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OPERATION AND MAINTENANCE EQUIPMENT AND PROCEDURES

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INTRODUCTION

Like a radio commentator, we often wonder who may be getting some benefit from our efforts. Consequently, it was most gratifying to receive a letter stating:

> "We have intended for some time to report to you upon the ready acceptance and usefulness of this publication. When operating problems are under discussion, it is a rather common occurrence to overhear a remark, 'I remember seeing a picture of a gadget they use at ..... in the O&M book.' The publication has gradually acquired a kind of 'Popular Mechanics' standing with Operation and Maintenance personnel."

The remarks are appreciated and it is hoped we can continue to publish material of interest to all concerned. Credit, however, for the success of the Bulletin is yours. We are publishing material submitted by O&M people for O&M people.

A really worthwhile suggestion has been made and we are sorry we haven't followed such a plan in the past. Name credit will be given for articles released in the Bulletin to stimulate the contribution of ideas of benefit to the Bureau and other Water Users. Many of the ideas submitted have previously been recognized under the Incentive Awards Program which parallels our purpose of pooling Bureau ideas for common use to reduce Government costs. In the future, name credit will be given and the added suggestion, that the contributor be given a copy of the Bulletin, will be followed.

It should be noted that the last three articles in this issue have particular reference to Weed Control. These articles have been paged and identified so that they may be incorporated with Release No. 3.

The O&M Equipment and Procedures Bulletin is circulated for the benefit of irrigation project operation and maintenance people. Its principal purpose is to serve as a medium of exchange of operating and maintenance information. Reference to a trade name does not constitute an endorsement of a particular product and omission of any commercially available item does not imply discrimination against any manufacturer. It is hoped that labor saving devices or less costly equipment developed by the resourceful water users will be a step toward commercial development of equipment for use on irrigation projects in continued effort to reduce costs and increase operating efficiency.

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PROTECTION OF CONCRETE AGAINST WEATHERING

Experience has shown that there are certain portions of exposed concrete structures which are more vulnerable than others to deterioration from weathering in freezing climates. These are the exposed surfaces of the top 2 feet of walls, piers, posts, handrails, and parapets; all of curbs, sills, ledges, copings, cornices and corners; and surfaces which will be in contact with water or spray at frequently changing levels during freezing weather. The durability of such concrete features can be considerably improved and their serviceability greatly prolonged by preventive maintenance in the form of the weatherproofing treatment discussed in the Concrete Manual published by the Bureau of Reclamation and hereinafter described. This treatment has been adapted from that used by the Oregon State Highway Department.

Except for hand-placed mortar restorations of deteriorated concrete, this weatherproofing treatment is ordinarily not applied on new concrete construction. It is most advantageously used on older surfaces when the earliest visible evidence of susceptibility to weathering appears. That is, before deterioration advances to a stage where it cannot be arrested by the treatment. Such early evidence consists primarily of fine surface cracking close and parallel to edges and corners. Sometimes the need for protection is indicated by pattern cracking. By treatment of these vulnerable surfaces in the early stage of weathering, later repairs may be avoided, or at least postponed for a long time.

Preparation of surfaces: After completion of the curing period, a repair should be allowed 1 or 2 weeks to dry before the waterproofing treatment is applied. New mortar and concrete patches should be given a neutralizing wash to prevent saponification of the linseed oil used in the waterproofing treatment. A solution of 0.25 of a pound of phosphoric acid and 0.17 of a pound of zinc chloride to a gallon of water is brushed over the surface and allowed to dry 48 hours. This application is not necessary on old concrete. Rinsing or brushing after the neutralizing wash has dried is unnecessary. Before applying the waterproofing, the repair must be clean and dry. Dust and loose material should be brushed off. Efflorescence may be removed by scrubbing with a 10-percent solution of hydrochloric acid.

Treatment of surfaces: After the surface is clean and dry, two coats of linseed oil are applied. The first coat consists of a mixture of 50 percent raw linseed oil and 50 percent turpentine, heated to a temperature of 175° F. and applied with an ordinary paint brush. Better results are obtained if the atmospheric temperature is above 65° F. For this reason the work should be done during warm weather. After the first coat has set 24 hours, spots will be evident where the concrete is more porous than the remaining surface. Such areas should be spot-treated with the hot mixture and allowed to set 24 hours before the second coat is applied. The second coat consists of undiluted raw linseed oil heated to 175° F. and applied in the same manner as the first.

If there are open cracks in the surface being repaired, a more effective waterproofing may be obtained by filling the cracks prior to applying the second coat of hot oil. A standard mineral paste wood filler, thinned as necessary to secure the desired penetration, may be used for this purpose.

After the second waterproofing coat is thoroughly dry, the entire treated surface should be given two coats of any standard outside white lead and oil paint. Without the protection of this pigmented paint, the oil treatment is subject to rapid deterioration, and its potential value will be seriously impaired. A color resembling concrete can be obtained, if desired, in the paint coats, by addition of lampblack and raw sienna ground in oil The Oregon standard white paint formula is as follows:

Paint composition:	Percent
Pigment, not less than	70
Vehicle, not more than	30

Pigment composition:

White lead carbonate	40-45
Titanium barium pigment	35-40
Zinc oxide.	15-20
Tinting pigment, if required	0-5

The first coat should be thinned by the addition of 2 quarts of turpentine and 2 quarts of boiled linseed oil to the gallon of the above formula. The second coat should be thinned with about 1 quart of boiled linseed oil to the gallon of paint so that it will not produce a heavy pigment coat susceptible to scaling but will be heavy enough to brush out uniformly and evenly.

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A BLENDED EARTH CANAL LINING

In his Monthly Progress Report for May, 1954, the Assistant Commissioner and Chief Engineer for the Bureau of Reclamation discusses this subject in which permeable materials encountered during canal excavation have been blended with a minimum of impermeable soil in providing a heavy compacted earth canal lining.

During excavation of the Eltopia Branch Canal, Washington, considerable reaches of coarse, clean, gravelly soils were encountered in the subgrade. These soils would obviously result in excessive seepage in an unlined canal, thus lining was deemed necessary.

Several types of lining were considered, including the use of heavy compacted earth constructed of materials found along the canal alinement. It was finally decided that a heavy compacted, impervious earth lining could be constructed by blending available gravelly soils with selected fines. For this scheme, carefully selected, fine-grained soils are to be obtained from borrow pits some distance away and hauled to the site. They will then be mixed with the in-place gravel in a sufficient quantity, but kept to a minimum for economy, to result in an impervious lining. It was necessary to test various proposed mixtures in the laboratory to determine the proper proportions of gravel and fine-grained soils.

Typical subgrade gravels from three locations and the proposed fine soil were received in the laboratory for testing. From the initial examinations and index tests, it appeared that probably a mixture of 50 percent fines and 50 percent gravel would provide the necessary impermeability. However, as testing progressed, it became obvious that the percentage of fines could be reduced. Tests were continued at progressively "leaner" mixtures until it was found that a 20-80 mixture would satisfy requirements. It was finally recommended that a 30-70 mixture be used to allow some leeway for variations in material and mixing in the field.

In commenting on this procedure, which is well adapted to fine sand and silt materials, gravel, necessarily placed on the slopes to protect them from erosion and to increase stability, is blended into the material and compacted as the lining is placed and a gravel protective blanket is not needed. The gravel also provides a greater density and increases the stability of the banks. Costs of $1.45 per square yard are reported on rather scattered work.

Laboratories can be of help in indicating the desirable mixtures, controls, and suggesting control during construction.

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HEAVY COMPACTED EARTH LININGS

In his resume on accomplishments of the Lower-Cost Canal Lining Program during Fiscal Year 1954, Mr. I. B. Hosig, Chairman of Committee, states recent experience indicates that, if suitable materials are available, heavy, compacted earth linings are the most satisfactory. In large canals with suitable materials, heavy, compacted earth lining is the lowest in first cost and probably in annual cost over a long time period. For small canals and laterals, costs are high because of the proportionately large volume of earthwork per square foot of water area.

During the past year, a method of lining small canals and laterals was developed on the Riverton Project by Government forces. At a cost of 57 cents per square yard of the wetted perimeter of a small canal, a section was lined with compacted earth. Construction consisted of overexcavating the canal to a V-shape with 4:1 side slopes and to a depth of 12 inches below the regular section at the critical points (the toes of the inside slopes). The slopes after excavation were then leveled and compacted. Two 6-inch layers of soil were then placed and compacted. The 6-inch layer of compacted, natural earth and the lower 6-inch layer of placed material form the impermeable layer. This work was done with motor patrols and sheep-foot rollers travelling parallel to the canal center line.

After compaction was completed, the normal canal section was constructed with ordinary equipment and without compaction. The result is not only a compacted earth lining of small total yardage produced by quality production procedures, but also an ordinary earth canal section which can cut or fill within reason and be maintained with ordinary equipment without appreciable danger of injury to the buried lining.

* * * *

RODENT CONTROL

Zinc phosphide is used on carrots as bait in the control of rodents by the Yuma County Water Users' Association, Arizona. The carrots must be at least an inch in diameter, peeled and cut in sections about two inches long. The zinc phosphide is sprinkled over the carrots in a bucket and then mixed thoroughly so that the carrots get a full covering of the poison. The cubes of carrots are placed in gopher runways and not in laterals made by workings of the gopher. By placing the carrots in runways, a gopher must remove the carrot to pass through. A very small amount of poison is required to kill these rodents, and in biting into the carrot to remove it, the gopher is poisoned.

After an area has been treated in this manner, it is necessary to go over it each year to pick up the few gophers that are left, as well as those that migrate from an unpoisoned area. The estimated kill has been about 90 percent. The 10 percent left increase rapidly, therefore it is advisable to either trap or repoison each year.

The work described is under the supervision of the United States Department of Agriculture, Fish and Wildlife Service, Phoenix, Arizona.

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BUMPER BRACKET HOLDS FLOOD LIGHT

When lights are needed during emergencies, there is no time to improvise holders for lights. By welding a bracket on a vehicle bumper for use in mounting a portable floodlight, Mr. James A. McDonald of the Fresno Office, Central Valley Project, has made available an efficient means of lighting at any location. Mounting in such a manner eliminates the necessity for carrying tripods and other types of standards for mounting of floodlights. His idea has proven its usefulness in the case of a drowning in the Friant-Kern Canal, and he has received an award under the Incentive Awards Program for his idea.

Construction Details:

Details of construction may be obtained from the Regional Director, Bureau of Reclamation, Sacramento, California.

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DANGER - STAY ALIVE BY STAYING OUT

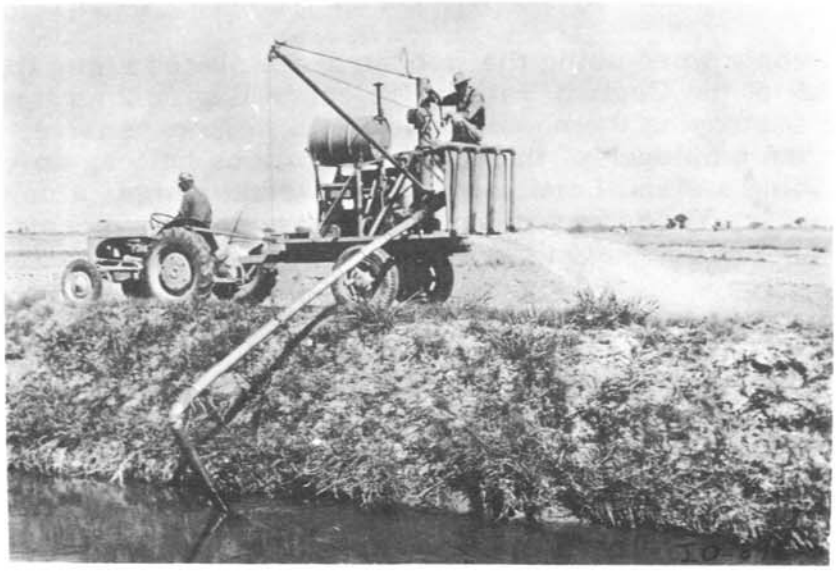
People were using the wooden signs placed along the Contra-Costa Canal of the Central Valley Project in Region 2 as targets or otherwise destroying them. Replacements were expensive. Mr. Harry F. Yoder, an employee of the Tracy Operations Office, solved the problem by making a stencil and painting the warning signs along the sides of the canal. Mr. Yoder was given an award under the Incentive Awards Program for his suggested solution.

* * * *

SPRINKLER DEVICE FOR SERVICE ROADS

Dust control and maintenance of project roads along the canal banks have always been serious problems. During the past few years maintenance personnel of the Yuma Project, Arizona, have developed a very simple but effective method of taking care of both problems. The benefits, resulting from the use of this device, accrue not only to the project maintenance forces but to many of the water users who are required to use portions of the maintenance roads.

The sprinkler device, as shown being towed by a small tractor, uses a small pump mounted on a trailer to pull water from the canal and spray the roadway. The use of this device, coupled with regular patrol grading, maintains the service roads in very good condition. Further details of construction may be obtained from the Regional Director, Bureau of Reclamation, Boulder City, Nevada.



SODIUM-FILLED VALVES ARE HAZARDOUS

The Bureau of Yards and Docks, Department of the Navy, issues a warning against efforts to reclaim as salvage sodium-filled engine exhaust valves once they are removed from diesels or other types of combustion engines.

Although precautions have already been cited by manufacturers, widely circulated in trade journals, both BuDocks Safety Engineer and YDSO at Port Hueneme believe it necessary to repeat the warning with advice on proper methods for disposing of the valves once they are removed from an engine.

All service personnel and mechanics likely to encounter sodium-filled valves should be told proper methods of disposal. For instance, it should be explained that a sodium-filled valve MUST NOT BE CUT, BROKEN OPEN OR THROWN ON A SCRAP PILE. Sodium burns spontaneously at very high temperature upon contact with water or moisture-laden air, therefore, there is immediate danger of explosion or severe body burns if a valve is cut or broken. There are two recommended ways to dispose of them:

1. Toss them into deep water where they cannot be recovered, or

2. Bury them deep in the earth (at least 30 inches) in an authorized area not likely to be excavated.

One manufacturer, the Caterpillar Tractor Co., has advised the Bureau of Yards and Docks that sodium-filled exhaust valves are now used in all D337 diesel engines and in all DW20 and DW21 tractor engines now leaving the factory. Some earlier Caterpillar engines have had 3H4872 and 3H5554 sodium-filled valves installed in the field. These valves may be identified by the Part Number 3H4872 or 3H5554 and/or the letters "SOD" stamped on the valve head or near the top of the stem.

This article reprinted from BUDOCKS TECHNICAL DIGEST No. 41, issue of January 1954, page 9.

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WEED CONTROL EQUIPMENT

The articles on the following pages are prepared for removal from this issue of the Bulletin and incorporation with similar articles in Release No. 3 which was devoted exclusively to weed control equipment.

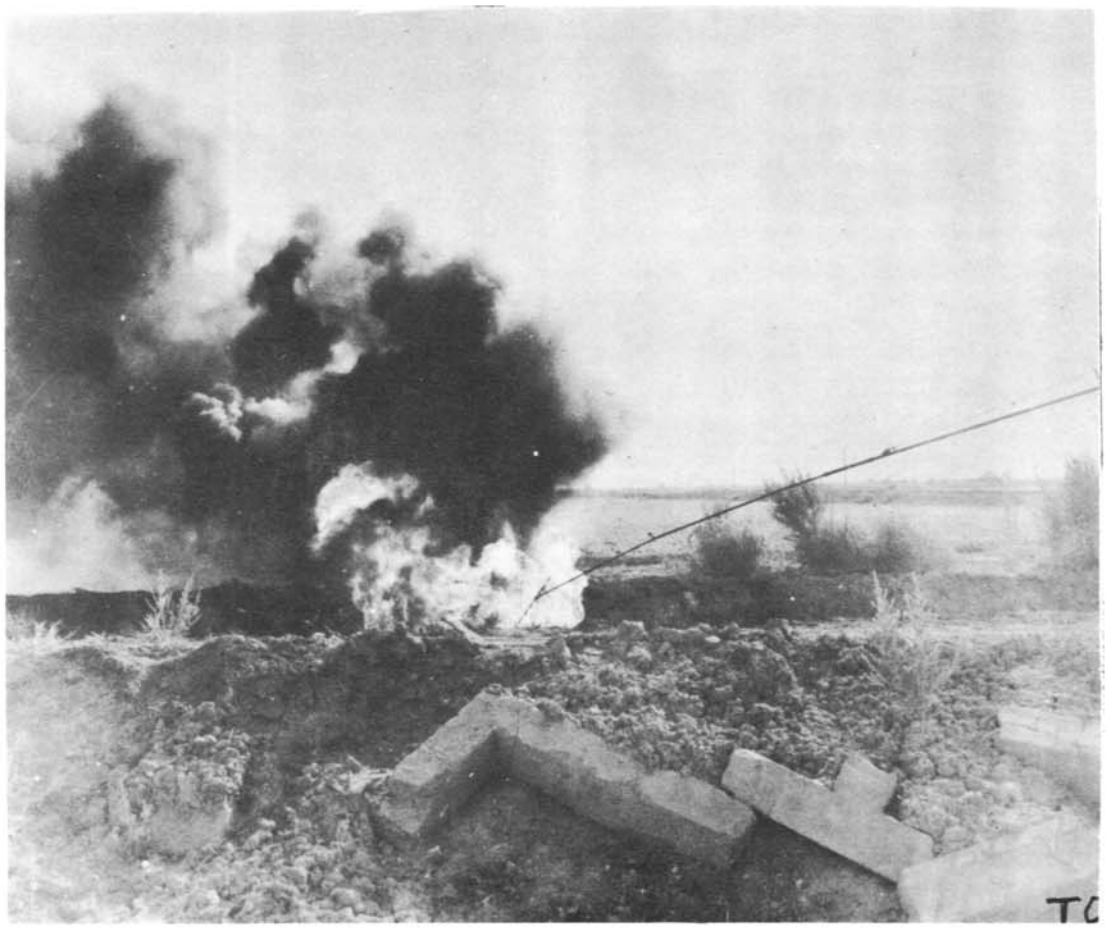
WEED BURNER

In November, 1953, an experiment was started with a new type burner by the Yuma County Water Users' Association, Arizona. The old type burner used oil excessively and a large percent went up in smoke (see picture on next page), due to improper combustion. The new type burner, using about 100 gallons of burner oil compared to 300 gallons per hour for the old burner, has a hotter blaze and very little smoke. The new burner, photograph above, uses a mixture of oil and air; the air being furnished by a compressor with a capacity of 105 cubic feet per minute and mounted on the truck.

Construction Details:

The new burner head is disc shaped, consisting of three plates, each separated by a .001 inch "U" shaped shim at the end attached to the boom. The purpose of the shim is to form two open end chambers within the single burner head. Oil is introduced into one chamber at six to eight pounds pressure, and air, at sixty pounds pressure, is

introduced into the other chamber. The oil and air upon leaving the chambers are mixed, creating an extremely combustible mixture. Additional information regarding this weed burner may be obtained directly from John C. Smith, Jr., Yuma County Water Users' Association, Yuma, Arizona, or the Regional Director, Bureau of Reclamation, Boulder City, Nevada.



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MOSS SCREENS

In June, 1951, moss infestation in the Coachella Canal, All-American Canal System, became so bad that almost the entire system was plugged. Some method had to be developed for the removal of the moss, and, through consultation and planning between Bureau personnel and a representative of the Coachella Valley Water District, arrangement was made for the construction of a movable type screen by an equipment company.

The first screens were placed in operation in 1952 and well demonstrated the ability to remove moss during chaining operations. Use of a finer mesh screen was investigated to remove the tule skins but this experiment increased the head loss to an unsatisfactory degree. Some mechanical modification of the first screens was incorporated in the next two screens constructed.

The lack of electric power at the site of operations made the use of air-cooled gasoline engines necessary. This method of motivation was a constant source of operating difficulty throughout the period of use. It was also observed that the side of the conveyor screen was being chewed-up along the edges by the angle iron guide rail.

Further mechanical refinements have since been made and the District forces have installed additional units on which the conveyor screens have a width of 4 feet. The narrower conveyor has proven more satisfactory since the screen has less tendency to creep or to run crooked on the rolls, and they are now serving effectively in preventing debris from entering the underground system.

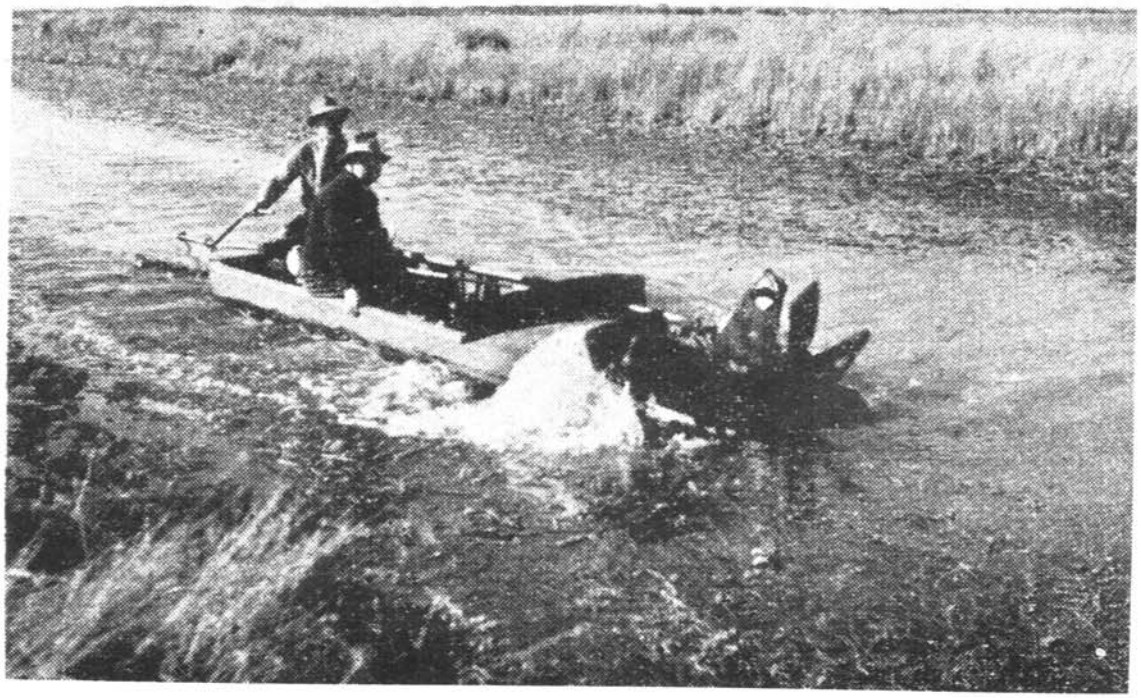
Construction Details:

Information for construction of the moss screens may be obtained from the Regional Director, Boulder City, Nevada or the Construction Engineer, Coachella, California.

(IIB7-1)

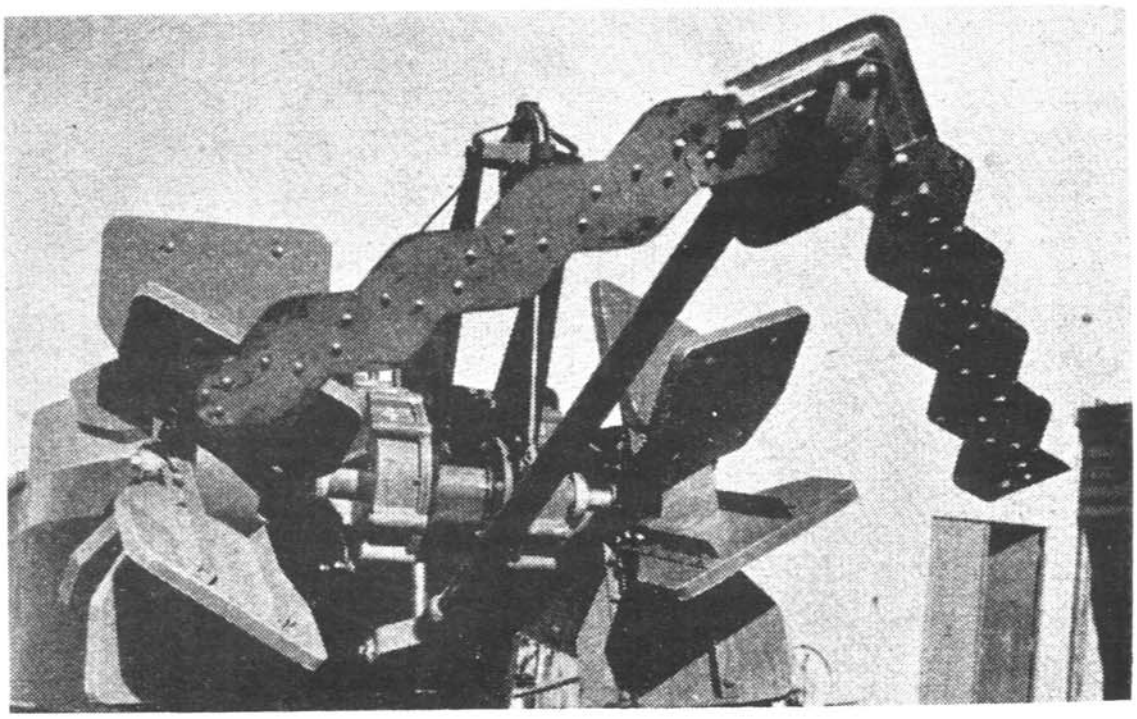
WEED CUTTING LAUNCHES

Extensive use has been made overseas of power-driven launches, equipped with cutting blades, for clearing weeds from irrigation, drainage and water supply channels. Following the recent inspection of land drainage projects in Britain and the Continent by Mr. L. R. East, chairman, State Rivers and Water Supply Commission, Victoria, when weed cutting launches were seen in operation, two launches were purchased by the Commission and their construction and operation described in an article appearing in Commonwealth Engineer, March 1, 1954. A condensation of the original article is presented herein.



Results achieved through the use of the weed cutting launches so far are quite satisfactory. The final cut is much cleaner than is obtained when using hooks or saws, and as it is made at silt level, it is considered that occasional cuts would then effectively kill the cumbungi. Fresh cumbungi shoots can be cut easily. Cat-tail and ribbon-weed offer only the slightest resistance. Actual operation costs have not yet

been worked out in detail, but it is expected that cost of weed cutting will be much less by means of this type of launch than is the case with other cutting methods. The type of weed cutting launch in use in the Kerang district is considered the most efficient mechanical means for maintaining long stretches of reasonably large waterways. In time, it is expected that launches of similar type will supersede hand clearing entirely, except for very small patches or channels with many structures close together.



Construction Details:

The small launch, type W. D., is constructed for narrow waterways; it consists of a shallow draught flat-bottomed hull with an over-all length of 17 feet, a hull width of 3 feet 6 inches and a net weight of 14 cwt. It is powered by a 4-1/2-horsepower J. A. P. engine and propelled by paddle wheels. Cutting speed is up to 3 m. p. h., according to conditions. Cutting blades consist of a number of small tempered steel sections riveted on to spring steel backs, mounted in the form of a "V" on the end of a hinged arm. The arm is controlled for depth of cut, and angle of the

blade is adjustable to suit operating needs. The cutter arm is lowered by means of a small hand winch and the cutters automatically follow the contour of the bed, the arm being hinged at its inner end. In operation the clutch driving the cutting mechanism is engaged; this causes the arm with cutting blades attached to oscillate rapidly, thus producing a positive cutting action. The launch is controlled by one man, the operating cost compares more than favorably with the cost of other weed-cutting methods now in use.

A larger launch now in use has an over-all length, including paddle gear, of 21 feet 3 inches, a hull length of 17 feet 3 inches, width 4 feet, and depth 1 foot 11 inches. It has a draught of approximately 11-1/2 inches and net weight of approximately 1-1/4 tons. Width of cut is 8 feet and depth 7 feet. Cutting speed is up to 3 m.p.h., according to conditions. There are two operating speeds--first gear for cutting and second gear for travelling without cutting. The engine is a water-cooled 10-horsepower motor which drives both the propulsion gear and the cutting mechanism. Water enters a water tank through screened holes in the side of the hull; it then passes through a cock into another tank, where it is filtered and pumped to the engine. Both screen and filter can be removed for cleaning. Propulsion gear is of the paddle wheel type, fitted at the stern of the launch. The whole gear is hinged radially, enabling it to act as a rudder, thus enabling reasonably good control of the launch. There are two double, fluted edged cutting blades, each 7 feet 3 inches long, similar to those of the smaller launch. Cutting edges consist of a number of small tempered steel segments riveted to a 7-foot 3-inch by 2-inch by 1/4-inch plate of spring steel, in the annealed condition, reinforced with a shorter plate at the butt end. These blades are mounted in the form of a "V" either in the forward or reverse direction on the end of an arm hinged at its inner end. The cutting unit is controlled for depth of cut and is given a rapid oscillating motion which effectively cuts all weeds in its path. Angle of the blades is adjustable to suit the average depth at which they are operating, and they are at all times rigidly supported so that they can be maintained in a horizontal position at any depth. While they can be lowered right on to the bed of the waterway, their weight can be sustained so that they do not sink too deeply into loose silt and therefore give too great a resistance.

Several devices are incorporated in the design of the machinery to safeguard the machinery. They are:

1. Blades are made of annealed spring steel which will bend if an obstruction is fouled.

2. Drive to the blades is through a cone clutch which is engaged sufficiently only to cut the weed growth. The clutch slips if the blades strike a solid obstruction.

3. Drive to the paddle wheels is through a spring loaded clutch, which will slip if the paddles strike an obstruction.

Operation and Maintenance:

Operation of the launch depends upon the nature of the weed and the condition of the channel. Submerged water weeds such as cattail and ribbon-weed offer no impediment to the launch's progress. At the other extreme, dry old cumbungi offers considerable resistance. In the former case, the launch can be driven without pause along the channel with blades trailing on the bed behind, making an 8-foot wide cut each sweep. In the latter case, a cut is first made along the edge of the cumbungi with blades trailing. This removes the fringe growth. The tall thick cumbungi is then attacked with the blades leading and lowered about one foot below water level. If the growth is in deep water and not too dense, it may be possible to force the launch through, making an 8-foot wide cut--otherwise it is possible only to make repeated cuts along the edge of the growth. This permits the launch to pass over the cumbungi to allow the final cut to be made with the blades trailing on the channel bed. This severs the stalks at silt level. A method of removing the cut cumbungi from the face of the cumbungi beds when the current is not strong enough to do so has been developed. The launch, after making its first cut, raises the cut weed on the blades and reverses out to dump in midstream. To deal with the large accumulation of cut weed inevitable with such rapid cutting, trials of a weed trap used in the United States of America to collect the cut weed and a hay-stacking grap to remove the weed, are being made.

At present two men operate the launch. The operator in charge has an assistant to control the cutting mechanism. Once the thick old growths of cumbungi have been removed from the channel, maintenance could probably be performed by one man, but two men would always be necessary in natural waterways where snags are prevalent or in channels with a thick growth of cumbungi.

GPO 843-417