HYDRAULICALLY OPERATED SPRAY RIG FOR WEED CONTROL1/

A combination of fertile soils, water and a year-around growing season have provided the essential ingredients for the thriving agricultural economy of Southern California's Imperial Valley. These same elements, however, also result in an undesirable by-product - weeds of unexcelled luxuriance and stamina.

Through the years Imperial Irrigation District, which operates over 3,000 miles of main canals, laterals, and drains, serving in excess of 500,000 acres of irrigated farmland, has run the gamut in methods of weed control. From the early-day use of labor gangs equipped with shovels, brush axes, and machetes, through the period of extensive use of weed burners, the District has progressed to the present-day method of chemical weed control, employing relatively sophisticated machines for the application of various liquid herbicide mixtures.

Nearly one-half million dollars is expended annually by the District in its weed control program. Such a sizeable expenditure, coupled with the rather extensive area to be covered, demands close attention to efficiency and economy of operation as well as to its overall effectiveness. The District's management team has concluded that the continued spiraling of labor and equipment costs makes it imperative that time-saving innovations be employed.

Imperial Irrigation District, also being in the power generation, transmission and distribution business, utilizes a fleet of line trucks equipped with personnel booms. It was only natural that someone would eventually ask as to why couldn't an adaptation of these hydraulically operated units be used effectively to support a spray bar, as well as put an operator out over his work?

One such unit was developed in the headquarters shops of the District, and field tested during the 1967 fall spraying season. Photograph 1 on the following page shows a full view of the new hydraulic-operated spray truck. The advantages of the automated boom and chemical-flow control were readily apparent. It appeared, however, that by relieving the boom of the weight of the operator and personnel basket, the boom could be lengthened from 20 to 25 feet, plus the addition of a pair of movable spray arms mounted at the end of the boom. These and other refinements were incorporated in a hydraulically operated articulated aerial boom spray rig fabricated at Imperial in the spring of 1968 and placed in service during the summer spraying period.

It will be noted in Photograph 2 also on the following page that the operator sits at a control panel mounted on the swinging pedestal of

1/This article was written and presented for inclusion in this bulletin by Mr. R. F. Carter, General Manager, Imperial Irrigation District, Imperial, California 92251. Inquiries for further information should be directed to Mr. Carter.

Photograph 1 - P214-D-64740D

Photograph 2 - P214-D-64741D

the boom, affording him a full view of his work. The main boom has a 360-degree horizontal swing with a vertical movement of 45 degrees below the horizontal. The two spray arms attached at the end of the boom are hydraulically operated from the control panel and each is capable of a 180-degree horizontal swing and a 90-degree up-and-down movement. This allows positioning of the spray pattern to conform to any normal drain section or canal side slope and berm. Each spray arm is equipped with six nozzles, operated in groups of three by valves operated from the control panel.

Other noteworthy features include the jet-agitated 1,800-gallon tank capable of being filled in 6 minutes, with the 3-inch centrifugal pump using a power takeoff from the truck transmission. Photograph 3 below shows a front view of the spray truck with the liquid herbicide tank clearly visible. One auxiliary gasoline engine powers the spray pump and the hydraulic pump for the boom operation.

The three-axle, 6 by 4 truck is mounted on high-flotation super single tires which will permit it to operate over most canal and drain bank roads under normal conditions.

The total cost of the rig was approximately $19,000, including $10,500 for the truck and $3,500 for the bare boom and pedestal.

The subject machine, along with its immediate prototype developed in 1967, has convinced District personnel that they are on the right track

Photograph 3 - P214-D-64742D

and as each unit of the present fleet of manually operated, swing-boom rigs is phased out it will be replaced by hydraulically operated equipment similar to that described on these pages. Specific nomencalture of the various components of this new rig is listed below:

Truck Specifications

1. Manufactured cab and chassis
2. 39,000 gross vehicle weight
3. Three-axle, 6 x 4
4. V-6 cylinders, 400.9 cubic inches
5. Wheelbase 157 inches with C.A. 84 inches
6. Transmission 5-speed
7. Auxiliary transmission 4-speed
8. Tires 15 - 22.5
9. Minimum speed of 1.5 mph at 1,600 rpm
10. Rear axle heavy duty
11. Addition to rear frame - 16 feet from cab to end of frame
12. Section modulus increased

Tank

1. Shop-built 1,800-gallon tank with baffle

Suction Pump

1. Centrifugal 3 by 3 inches
2. Power takeoff from transmission
3. Tank fills in approximately 6 minutes

Boom

1. With hydraulic control pedestal
2. Two 10-foot 5-inch hydraulic-operated with vertical and horizontal motion
3. Hydraulic controls mounted on boom

Auxiliary Engine

1. Engine rated at 25 hp at 2,400 rpm
2. Engine powers both the spray pump and the hydraulic pump
3. Hydraulic pump rated at 1,200 rpm giving 6-1/2 gpm with a 9-1/2 hp output from engine. Spray pump at 2,400 rpm with maximum 360 gpm using 11 hp from engine

Spray Booms

1. Two 1-inch id by 10-foot 5-inch hydraulically operated booms with six nozzles per boom, producing 3.4 gpm at 30 psi.

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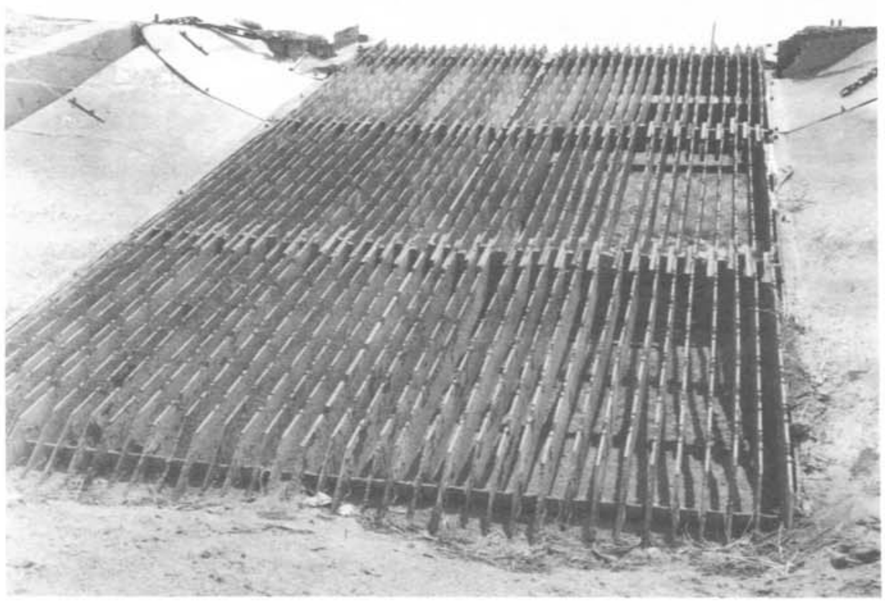
This mechanical trashrack used on the Northport Canal, North Platte Project, Northport, Nebraska, is a product of 4 years of experimentation and improvement. Most of the construction and alterations that were necessary for the efficient operation of this device were done by Mr. N. E. Troudt of the Northport Irrigation District, Northport, Nebraska.

It is basically a very simple mechanical device that is reported to operate most efficiently. Photograph 1 below is a view of the trashrack looking up at it from the lower section. The trash moves up the rack and falls on to the conveyor belt which moves it to a depression on the right side of the 60 cfs canal where it has been installed at a drop structure. Photograph 2 at the top of next page shows the eccentrics or camshaft detail. A full view of the mechanical trashrack installation is shown in Photograph 3. Photograph 4 on page 21 looking upstream shows the trashrack as it fits into the drop structure.



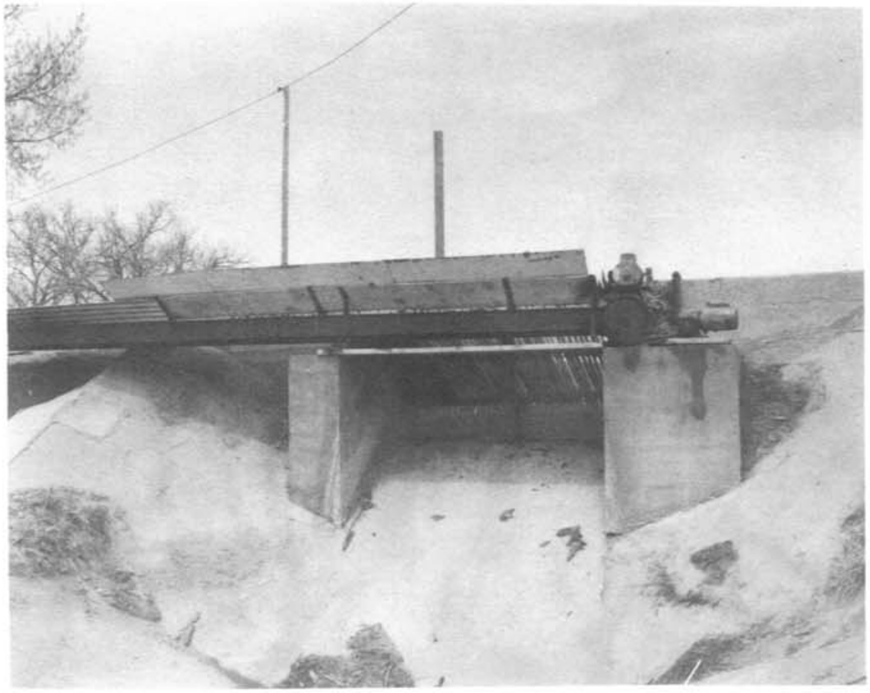
Photograph 1 - P20-703-5845NA

Trashrack Construction

The device is made of a 2-inch steel shaft that has eccentrics or cams keyed to the shaft. These raise and lower alternate steel bars or walkers approximately 2 inches with each stroke. The walkers are made

Photograph 2 - P20-703-5912NA

Photograph 3 - P20-D-64743D



Photograph 4 - P20-703-5840NA

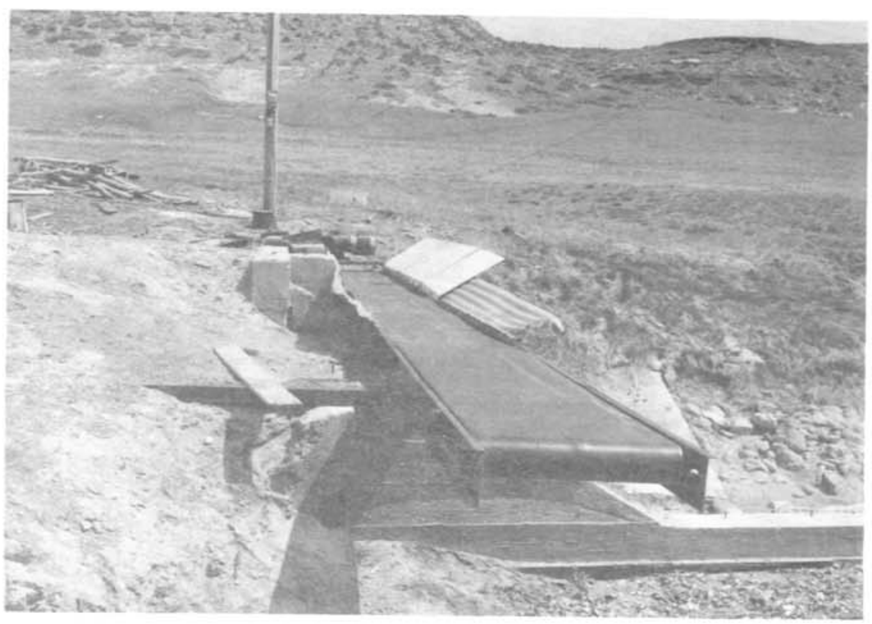
of 3/8-inch steel, 4 inches wide. Each walker is notched at intervals of about 8 inches and has several weld spots to further roughen the top surface and aid in the upward movement of the trash, as shown in Photograph 5 on the next page. The walkers are spaced 1-3/4 inches apart.

A piece of 3/8-inch steel is used on each side of the walker to eliminate lateral movement and also to give a closer fit as the walkers slide in the groove on the eccentric. It was found that better results were obtained if the bearing surface was bronzed at the bottom of the walker where it makes contact with the eccentric. The shaft makes 42 revolutions per minute and is powered electrically with a 1-1/2-horsepower motor. The walker-eccentric contact surface is greased once a day and it was discovered that wheel bearing grease gives the best results.

The Belt Conveyor

The view of the conveyor belt also is shown in Photograph 6 at the bottom of the next page. This particular conveyor belt is 60 feet long and 2 feet wide and also is powered electrically by a 3/4-horsepower motor. The smooth type belt does not move the lighter weight weeds as well as it should. A rough surfaced belt 3 feet wide is recommended. It is believed that the added width is needed to handle longer logs and large objects.

Photograph 5 - P20-703-5844NA



Photograph 6 - P20-703-5842NA

There are no plans of the trashrack available, as it was built and altered as ideas and problems arose. However, if further information is desired, it can be obtained by writing to the Northport Irrigation District, Post Office Box 547, Bridgeport, Nebraska 69336.

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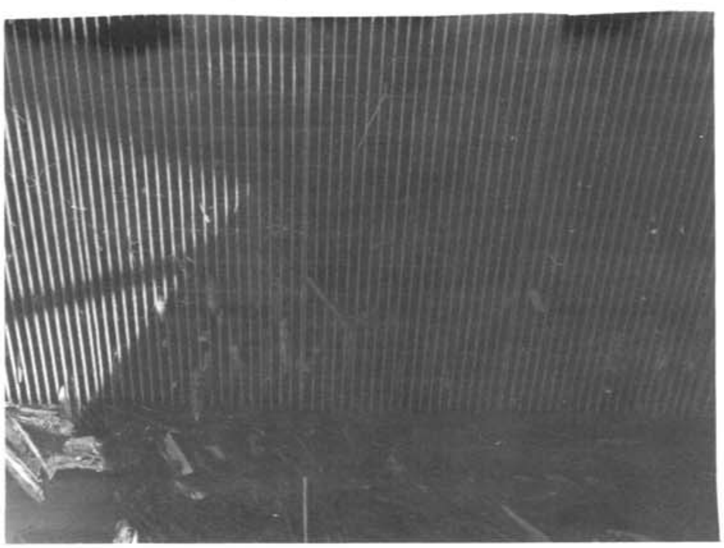
PUMPING PLANT TRASHRACK

A heavy concentration of debris on the trashrack at the Burbank No. 3 Pumping Plant, Columbia Basin Project, Ephrata, Washington, was continually interferring with the flow of water to the pump, causing frequent shutdown at the plant.

In order to eliminate this problem another trashrack as shown in Photograph 1 was constructed approximately 6 feet in front of the original rack.

Photograph 1 - P222-D-64738D



Photograph 2 - P222-D-64739D

Photograph 2 at lower left shows the original trashrack that was built with a 1-7/8-inch spacing on a 1 to 3 slope. The supplemental trashrack with a trash bar spacing of 3 inches, made from 1/2- by 2-1/2-inch steel bars, restricts the larger material to the forebay where it can be removed easily.

The new rack has a much flatter slope which makes it possible to clean both racks at less frequent intervals. This has been made possible because of the heavier driftwood and other large debris being caught by the auxiliary trashrack.

Project field personnel fabricated this new rack and a platform was made from surplus landing mats in which the debris can be piled for removal.

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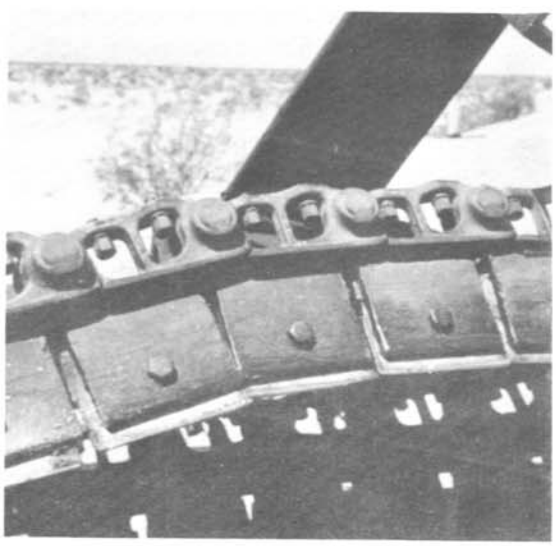
SCRAPER FOR CLEANING CANALS1/

A unique scraper for cleaning sediment and algae from the concrete lining of a canal is used by the Metropolitan Water District of Los Angeles, California. The scraper was developed by the District and consists of an old track from a tractor on which scraper blades have been mounted.

Photograph 1 - P214-D-64736D



Photograph 2 - P214-D-64737D

The scraper blades are about 6 to 8 inches long and are bolted to the tractor tracks, which makes an articulated section. The length is about 6 feet and it is supported on a bar to which it is attached at three points; at both ends and the middle. A sling attached to this bar is then pulled from the crane. Special sheaves at the end of the boom were developed to make this job possible.

Photograph 1 shows the articulated scraper. The frame supports the track at both ends and the center. The sling is attached to the frame. Photograph 2 is a closeup view of the scraper and the hard metal pieces bolted to the track.

Two 25-ton rubber-tire-mounted truck cranes are used continuously to clean the canal linings in the District. The truck cranes drive along the operating roads, which are on both sides of the canal, and drag this particular piece of equipment along the canal lining to remove the sediment and algae.

It takes six passes to clean one reach of canal; two passes for the bottom and two for each of the sides. The passes can be made from either side of the canal.

1/Taken in part from a field trip report by J. K. Shankland, H. E. Pelham, and T. L. Steel of the Office of Chief Engineer, dated June 11, 1969.

HERBICIDE MONITORING STUDY IN IRRIGATION SYSTEMS

Herbicide Residues

A 3-year herbicide monitoring program in cooperation with the Federal Water Pollution Control Administration is in progress by the Bureau of Reclamation to determine the fate of herbicides used on irrigation systems. The program is part of a nationwide study in which the Bureau is participating. Data obtained from the study will be used to support national registration of commonly used herbicides.

Under the Department of Agriculture's compulsory registration program for herbicides used in or near irrigation systems, evidence must be submitted demonstrating that a herbicide can be used to prescribed concentrations without injury to man, wildlife, livestock, or crops before that particular herbicide can be approved. Some herbicides have now been in common use for as long as 20 years with very little documentation having been obtained as to the residues of the herbicides. The purpose of the study is to obtain such documentation.

The Columbia Basin Project in the State of Washington was selected for the field phase of the study because of its broad system of canals, laterals, and drains of various sizes, lengths, and conditions, and the availability of personnel experienced in water monitoring procedures and needs. The program is closely coordinated with the Quincy, East, and South Columbia Basin Irrigation Districts, which actually carry out the weed control operations on the Project.

Technical guidance is provided by the Chief Engineer's Office of the Bureau of Reclamation in Denver, Colorado. The field segment of the work consists of a number of operations required in the program. Some of these include the planning of canal sampling and coordination of it with district personnel making the herbicide application, tracing the movement of water subjected to herbicide application through the use of dyes, collecting water samples periodically at a number of stations along the canal, recording data on all parameters involved, performing the initial steps in the extraction of the herbicide from the irrigation water, and the preparation of samples for shipment to Denver.

The laboratory and data analysis phase of the work are performed in the Research Division, Office of Chief Engineer, as a part of the Bureau's cooperative weed control research program with the Agricultural Research Service of the U.S. Department of Agriculture, Denver, Colorado.

The Study

Since the amine salt of 2,4-dichlorophenoxyacetic acid (2,4-D) is used extensively on irrigation systems of the western states for controlling broad leaved weeds on ditchbanks and it is not registered specifically for use on this type area, top priority is given to this herbicide in the first year of the study. Other herbicides will be monitored as the program develops.

This entire monitoring program follows procedures reviewed and tentatively approved by the Interagency Ad Hoc Committee on Use of Herbicides in Aquatic Sites. The first steps of the analysis are performed in a laboratory on the Columbia Basin Project. Extractions reduce the volume of liquid for shipping from 1 quart to a few ounces and leaves the 2,4-D in a liquid medium resistant to biological activity. On arrival in Denver the samples of extracts are processed and analyzed for 2,4-D content with the gas chromatograph. The data are transferred to punch cards, and an automatic data processing program is used to process these data for future reports and other purposes.

A total of five channels have been sampled. These are selected at random throughout the project to obtain a cross sectional representation of the variability in water conveyance channels and herbicide applicators.

Throughout the sampling program, agronomists will identify and appraise both aquatic and terrestrial vegetation in the sampling areas so that the effect of herbicides at the different sites can be evaluated. Some of the things that are expected to be learned from the study are the extent of dilution of particular herbicides as they move through the irrigation system, the degree of absorption in soils or plant life which takes place, and the amount of loss through evaporation.

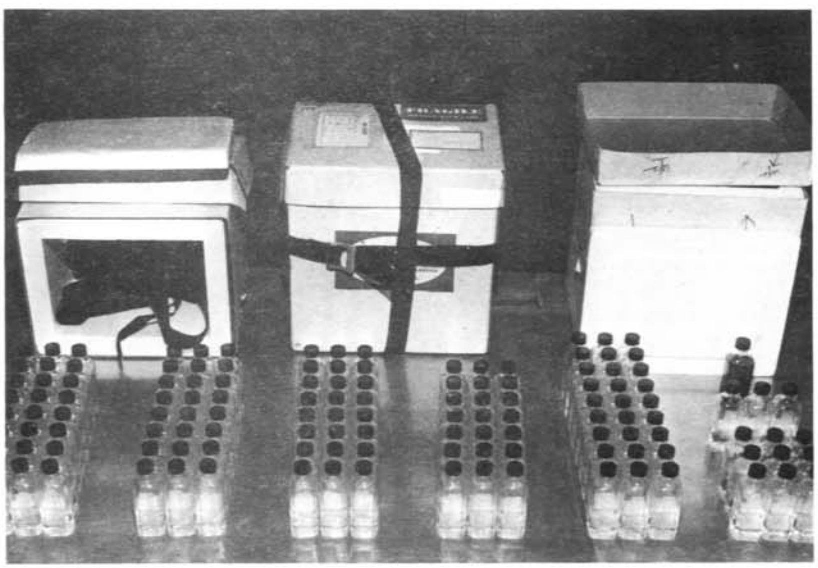
A typical example of collecting a set of three replicated water samples from a canal on the project is illustrated in Photograph 1 at left, and, on the next page, Photograph 2 depicts the manner in which three 1-quart glass bottles are positioned on the sampler so that the three replicates are collected at the same time. Water samples collected are kept under refrigeration until the following day when they are extracted. The extracts are stored under refrigeration in 4-ounce glass bottles fitted with teflon-lined caps until ready for shipping. The bottles

Photograph 1 - P222-D-64735D

Photograph 2 - P222-D-64733D

are packed in sytrofoam containers and shipped to Denver. Samples are in route less than 24 hours by this mode of transportation. On arrival in Denver the samples are unpacked, Photograph 3 below, and stored under refrigeration until the analytical procedures are commenced. The number of samples collected from each canal and included in each shipment may vary from 100 to 150 depending on the number of sampling stations employed which varies with length of the canal.

The analysis of samples from the first two collections are nearly completed but the 2,4-D chromatograms have not been processed. Very low concentrations of 2,4-D are found in most of the samples analyzed.



Photograph 3 - P222-D-64734D

It is planned that this study be continued through 1971. Different herbicides will be monitored during this period. Herbicides selected for future study will be based on the need for this type of information to support their continued use.

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