the fuel never reaches the ignition point.

Cold weather starting aids can therefore provide an easy method of starting diesels.

Two basic aids are used, according to some service engineers: a fluid or vapor with a low ignition point and an air heater.

#### Combustible Fluid Most Common

The fluid type is the most common. Usually a capsule of highly combustible liquid is crushed in a tube. The liquid is then forced through a vaporizing nozzle into the air intake system. A small amount of heat will ignite the fluid and help turn the engine.

An off shot of the liquid-type primer is the pressurized can. With this method, the fluid is vaporized as it leaves the can. The spray is directed into the air intake and ignited in the cylinder.

The air heater is a small oil burner with an electric ignition. Once ignited, the oil heats the intake air raising the cylinder temperature and allowing the diesel fuel to ignite. A variation of this uses an electrical heating element to accomplish fuel ignition.

<sup>1/</sup>Reprinted from WESTERN CONSTRUCTION, November 1965, by permission of the Editor.

### Keep Battery at Full Charge

By using the proper weight oil with the most modern machinery, starting is not a problem if the battery is kept at full charge. A battery loses half of its power at freezing temperatures and if it is not fully charged to begin with, its efficiency is drastically reduced.

### Use Proper Fuel

Fuel is another consideration for easy winter starting. Fuel used should have a cloud point below expected ambient temperatures. A No. 2 fuel should be used whenever possible or use cold weather fuels recommended by your supplier.

Fuel requirements should meet four basic qualifications: cleanliness, chemical purity, proper burning characteristics and low ignition point.

### Use Clean Fuel

Cleanliness means freedom from water, dirt and other noncombustible ingredients. Fuel leaves the refinery clean, but in transportation, storage and fuel tank containers, it picks up rust, water, and dirt. Recommended maintenance of fuel filters will help eliminate this problem.

### Use Pure Fuel

The fuel should be chemically pure, that is, it should be within the recommended limits for ash, carbon sulphur (when sulphur content exceeds more than 1/2 of 1 percent, more frequent oil change periods will be required). These materials form sludge and sediment. In addition to making the fuel hard to ignite, they also form harmful residues in the combustion chamber.

### Use High Specific Gravity

The power characteristics of a fuel are related to the API gravity. A high specific gravity contains more fuel heat units per gallon and therefore more power output. High volatility is required to enable complete vaporization, clean combustion and low residue formation.

### Use High Ignition Quality

Fuel ignition quality is expressed as a "cetane" number. The higher the number, the higher the fuel quality. The higher cetane fuels have better ignition characteristics to facilitate starting and improve combustion.

## Good Care Comes First

Cold weather starting aids should be used as a last resort because of their explosive effect (vs. diesel fuel) on the pistons. Avoid using vapor aids over freezing temperatures. It is easier on the engine to maintain a fully charged battery, burn the proper fuels and use the recommended oil. Engines are easier to start and operators don't heat up either.

\* \* \* \* \*

### WEED RAKE (Suggestion SWF-1-65-78)

A suggestion by V. Carrol Donner, of the Bureau of Sport Fisheries and Wildlife, is a rather simple implement resembling a garden rake, considerably oversized and used with a small dragline, replacing the regular bucket. It was built and first used to remove dense growths of pondweed, (Potamogeton spp.), from a canal. This pondweed restricted waterflow severely and, allegedly, raised water levels in Truckee-Carson Irrigation District's drains, causing complaints from farmers.

It was used on several sections of the canal in 1964, and it is claimed that about 85-90 percent of the pondweed is removed. It required approximately 3 days to clear 1 mile of the canal. The best time for treatment is when the pondweed is nearing maturity. It is very effective in removing pondweed, and can be used without removing water from the canal or without dangerous side affects as with chemicals.

In the spring of 1965, after a very windy winter, a drain contained more loose, blown-in, alkali weeds than ever before. It was decided to try this rake and the dragline to pull the weeds out onto the bank where they could be burned. The results of this trial were more dramatic than results of the original trial on the canal.

In 1964, 15 days were spent with the same dragline and operator (with regular bucket) removing weeds from 4 miles of the drain and an adjacent canal. In 1965, with the "rake," weeds were removed from 5 miles of the drain and 1/2 mile of the adjacent canal in 4-1/2 days. It has since been used on sections of other canals where there was a need for the removal of weeds and other debris. The rake is quite effective in "ripping up" bars formed by weeds that have silted into the bottoms of canals. The dragline operators are very enthusiastic about this implement.

The implement as originally built was made mostly from scrap iron and material on hand. Strength of material indicated on Figure 1,



on page 23, is greater than that originally used, since field trial quickly revealed weak spots. It is felt that material indicated is adequate, but conditions at other stations may indicate a need for change. It is possible also that spacing of teeth might be reduced to probably 7 inches for use in pondweed removal, but for general work, the 9-inch spacing is working very well.

Photographs of this device are shown below and on the following page.



Photograph No. 1

Dragline and "Weed Rake" at work.



P247-D-52146 NA

Photograph No. 2

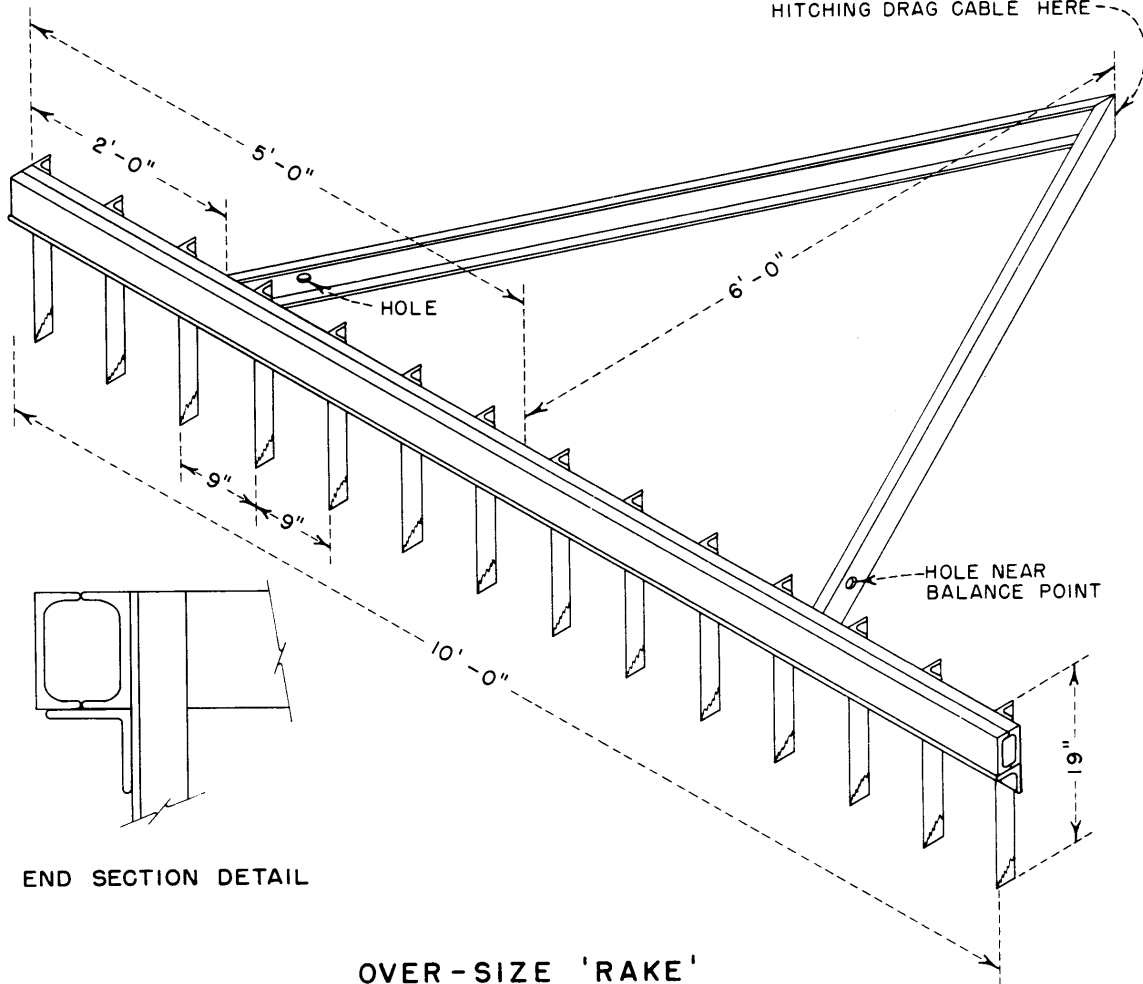


P247-D-52147 NA

Photograph No. 3

DRILL HOLES (AS MARKED),  
USE DEEP CLEAVISES FOR  
FASTENING RAKE TO BAIL  
CHAINS.

BUILD HITCH SUITABLE FOR  
HITCHING DRAG CABLE HERE



### OVER-SIZE 'RAKE'

FOR REMOVING LOOSE WEEDS, DEBRIS FROM CANALS  
AND DRAINS WITH LIGHT DRAGLINE. IT CAN BE USED  
ALSO FOR REMOVAL OF PONDWEED FROM CANALS.

**MATERIAL NEEDED:**

4" CHANNEL IRON, 2 PCS. 10' LONG,	2 PCS. 6' 8" LONG - 180 LBS.
3" X 3" X 5/16" ANGLE, 1 PC. 10' LONG	49 LBS.
2" X 2" X 1/4" ANGLE, 14 PCS. 19" LONG	71 LBS.
	<u>TOTAL 300 LBS.</u>

WELD ALL JOINTS AND SEAMS AS NEEDED.

Figure 1