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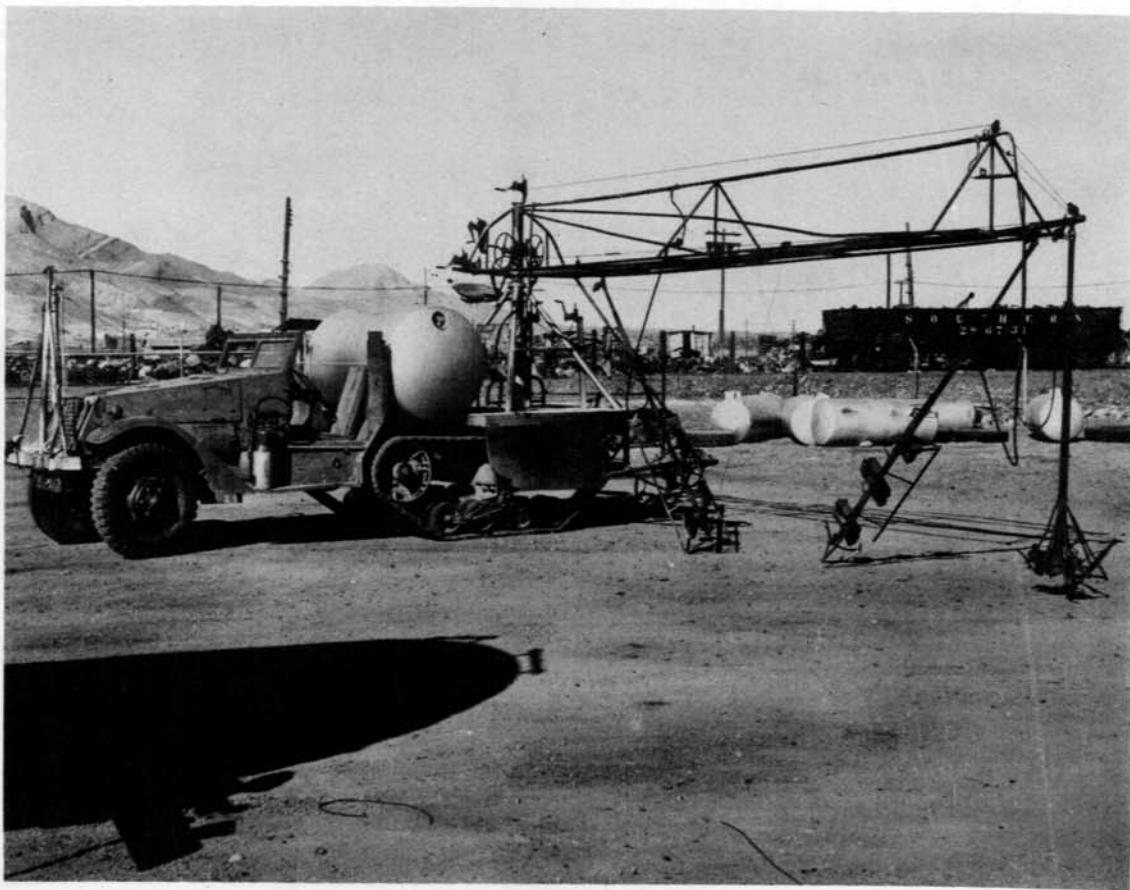
Department of the Interior  
Bureau of Reclamation

**OPERATION AND MAINTENANCE  
EQUIPMENT AND PROCEDURES**

RELEASE NO. 16

APRIL-MAY-JUNE 1956

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CONTENTS

**Weed Control on Irrigation Systems**

Release No. 1 is out of print and will not be reissued.

Releases No. 3, 8, 16, and 37 were on the subject of Weed Control Equipment and have been superseded by Release No. 97, "Equipment For The Prevention, Control, and Disposal Of Weeds On Irrigation Projects."

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(It is suggested that this table of contents replace that given in Release No. 3 and Release No. 8, of the Operation and Maintenance Equipment and Procedures Bulletins issued in March-April 1953 and April, May and June 1954. Pages indicated by (\*) will be found in Release No. 3 and those indicated by (\*\*) in Release No. 8.)

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## INTRODUCTION

This is Release No. 16 of the Operation and Maintenance Equipment and Procedures Bulletin, which is published Quarterly. The information in this Bulletin is assembled for the most part from suggestions by people engaged in the irrigation of our western lands. The Bulletin is 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, with its principal purpose being 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.

This issue of the Bulletin is being devoted entirely to the subject of weed control. Two previous issues of the Bulletin also were devoted to this subject; Release No. 3, issued in 1953 and Release No. 8, issued in 1954. This issue differs somewhat from the previous issues which were devoted primarily to equipment for combating undesirable weeds, in that several requests have been received and suggestions made that the Bulletin provide some up-to-date information concerning the types of chemicals and solvents best suited for the control of certain types of weeds and grasses. Such an article appears on page IVB1 of this issue, and is intended as an aid in detecting the limits of different types of hydro-carbons used in aquatic-weed killers.

You will note that this issue of the Bulletin has been punched for binding in a standard 3-ring binder. The subject matter also has been divided into sections to correspond with the subject matter of the previous issues. Therefore, the pages of this issue can be incorporated with those of the previous issues.

You also will note that a new index is provided which will replace and bring up to date all information published on the subject in this and previous issues.

A much greater distribution of Bulletins devoted to this subject is necessary because of the interest shown in weed control. For this reason, some information that has appeared in previous Bulletins devoted to general O&M equipment are being repeated.

For the benefit of those who did not receive the earlier releases on weed control, a few copies are available. If you are interested in receiving the earlier releases, please fill in the blank on the next page and forward it to the Bureau of Reclamation office located nearest you as follows:

Regional Director, Boise, Idaho  
Regional Director, Sacramento, California  
Regional Director, Boulder City, Nevada  
Regional Director, Salt Lake City, Utah  
Regional Director, Amarillo, Texas  
Regional Director, Billings, Montana  
Regional Director, Denver, Colorado  
Assistant Commissioner and Chief Engineer, Denver, Colorado.

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Please forward copies of your Operation and Maintenance Equipment and Procedures Releases Nos. 3 and 8 to the following:

Name \_\_\_\_\_

Organization \_\_\_\_\_

Address \_\_\_\_\_  
\_\_\_\_\_

## DESCHUTES WEIR POOL WEED SPRAYER

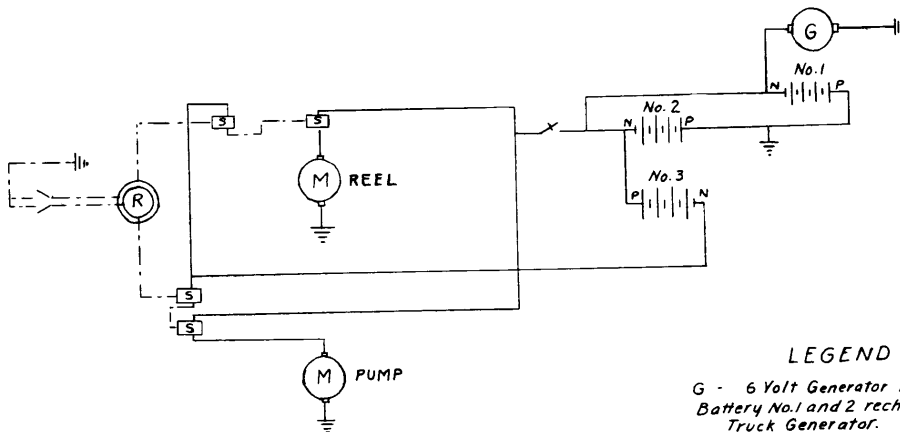
Use of the "Deschutes Weir Pool Weed Sprayer", planned and constructed by Mr. Huron D. Wise, heavy duty mechanic, Deschutes Project, Oregon, and used on the project, results in considerable savings in time, more weir pools and isolated areas being sprayed, and the spraying operation being much better than that usually performed with less efficient 3-gallon back-pack-type sprayers. The new device delivers the spray material from the spray wand held in the operator's hand in response to his pressing a button on the handle of the wand. The device is shown in the photograph below.



### Construction:

The unique feature of this unit is the elimination of a gas engine for power. The pump and reel are both operated by two 6-volt starter motors with remote controls on the boom handle which gives the operator finger tip control when spraying 100 to 200 feet from the machine.

The unit is built on a metal base which can be placed in any one-half-ton pickup with room to spare. It has a tank capacity of 50 gallons. A diagram of the complete unit and a wiring diagram and details of the hollow bronze shaft are shown on the following pages.



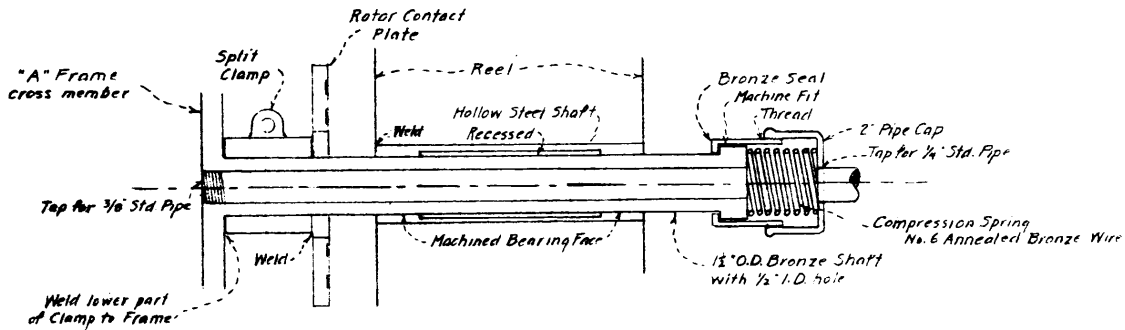
WIRING DIAGRAM

NOTE: For 150 Ft. Hose - 12 volts are required to operate solenoid switches (Batteries No. 2 and 3.)

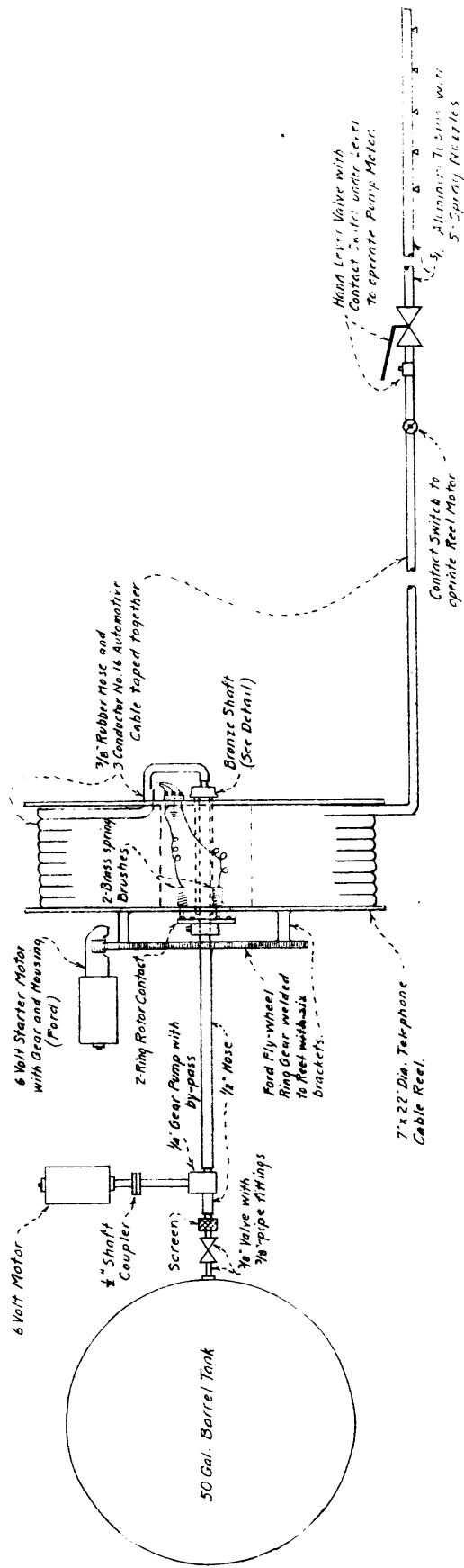
For 75 Ft. or less - 6 volts is sufficient to operate solenoid switches and Battery No. 3 could be omitted.

LEGEND

- G - 6 Volt Generator in Truck
- Battery No. 1 and 2 recharged by Truck Generator.
- Battery No. 3 recharged in Shop
- M - 6 Volt Automobile Starting Motors (Ford)
- S - 6 Volt Automobile Solenoid Switch (Ford)
- R - Rotor Contact (2-Rings) for transmission through reel and spray control.
- 300 Amp. Battery Conductor Cable.
- No. 16 Automotive Conductor



HOLLOW BRONZE SHAFT DETAIL



WEIR POOL WEED SPRAYER



## LIQUID GAS WEED BURNERS

In the past few years, an effective burning program for weed control has been put in operation on six projects in New Mexico and Texas, by Region 5 of the Bureau of Reclamation. This was brought about by the introduction and availability of liquid gas, particularly butane and propane. Although other methods of grass control on distribution systems are effective, burning still has a place in the routine weed control program. This is more applicable since liquid gas burners, mounted on both trucks and tractors, have been developed.

Several important and beneficial features have been incorporated into the burners used in Region 5, shown and described on the following pages. These features include:

- (1) Vaporization of liquid at the burner,
- (2) Swinging of booms so that the truck may traverse either bank of a canal, and,
- (3) Cables or hydraulic means to raise and lower the burners so that they can be kept in the most effective burning position.

Vaporization of the liquid at the burners eliminates special heat exchangers which are dangerous, expensive, and burdensome. Many of the burners used on the equipment described were designed and fabricated on the several projects by project personnel. They may be mounted in clusters on the burner bars. The bars, usually, are mounted on black standard pipe which in turn telescopes over smaller pipe attached to the boom. The bars can be moved away from or pulled closer to the truck and can be raised or lowered hydraulically or by the use of cables, pullies, and cranks, generally by one man.

The burner heads for many of the burners were constructed of old boiler flues; however, the most durable are constructed of seamless steel tubing. A heat generating burner head is desirable and probably the most efficient; however, is not a necessity, as liquid gas will burn without producing much smoke, even when released through an open jet nozzle.

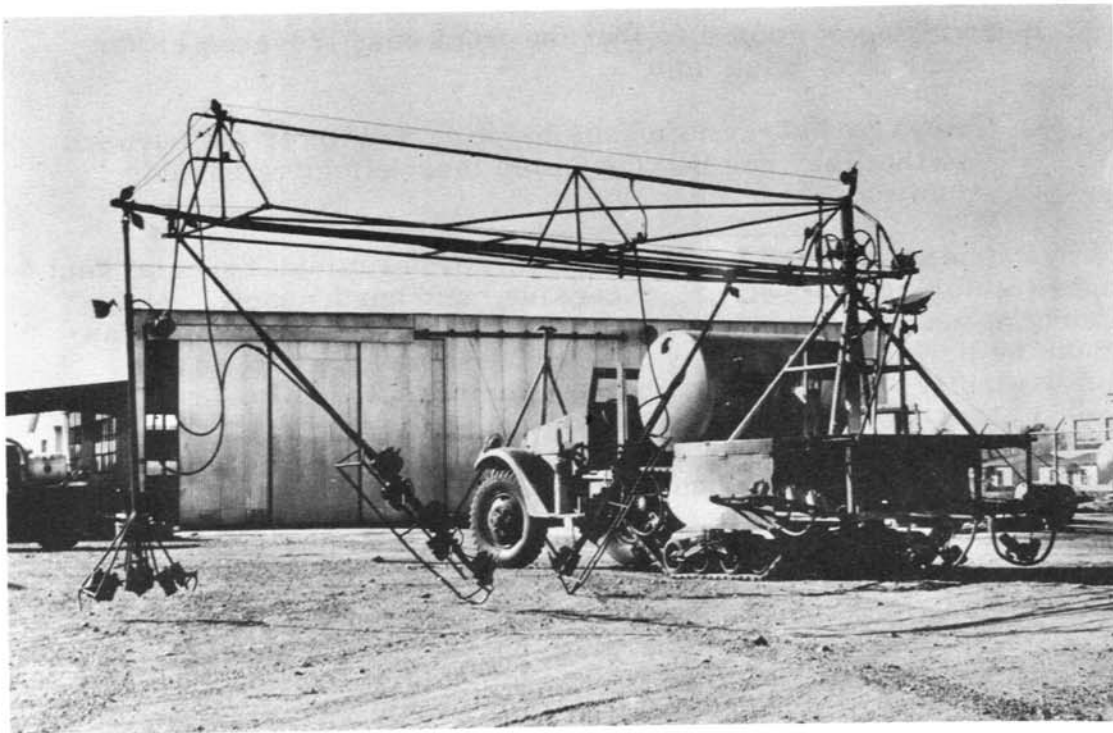
With a swinging boom, the truck can move on either bank of the canal while burning, the burners can be swung to the rear of the truck when burning the top of the canal bank, or the boom can be swung to a forward position when moving from one location to another. Burning weeds in a canal with an operating road on only one side is made more convenient and effective and wind conditions can be tolerated, by proper manipulation of the boom.

In order to burn canals having variable distances from the road bed to the water line, most of the burners shown have easily

adjustable burner bars, which can be controlled from the operator's seat and can be maintained in the proper burning position at all times.

### Truck Mounted Burners

The butane weed burner shown on the cover of this issue of the Bulletin and in the photograph below is a little more elaborate than the usual burner of this type in use. The weed burner shown was constructed and is owned and operated by the Hood Petroleum Company, El Paso, Texas. The owner contracts with the Elephant Butte Irrigation District to burn weeds from ditches on a portion of the Bureau of Reclamation constructed Rio Grande Project. This arrangement has been in effect since 1949. The cost of burning with this and similar rigs has averaged about \$17.00 per mile for one canal bank and \$26.00 per mile where both banks have been burned.



There are differences in the design and construction of booms and mountings, which reflect the ideas of the several builders. The booms may be either manually or hydraulically controlled and are in general 25 to 30 feet in length. They are usually counter-balanced for ease of manipulation. The manually controlled boom, such as that shown at the top of the following page, is mounted on a turntable, which permits operations from one side of the truck to the other from the rear of the truck bed. The weeds in a small lateral are being burned by the truck mounted burner constructed in the shops of the Carlsbad Project, New Mexico, by project personnel. In this type of burning, the truck travels about 3 miles per hour.



Another burner that is very universal in operation, easily adjustable to meet unusual conditions and very mobile, is that shown below. This rig also was constructed by project personnel in the shops of the Tucumcari Project, New Mexico. It is completely hydraulically operated.



Hydraulic mechanism from an old pull grader was used for the controls on this machine. The operator sitting on the truck bed turns with the boom, which also is controlled hydraulically in its horizontal and vertical movement.

The burner consumes about 70 gallons of liquid propane fuel per hour under continuous operation. The truck ordinarily travels 1 to 3 miles per hour in the burning of green weeds and grasses, varying with

the height of the canope and the smoothness of the road, and travels 5 to 6 miles per hour when burning dry weeds in the ditches. A 400-gallon tank has been mounted across the truck frame and the liquid butane is piped from the tank to the burners. A high pressure regulator set at 50 pounds pressure is used to control the flow of butane to the burners.

The swinging boom is made of pipe and is mounted on a mast pipe. The mast pipe consists of two pieces of pipe, actually, with the smaller top pipe mast fitting inside the larger lower pipe. Roller bearings at the top and bottom of the mast pipe provide for easy movement. A support made also of pipe and mounted on the front bumper of the truck is provided for the boom to rest upon when travelling from one location to another, or when the rig is not in use.

Further information concerning this particular burning rig can be obtained by contacting the Project Manager, Rio Grande Project, 211 Federal Building, El Paso, Texas, or the Regional Director, U. S. Bureau of Reclamation, Amarillo, Texas.

### Tractor Mounted Burners

Burners constructed on trucks, half-tracks or trailers, burn to the side and behind the carrier, while those that are tractor mounted, as shown below, burn to the side and in front of the transporting vehicle. The latter are used in Region 5 entirely for searing and burning green weeds and grasses.



A project shop-constructed, tractor-mounted liquid gas weed burner used on the Tucumcari Project, is shown at left. This burner consumes about 70 gallons of liquid gas per hour under continuous operation.

This machine operates at about 2 miles per hour when burning green weeds. Intense heat from the burning of dry weeds in front of the tractor and butane tank makes this

machine impractical for winter cleanup. The boom of the burner on this rig is raised and lowered hydraulically and rotated with a mechanical screw device.

Another tractor mounted liquid gas weed burner is that shown at the top of the following page. This burner is used on the Fort Sumner Project, also in New Mexico. This burner also was constructed by project personnel in the project shops. It is completely hydraulically operated.



In operation on a project lateral, the burner head works to the side and front of the tractor, which makes it easily visible to the tractor operator. Like the previous tractor-mounted burner used on the Tucumcari Project, care is used in burning because of the proximity of the tractor and the butane tank.

### Cost of Operation

Cost of operation varies from project to project and depends on the amount of liquid gas consumed per hour of operation and the number of burnings required to suppress the vegetation. Ordinarily, liquid gas weed burners operate on a tank pressure of about 100 p. s. i., and each burner head will consume 8 to 12 gallons of liquid gas per hour. The efficiency of liquid gas burners is considered very high as little smoke is evident.

On ditches heavily infested with weeds and grasses, two burnings are ordinarily recommended. The first burning being accomplished with the equipment moving at a rate of about 3 m. p. h. This searing results in an effective top kill even though there is little immediate change in plant appearance. The second burning, made about a week to 10 days later, consumes the old dead tops and retards any regrowth of new plants. By continuously burning and reburning when the green plants reach a height of 8 to 10 inches, weedy grasses and undesirable vegetation on the inside slopes of ditches have been successfully controlled.

A weed burning program has been employed on a part of the Rio Grande Project, Texas-New Mexico, for several years. In 1949 and 1950 five to six burnings were necessary to keep the Johnson grass suppressed to the extent it did not retard the flow of the water in the canals and laterals. Following the same procedure for Johnson grass control during the years, only four burnings were necessary in 1954, and it was indicated that only three burnings would be required in 1955.

In 1954, the average cost for burning green weeds on the inside of small ditches on the Carlsbad Project, averaged \$8.78 per mile per burning, and the cost of burning 35 miles of small ditches on the Balmorhea Project, Texas, averaged \$7.80 per mile of burning.

For further information concerning the weed burners in use in Region 5, contact the Regional Director, U. S. Bureau of Reclamation, Amarillo, Texas. By way of general information, commercial manufacturers of liquid gas weed burners in the Region 5 area are:

Bazooka Burners, Box 5211, Amarillo, Texas  
Snorkel Jet, 4110 N.E. 8th, Amarillo, Texas  
Agricultural Equipment Corporation, La Junta, Colorado.

\* \* \* \* \*



## COLUMBIA BASIN TRASHRACK

The trashrack shown in the photograph below is of the type presently being installed on laterals in the West Canal area of the Columbia Basin Project, Washington. The flat slope of the rack aids in the removal of weeds and the landing mat deck provides good footing. The trashrack shown was installed in a lateral having a capacity of 400 cfs.



### Construction:

Surplus rails are used for the supporting cross members and pipe for the rack varies from  $3/4$ - to  $1-1/4$ -inch heavy duty, depending on the length of span. The rack shown was constructed of  $1-1/4$ -inch pipe with the longest pipe length being about 20 feet.

The pipe is spaced 8-inch center to center and placed on a slope no steeper than 4:1. Upper ends of the pipes are loosely attached to the rail by large spikes which pass through holes in the ends of the pipes and through the web of the rail. The foundation for the rail cross member can be of concrete or serviceable timber. The

platform required in large laterals, as shown in the photograph, has a deck constructed from surplus landing mat supported by a pipe framework.

In many cases the complete unit is fabricated in the project shop and is rigidly constructed, using pipe or heavy strap around the outside perimeter of the rack. A fence enclosure is constructed adjacent to large installations for deposit and burning of weeds collected.

\* \* \* \* \*



## ORCHARD MESA WEED CUTTER

The weed cutter shown in the photograph below was built in the shops of the Orchard Mesa Irrigation District, Orchard Mesa Division of the Grand Valley Project, Colorado. Used to control water weeds and remove silt deposits in the District's canals, it is reported to be very effective in accomplishing the job for which designed and can clean approximately 52 miles of canal in a week. The device is only operated when there is water in the canal; thus the water carries the dislodged material to the end of the canal where it can be removed.



### Construction Details:

The point of the "A" frame is constructed from grader blades which are about 6 inches high and 2 feet long, forming a "V" and reinforced with iron braces and a post. The side wings of the frame also are constructed from grader blades and are about 4 inches high and 11 feet long with the end of the wings having an upsweep of approximately 2 feet. They are attached to the post by heavy iron hinges.

The cross bar is constructed from two pieces of 2-inch pipe, 2-1/2 feet long, each being attached to the side wings. Inside the 2-inch pipe is a 6-foot length of 1-1/2-inch pipe, all three sections of pipe having vertical 1/4-inch holes drilled through them. The pipe sections are secured with steel pins. The pins can be removed, allowing the side wings to be adjusted to the desired width.



Short sections of rail coupled with chain links are attached to the end of the side wings to form a U-shaped drag behind the frame. The drag aids in dislodging moss and silt.

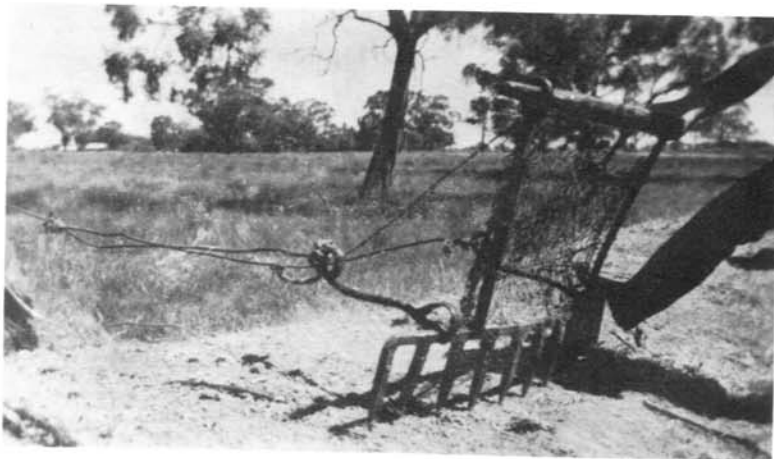
The "A" frame is pulled by a tractor. It is attached to the tractor by a 12-foot side drawbar, shown in the photographs. A heavy chain is attached to the

dozer blade of the tractor and the post of the "A" frame. This tends to keep the "A" frame in the bottom of the canal.

\* \* \* \* \*

## CHINESE RAKE

A device used for control of weeds in irrigation channels and drains in Australia, is the Chinese Rake shown below. The rake was developed by the State Rivers and Water Supply Commission. In



the lower photograph on this page, water couch grass, distichum, or silt grass, which is a vigorous growing, creeping perennial, has completely choked a drain, and is being removed with the rake.

The photograph on the following page is a view of the channel after it has been cleaned with the rake.



The photographs and a drawing of the rake were supplied by the State Rivers and Water Supply Commission, Victoria, Australia. Use of the rake is described in the Commission's Technical Bulletin No. 5, Weed Control in Irrigation Channels and Drains, June 1953. The bulletin is a progress report and summary of mechanical and chemical experiments made

by the Commission in a study of methods to control various types of weeds and plant growth causing considerable difficulty in the operation and maintenance of their irrigation systems.

### Construction Details:

The rake is constructed primarily of pipe and steel. Two rakes of similar design have been used. The larger rake has an overall width of 6 feet 5-1/2 inches and a height of 3 feet 4 inches. The smaller rake has an overall width of 4 feet 3 inches and a height of 2 feet 9 inches.

Four horses and three men are required to manipulate the larger rake and two horses and two men the smaller.

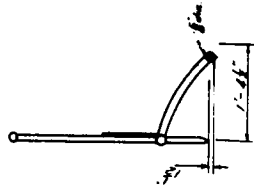
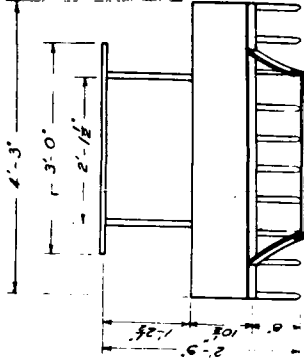
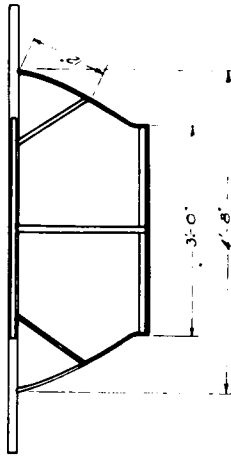
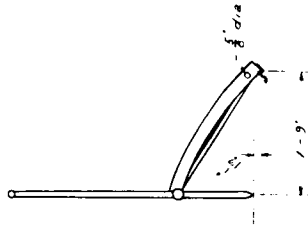
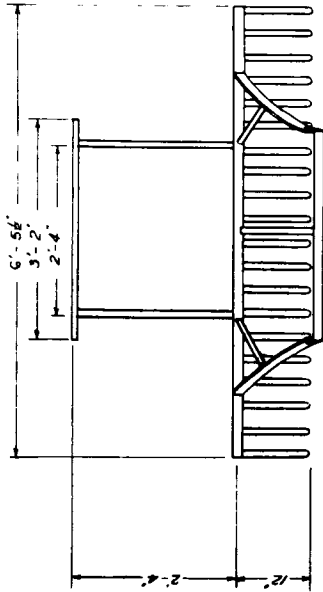


A drawing of the large and small rakes is given on the following page, together with a bill of materials.

The rakes are of welded construction, and the smaller one has been provided with a back plate to protect the operator of the rake.

In the photograph of the rake on the previous page, a wire screen has been placed on the rake uprights to protect the operator.

\* \* \* \* \*



### LARGE RAKE

- Horses Pulling . . . . . 3
- Horse Retrieving . . . . . 1
- Total Horses . . . . . 4
- Three Horses Driver . . . . . 1
- Maneuver . . . . . 1
- Leader Retrieving Horse . . . . . 1
- Total Men . . . . . 3

#### MATERIALS

Item	Material	Quantity
Handle	1" R M S	1
Standards	2 3"	2
Rake Bar	1 1/2" R M S	1
Ignes	2 1/2" R M S	20
Draw Bars	2 3"	2
Centre Strut	1" R M S	1
Side Strut	1" R M S	2
Tulcrum Skid	1/2" x 1/2" Angle	1
Shackles	3" x 1/2"	4
Chain Plough	Black Iron	2
Ring	Black Iron	2
Rope Wire	Iron 1"	1
Swing Bar	Gal. Steel 1/2"	2
Wire Rope	3 horse set	1
Thimbles	1 horse set	1
Wire Rope Clips	3/8"	4

### SMALL RAKE

- Horses . . . . . 2
- Men driver + manuever . . . . . 2

#### MATERIALS

Item	Material	Size	Quantity
Handle	1 1/2" Gal. W. I. Pipe	3'-0"	1
Standards	1" R M S	2'-0"	2
Rake Bar	1" R M S	4'-3"	1
Ignes	1" R M S	4'-3"	10
Draw Bars	2" x 1/2" AFS	1'-10"	2
Tulcrum Skid	1/2" x 1/2" Angle	2'-3"	1
Shackles	1 1/2" x 1/2" Angle	1'-3" x 1/2"	1
Chain With Eye	8" M S Sheet	40"	1
Rope Wire	Gal. Steel 3/8"	30'	1
Thimbles	Black Iron	3 1/2" x 1/2"	2
Wire Rope Clips	Gal. Steel	3/8"	2

STATE RIVERS & WATER SUPPLY COMMISSION  
 MAFFRA - SALE IRRIGATION DISTRICT

**CHINESE RAKE**