Department of the Interior

Bureau of Reclamation

OPERATION AND MAINTENANCE EQUIPMENT AND PROCEDURES

RELEASE NO. 8

April, May and June 1954

CONTENTS

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Releases No. 3, 8, 16, and 37 were on the subject of Weed Control Equipment and have been superceded by Release No. 97, "Equipment For The Prevention, Control, and Disposal Of Weeds On Irrigation Projects."

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C O N T E N T S

(The contents of these pages supersede and supplement page "i" of Operation and Maintenance Equipment and Procedures Release No. 3, but do not remove the "Introduction" shown on page 1 of that release. Pages marked with an asterisk (*) will be found in Release No. 3 and are not included with this release.)

PREVENTIVE WEED CONTROL:

MISCELLANEOUS ITEMS RELATING TO WEED CONTROL:

INTRODUCTION

This release of the Operation and Maintenance Equipment and Procedures Bulletin, like Release No. 3, issued March-April 1953, is being devoted exclusively to the description and illustration of "shop-built" equipment for combating undesirable weeds on irrigation systems and irrigation project lands, and information pertinent to the equipment and materials used.

In Release No. 3, of the Bulletin, the intention to print and distribute additional information on weed control equipment was mentioned. Accordingly, the earlier issue of the Bulletin was punched for binding in a standard 3-ring binder and divided by subject matter into sections, with the pages numbered correspondingly. This issue is being prepared in the same manner for your convenience in incorporating the material from this present release with that in Release No. 3. You will also note that a new index has been provided.

Our thanks to the many contributors of information for this and other releases of the Bulletin. In many instances, it has not been possible to give credit for the design and construction of equipment to an individual. Photographs, except as noted, have been taken by Bureau of Reclamation photographers.

As in previous Bulletins, reference to a trade name does not constitute an endorsement of that product, and omission of any particular commercially available item does not imply discrimination against any manufacturer. Frequently, mention is made of specific articles which are used as integral parts of the equipment. When necessary to express a point or to indicate which parts have been used in a particular instance, the name of the manufacturer has been given. Undoubtedly, other products would serve as efficiently as those which have been designated. It is hoped that labor saving or less costly equipment developed by the resourceful water users and Bureau personnel will be a step toward commercial development of equipment for use on irrigation projects in continued effort to reduce costs and increase operating efficiency.

The interest shown in weed control information has resulted in a much larger required distribution of Bulletins devoted to this subject than that of the regular issues of the Bulletin. For this reason, some information that has appeared in previous Bulletins is being repeated herein.

For the benefit of those that did not receive the earlier release on weed control, a few copies are available. If you are interested in receiving the earlier release or additional information that may be published on the subject, please fill in the blank on the next page and forward it to the nearest Bureau of Reclamation office. These offices are 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, Code 400.

Please add my name to your mailing list to receive additional information which may be published regarding equipment used for controlling weeds on irrigation systems:

Name_____

Organization_____

Address_____

_____

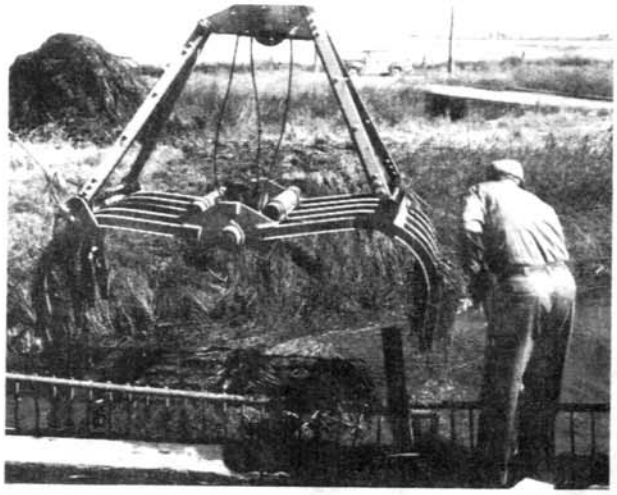
( ) Forward future releases on Weed Control. ( ) Forward Release No. 3

TUCUMCARI SPRAY BOOM

The above spray boom is being developed on the Tucumcari project, Tucumcari, New Mexico. Designed primarily to patrol small laterals, a cable adjustment tilts the spray bar for operation against either the inner or outer bank slopes.

Construction Details:

A lever adjustment raises or lowers the boom and it swings either front or back against the truck in order to pass obstructions. Mounted on a Dodge Power Wagon, which carries a tank and pump, this equipment can travel almost anywhere and is calibrated to deliver 100 gallons of spray per mile of travel. While more than one man is shown in the photograph, the equipment is being perfected for one-man operation.



MOSS FORK AND TRAPS

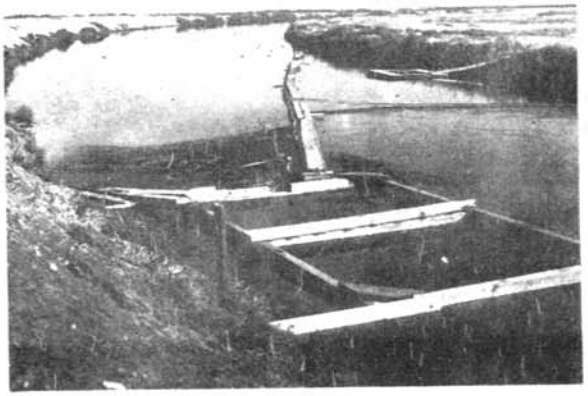
An extensive system of open drains which is essential to the reclamation of 190,000 acres of irrigated land of the Klamath project totals over 500 miles in length, and is moss and weed infested more than usual because of the large amount of water carried and the flat gradients and slow current. Nearly all the drain discharges are evacuated by pumps of various sizes--over 30 in number. Keeping the drains open is a major problem. Several methods of control are in general use--aromatic solvents, chaining, and dredging. The removal of the dislodged moss and weeds that have floated downstream to the pumps or to culverts and siphons has in past years been done to quite an extent by hand labor at a relatively high cost. The savings, therefore, due to the use of the device and system here described has been very gratifying and believed worth the consideration by other projects with like problems.

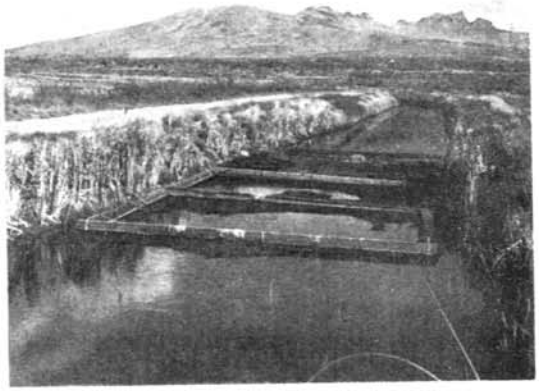
Construction Details:

In an attempt to reduce the manpower used in this work, the Tule Lake Division of the Klamath project purchased a crane-operated Blaw-Knox sugarcane grapple or fork. This fork was modified by adding two prongs and a heavy weight to each jaw. The weights were needed to give faster and more positive action in opening and closing. This fork was operated by a truck crane, giving it the required mobility to move around to various ditches as required.

Following the adaptation and successful use of the "moss fork," as it is locally termed, it became evident that a better method of ponding the moss for the truck crane would be needed than to let it pile up at structures. Floating booms, mesh fencing, trash racks patterned after pumping plant grates, and other methods and devices were tried out. The

most successful method, termed a "moss trap," consists of two 30-foot power or telephone poles or large timbers placed parallel to each other and three 4 by 12-inch timbers bolted crosswise, one at each end and the third in the middle, thus forming two stilling ponds. The length of the 4 by 12-inch cross timbers depends on the width of the ditch. These traps are placed in the ditch at points readily accessible to the truck crane and are held in place by cables.



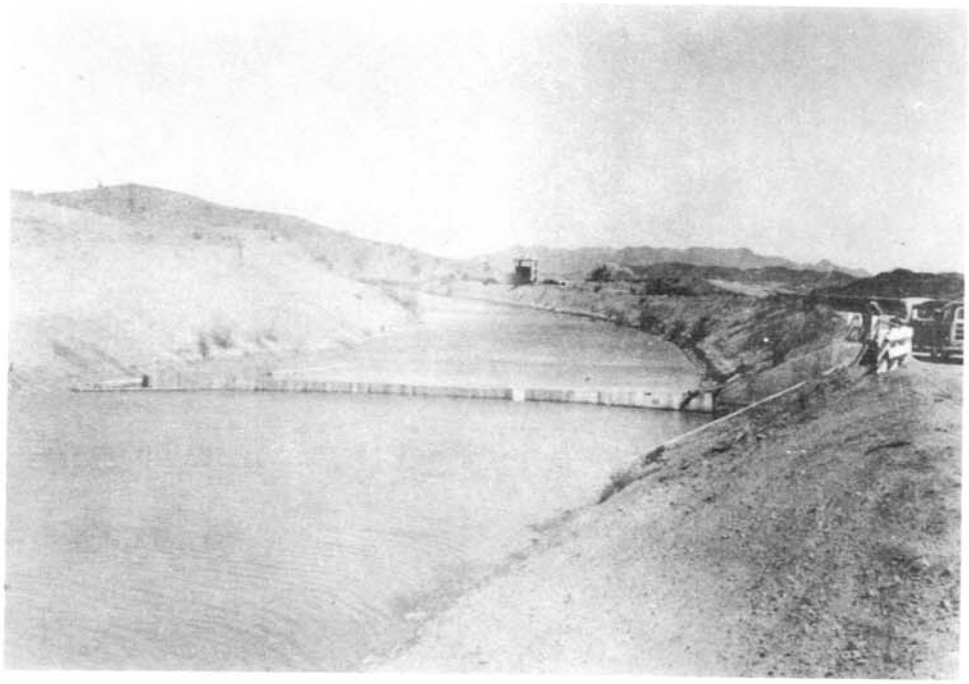


As the moss and weeds are torn loose by chaining and float downstream, they lodge against the upstream cross timber of the trap. Some of the floating material is forced under and lodges against the middle cross timber. Very little moss is found in the second stilling pond of the trap. The blanket of moss lodged against the trap has been a quarter of a mile long without seriously impeding the flow of water. When sufficient moss has been ponded, the truck crane removes it with the moss fork. These traps are left in place throughout the year.

Annual savings to the project from the use of the moss fork and moss traps have been estimated to be about 10,000 man-hours of unskilled labor; only two men, crane operator and oiler, being required for the truck crane. The original cost of the moss fork purchased in 1950 was $653. The estimated cost for construction of each moss trap was $140. Twelve of these traps were placed in operation in 1952, each one more than paying for itself in savings of man power during the first irrigation season.

condensed

This material is a/reprint of an article by E. C. Cakin, Agriculturist, Klamath Project, as published in the June, 1953, issue of Reclamation Era.

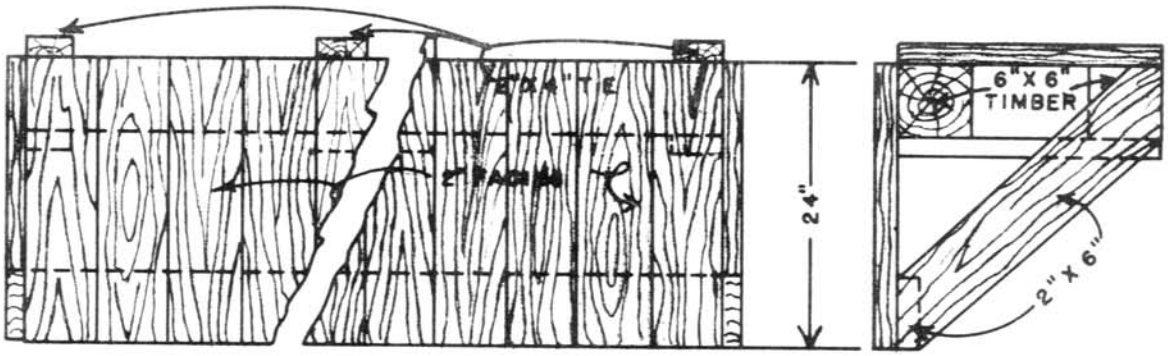


A BOOM IS USED TO DEFLECT WEEDS INTO A WASTEWAY

As shown in the above photograph, a simple floating boom has been installed across the Gila Canal at the wasteway immediately upstream from the Gila River Siphon to deflect weeds and debris into the wasteway during chaining operations.

Construction Details:

Short vertical boards on the upstream face of the boom, as shown in the sketch below, extend below the water surface a nominal distance to prevent floating material from being drawn under the boom. Logs may be substituted for the horizontal members of the boom and the length of the boom varied to fit the given canal or lateral. Although not designed as a platform from which to operate, the boom could be made so by providing a decking.



OFF-SEASON PROTECTION OF UNDERGROUND WORKS

Weed racks placed at the ends of siphon structures prevent the entrance of trash, tumbleweeds, and animals during the nonoperating season on the Cambridge Canal of the Frenchman-Cambridge Unit of the Missouri River Basin project in Nebraska. The lightweight racks, similar to the ones shown in the photograph above, are placed in the fall after the irrigation season and removed the following spring before water is again placed in the canal system.

Construction Details:

The lightweight racks consist of pipe, steel rail or wooden frames, to which a wire mesh is attached. They have been very effective and are believed to have reduced O&M costs materially.

COPPER SULPHATE TREATMENT

FOR ALGAE — MADERA CANAL

Unretarded growth of algae in lined canals can materially affect their carrying capacities. This is especially true during the hot summer months when the demand for water is the greatest and any interruption in service may mean costly crop losses. The problem of algae growth in the Madera Canal is, no doubt, typical of conditions in many other canal systems.

This canal is 36 miles long and has an initial capacity of 1,000 cubic feet per second. Only the first 7.7 miles is lined, and it is this lined section which is appreciably affected by algae growth. In past years (this part of the canal was placed in operation in 1945), before an effective schedule of treatment had been worked out, the capacity between treatments was occasionally reduced by as much as 29 percent. It has been determined that the most prevalent algae form present was "Ulothrix."

Method of Treatment:

Early methods of treatment consisted of suspending "nut" size copper sulphate, in burlap bags, in the canal as near the outlet valves of Friant Dam as possible. These treatments, at seven to ten day intervals, were frequently insufficient to restore the full capacity of the canal; and another treatment was required within two or three days. When the algae growth was far advanced, and the required dosage was in doubt, as many as 13 or 14 treatments were made each water season (usually 6 to 8 months long). Later experience, together with aid from the Bureau of Reclamation's laboratory in Denver, Colorado, established that two pounds of copper sulphate to each second foot of flow provided an optimum rate of application. Lesser amounts frequently proved insufficient, and the treatment had to be repeated. Heavier applications appeared unnecessary.

Other methods tried included: placing copper sulphate in solution before applying, the use of chlorinated lime, and the application of Rosin Amine D. Acetate with a weed spray rig. Satisfactory control was achieved with these various chemicals but all required considerable time and labor to get these materials in solution.

The present method of application is to "slug" the canal with fine crystals of copper sulphate, dumped directly into the stilling basin at the head of the canal. The fine crystals dissolve rapidly and the turbulent action in the stilling basin assures satisfactory diffusion throughout the entire cross-section. The material is dumped at as uniform a rate as possible over a 15 minute period. Allowing an additional 5 minutes for total dissolution, the entire treatment covers a 20 minute period. Using 2 pounds per second

foot, a concentration of 26.6 PPM for 20 minutes is achieved. This concentration usually results in restoring practically the full capacity of the canal within 24 hours. A treatment usually clears the entire lined section. However, in some systems it might be necessary to add additional material at 4 to 6 mile intervals to secure the best results. The chemical is purchased in 20 and 100 pound bags to facilitate closer measurement of the material. The fine crystals dissolve faster than the "nut" or coarse grade, and are less irritating to skin and eyes of the operator than the powdered grade. In all, the fine crystals proved most satisfactory from all angles.

Only one man and a pick-up truck are required for the operation.

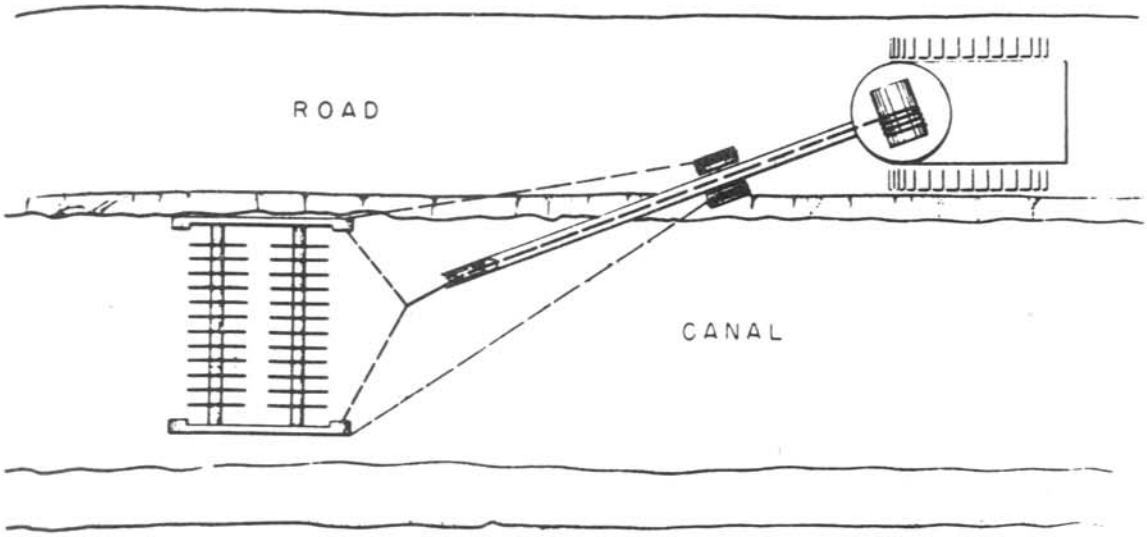
Each of the material bags is opened before the actual application begins, assuring no lost time or irregularity in the rate of application. This method has proven entirely satisfactory and the most economical of all methods tried.

A schedule of the optimum time between treatments has been worked out, based upon curves expressing the relationship between the discharge through the needle valves, discharging into the canal, and a gaging station located about a mile downstream from the Dam. These curves are kept on a daily basis. When the recorder at the gaging station shows a 4 to 6% rise in the apparent canal flow, and the valve discharge has not been increased, a treatment is scheduled. Likewise a daily climb of 2% at the recorder (no increase having been made at the valves) usually indicates an application of copper sulphate is needed.

Treatments have been required most frequently during the warmer summer months. Over the past three years, four or five applications have sufficed for the months of June, July and August, with two or three others spread over the spring and fall months.

Concentrations up to 35 PPM have not killed fish in the canal. However, higher concentrations have been known to do so on certain species. This is a secondary consideration because no effort is being made to propagate or protect the fish. Fishing and hunting are not allowed along the canal right-of-way.

This article was written by Max Wilson, Canal Superintendent, Friant Unit, Operations, U. S. Bureau of Reclamation, Friant, California.

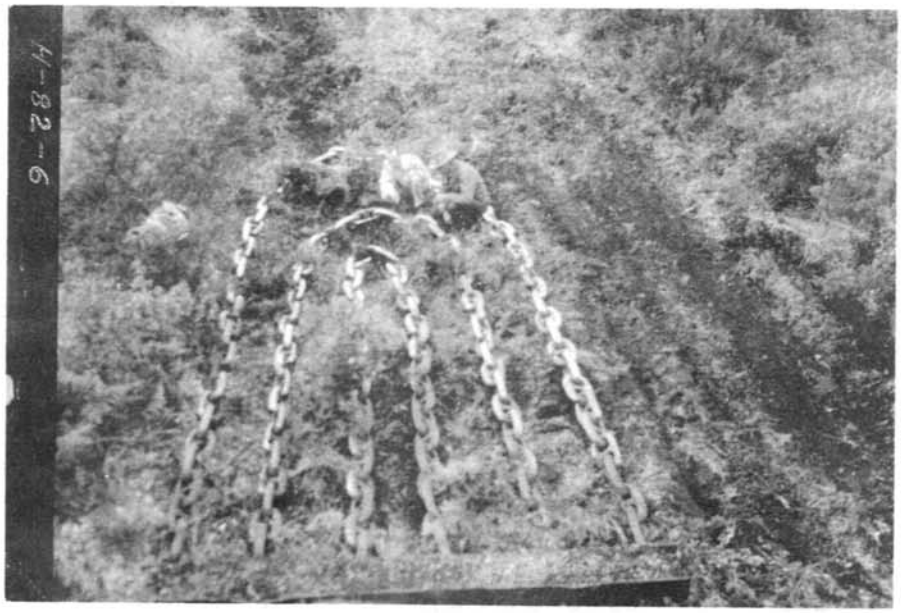


BOOM-MOUNTED DISC

Operated by the Truckee-Carson Irrigation District, Newlands project, Nevada, the unit above has been very successful in controlling water weeds in large canals.

Construction Details:

A Hyster boom is mounted on the back of a D-7 Caterpillar tractor. Two rows of heavy discs, 18 inches in diameter, are attached in tandem to the boom by adjustable cables. The cables are controlled from the power take-off and can be adjusted to lengthen or shorten the distance between the boom and the discs, or to control the direction of the discs. The discs also can be raised over drops or other obstructions by manipulating the cables and boom.



CHAIN DRAG

It has been said that "woody vegetation requires two to four times more water to produce a pound of dry leaves than does grass." Thus, a different kind of "brush control machine" has been developed in Hawaii.

The development of a heavy anchor chain drag has done a lot toward bringing about brush control and grass improvement on the rough, broken and rocky rangelands of the Territory of Hawaii. The anchor chain drag, for use in brush control, was first conceived and used on the Kaalualu Ranch in Kau. The Kaalualu Ranch is owned and operated by the Hutchinson Sugar Plantation Company with headquarters at Naalehu. Back in 1944, Kaalualu Ranch Manager, Mr. Allan P. Johnston, like most ranchers in the Territory, was faced with the problems: controlling such brush as lantana, puakeawe, and alii, guava and Christmas berry and with preparing the land for seeding improved varieties of grasses.

Although several machines for removing and controlling brushy vegetation such as: beaters, power mowers, dozers, powered saws, heavy root plows, tree shears, rail drags, disc harrows, and buck rakes, have been developed and used on the mainland with varying degrees of success, no such machines were available for local trials or even seemed too well adapted to much of the rough and rocky rangelands in the Territory.

Stockmen know that a brush control machine to be successful needs to break up and kill brush of considerable size. This meant the machine would have to be heavy. It also would need to be adapted to areas of little or no soil, very often aa and pahoehoe lava flows. It must follow the land surface, though very irregular, and remove the

brush in the low spots as well as on the high spots. This meant the machine could not be rigid in construction. Finally the machine would have to be durable enough to stand the constant grinding of the rocks, be relatively free of breakdown and constant repair. In short, "the machine used in removing brush, must meet the requirements as to sturdiness and economy of operation. The equipment must be suited to handle the plants to be removed and the terrain over which the work is to be done."

Many hundreds of acres of range and pasture lands are presently being dragged for brush clearing and seeding to adapted grasses and legumes. Clearing with chain drag is going forward on such ranches as Kaalualu and Kapapala in Kau; McCandless and Puuwaawaa in Kona; Kahua in Hohala.

Ranchers point out that the development of the chain drag has permitted brush clearing and control on rough rocky lands that could not otherwise have been treated and as a result they have been able to establish many high producing pastures. The success of the brush clearing or control is somewhat dependent upon the kind of brush being treated and season when work is done. On puakeawe and alii there are reports where 90% kill have been made with once over. On Lantana 50% and on guava 30% kills. On lantana and guava dragging in two directions gave the highest percentage of kill.

In summing up, the "Johnston Chain Drag" has:

1. Provided a relatively simple and inexpensive machine with a low original and maintenance cost.

2. Permitted brush control and seedbed preparation in rough rocky areas not otherwise possible with other equipment.

3. Left trash and debris on the surface soil for erosion control.

4. Low cost per acre of brush control. As low as $3.50 per acre double chaining operation.

5. Simplified livestock management and handling by removing high brush in rough rocky areas.

Construction Details:

Brush control work in the Territory shows the chain drag really has contributed to the range improvement program of many ranchers, and has often been referred to as the "Johnston Chain

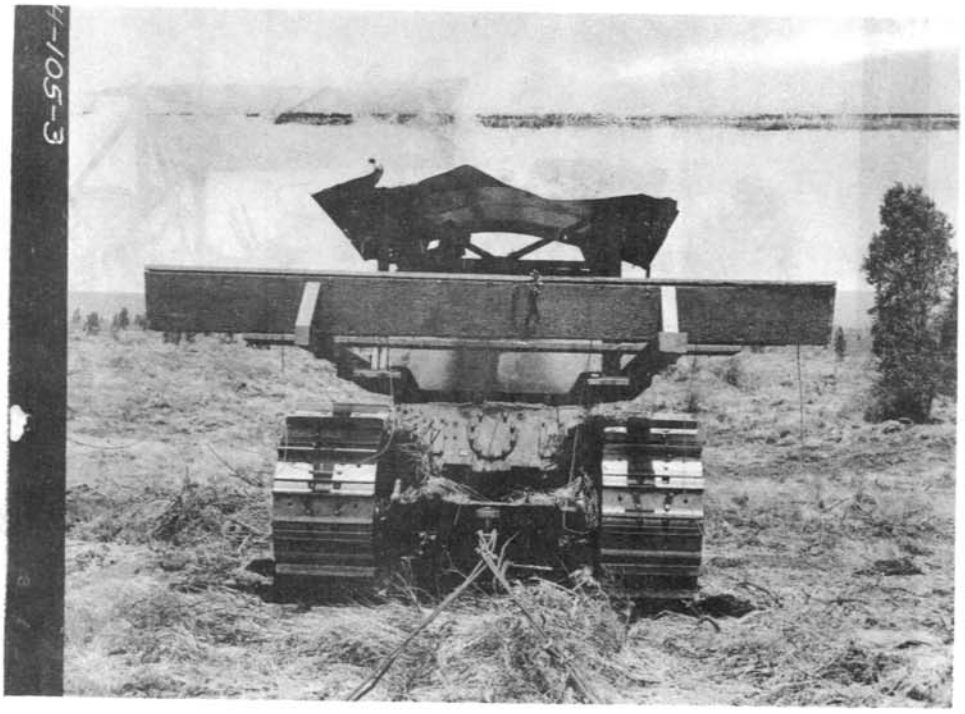
Drag." The drag is made from old battleship anchor chain. Each link in the chain weighs 80 pounds. The chain drag constructed for use behind the large crawler-type tractors has a total of 180 links. The links are arranged in three loops behind an "I" beam 14 inches wide, 6 inches high and 12 feet long. The first or outside loop has 60 links, the inner loop 50 and the center loop 540. The hitch contains 30 links. The ends of the chain loops are secured to the bottom of the "I" beam by "U" clamps. In operation the "I" beam rides on top of the chains. They serve as skids under the beam. The hitch, 30 links, is actually a continuation of the center loop. Keeping the hitch near the center of the "I" beam permits the beam to pivot or swing when the ends are caught by trees, heavy brush, boulders, etc.

A chain drag, as described above, weighs approximately 7½ tons. The 180 links weigh 14,400 pounds and the "I" beam approximately 800 pounds.

Materials for the original drag cost about $472 for all items. The battleship anchor chain was purchased as scrap metal at $60 per ton, including freight from Honolulu. The "I" beam cost about $30. Another $15 was needed for "U" clamps.

Lighter chain drags, made from battleship anchor chains, have been made for use on the smaller crawler type tractors. Some drags instead of being constructed with 180 links have 150 links. Other versions of the drag have only two instead of three chain loops behind the "I" beam. Thus, the weight of the chain drag is varied for use behind a particular size crawler tractor. In fact ranchers "tailer make" the chain drag to their choosing.

Material for this article was supplied by Allan P. Johnston, Manager of Kapapala Ranch, Hawaii.



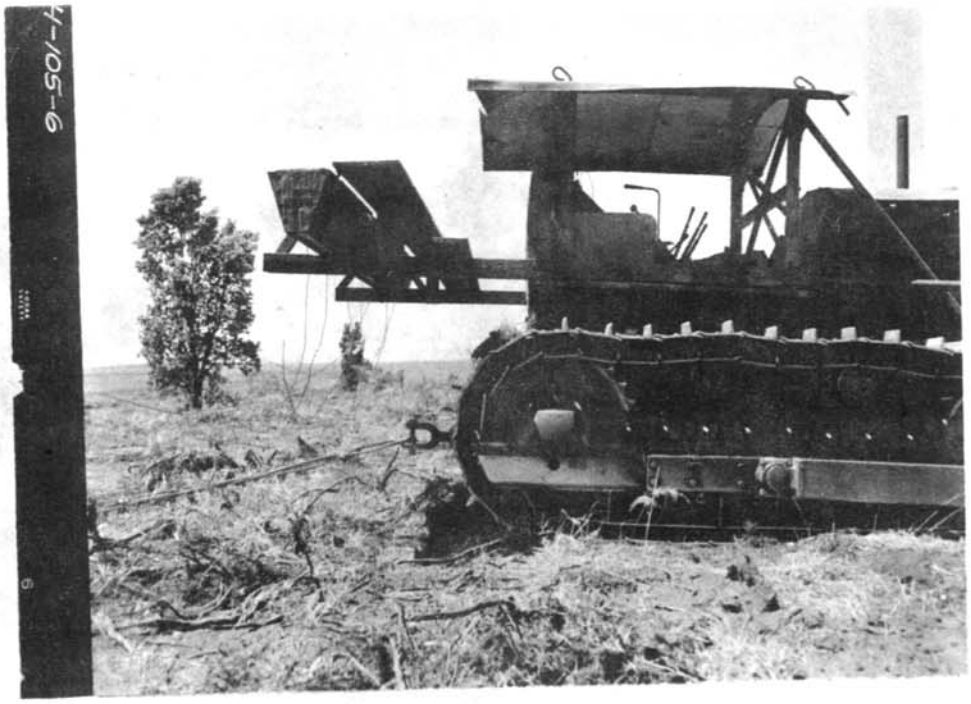
"HOME-MADE" GRASS-LEGUME SEEDER

A "home-made," low-cost grass-legume seeder for use on brush-cleared rangelands, has been devised by Allan P. Johnston, manager of the Kapapala Ranch, Hawaii. Johnston, chairman of the Kau Soil Conservation District, worked out the seeder after years of wrestling with range seeding problems. The seeder has real promise because it can be built at low cost and keeps planting costs down. The first seeder worked so well that Johnston has since made a second one. The second one was built in much less time and at considerably less cost. He estimates that the total cost now is about $25.00, including both labor and materials.

Construction Details:

The first seeder was mounted on 4 by 4 inch timbers on the back of a D-8 caterpillar tractor at about the same height above the ground as the driver's seat. The seeder is well suspended about 5 feet above the ground, well away from the rocks, brush and rough terrain that so often wrecks the conventional drill. The seeder is relatively free from repairs and after a month's operation no repairs were necessary. A few slight improvements were made as the original model was put to test.

The seeder box, or hopper, is constructed very much after the pattern of a seeder box on most conventional drills. The box is about 12 feet long and about 12 inches deep. The top of the box is 12 inches wide and tapers at the bottom to about 4 inches wide. The box was constructed of unplaned lumber one inch thick.



The feeder openings bored through the bottom of the hopper are about 3/4-inch in diameter and spaced 16 inches apart. The box is divided into small compartments by fitted wedge-shaped wooden dividers. The dividers prevent the grass and legume seeds from "running" to one end on rough terrain or when traveling on a slope. The wooden dividers are fastened midway between the "puka" openings.

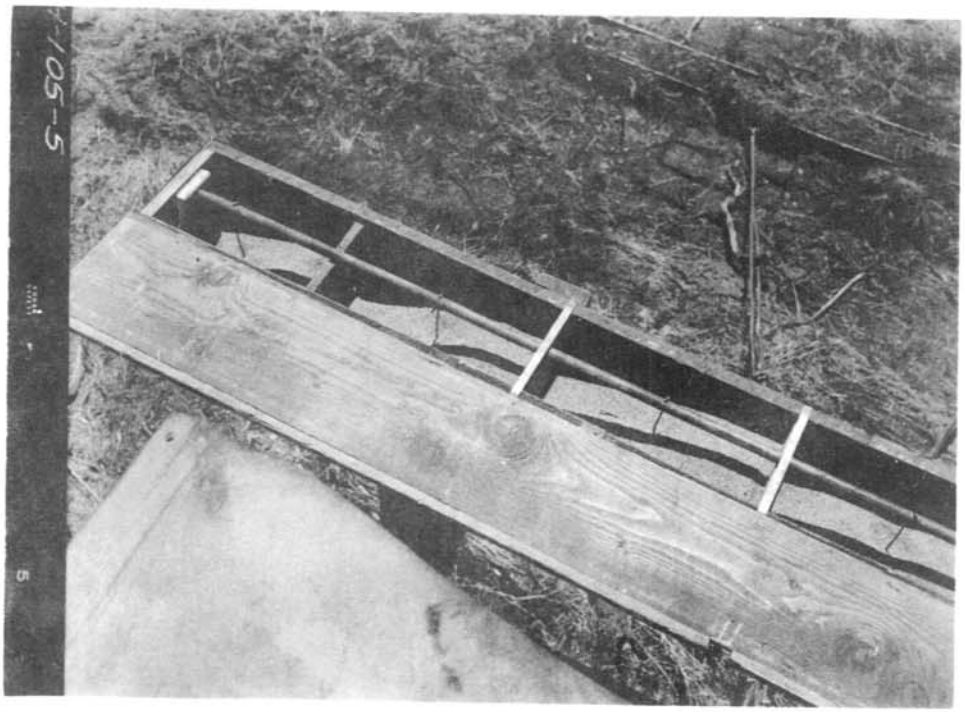
A 1/2-inch pipe runs the entire length of the seeder box and is mounted in the top center so that the lid can be closed without binding on the pipe.

The problem of getting grass seed to flow evenly through feeder openings was overcome by the use of 6-gauge galvanized wire, about 4 or 5 feet long. It runs through the feeder openings and is fastened at the top to the one-half inch pipe mounted inside and near the top of the box. The pendulum motion of the wires aids in a steady flow of seed through the openings.

In calibrating the seeder to seed the proper pounds per acre, three holes, 3/8, 7/16, and 1/2 inch diameter respectively, and about 2 inches apart, were bored through pieces of heavy tin about 2 inches wide and 6 inches long. The 2 by 6 inch tin plates were then "slipped" over the wire through the size of opening desired and were fastened to the bottom of the hopper by small screws exactly over the 3/4-inch hole drilled through the bottom of the hopper.

The seeder broadcasts the seed behind the tractor. A chain is dragged behind for covering the seed. Observations of germination

and stand on some of the earliest seedings show a surprisingly uniform stand of seedling. Johnston sums up the results of the seeder in this way: "The stand is much more uniform than when seed was broadcast by hand and there is a considerable saving in labor. Now one man is doing a better seeding job than three men were previously doing. This is accomplished by seeding and covering the seed in one operation."



Calibrations:

Calibrating the seeder to drop enough, but not too much seed, was a stickler until Johnston hit on an idea. The gimmick was a two-pound coffee can with a hole in the bottom large enough to slide upward over one of the wire ends hanging below the seeder. The can was then tied against the bottom of the hopper so as to catch all the seed coming through one opening.

Johnston operated the seeder over a distance of about 1000 feet. Seed collected in the coffee can over the distance traveled is weighed and multiplied by the total openings in the drill. Thus it was possible to calculate the pounds of seed being applied per acre to the land. When too much seed was going through an opening the metal plate was moved so that a smaller opening was used.

Johnston explains that the second seeder mounted on the back

of a D-4 crawler tractor did not seed at the same rate as the one behind the D-8 tractor. The speed at which the seed drops through the seeder openings is dependent upon vibration of the particular tractor and the movement of the wires hanging pendulum-like below the seeder box. The seed automatically quits flowing once the machinery is stopped. The second model was speedily calibrated to seed the right amount by changing to the proper opening in the metal plate.

This material is a condensation from an article by Roy I. Shipley, Range Conservationist, Soil Conservation Service, Territory of Hawaii, as published in the October, 1953, issue of Westland Pasture Journal.

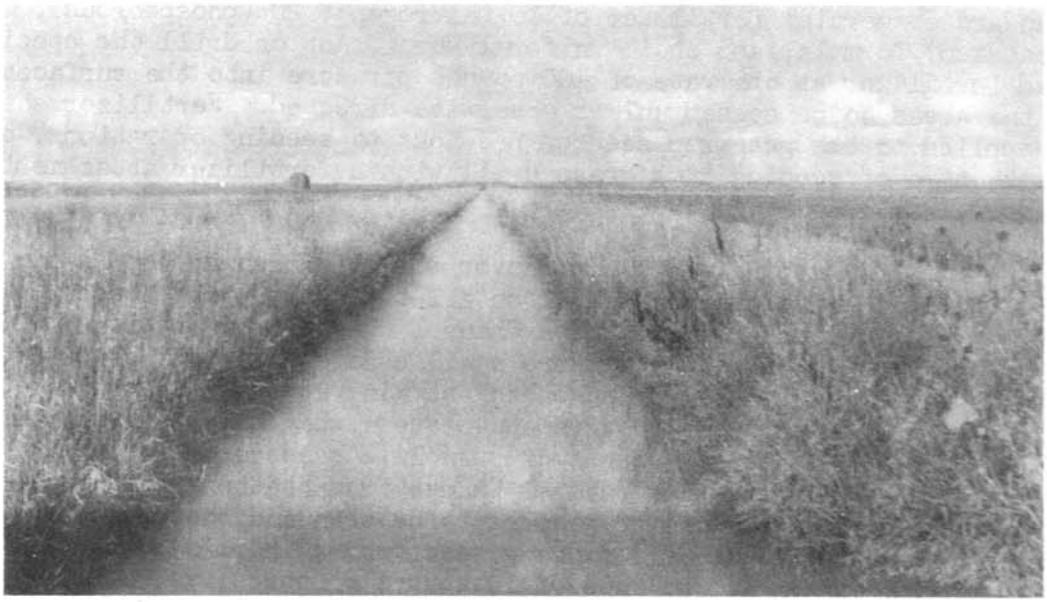
SEED SCARIFIER

Mr. Johnston, Kapapala Ranch, Hawaii, recommends placing hard coated seed in a cement mixer with two bags of crushed rock and running the mixer for a few minutes. Seeds then may be separated from the rock by screening through proper-sized mesh.

DITCH BANK SEEDING

The best method of controlling weeds on irrigation systems is to plant desirable adapted grasses. Experience under the climatic conditions in Region 7 shows that four to five years after planting the grasses, weed control expenditures hit rock bottom. During the four to five year period that the grasses are becoming established, they must compete with weeds for nutrients, water and light. Spraying with 2-4D during that time eliminates most of the weeds and encourages more rapid development of the grasses. Studies of grass stands previously established have shown that for every one dollar invested in seeding grasses, about $2.50 is saved in O&M costs.

What does it cost to establish a new stand of grass on a ditch bank? In 1952, cost records were kept in planting work done on the Frenchman-Cambridge and Bostwick Divisions, Missouri River Basin project. The costs ran from $6.60 to $13.76 per acre, depending upon conditions encountered and method of seeding used. In the same Divisions, weeds were sprayed with 2-4D using ground rigs, at costs ranging from $3.23 to $4.95 per acre. Mowing costs averaged about $2.45 per acre. However, mowing had to be accomplished two or three times during the season to give results comparable to those obtained with one 2-4D spraying. Isn't the comparatively high initial investment in seeding worth the chips . . . even if for no other reason than eliminating the recurrent need for annual spraying and mowing?



A good stand of grass on the banks of a canal on the Mirage Flats project, Nebraska, is shown in the preceding photograph. Much of the ditch bank seeding in Region 7 has been done under contract. To indicate how the work is done, an excerpt from a typical seeding specification is presented:

"Spreading fertilizer and sowing grass seed. (a) General.—Areas of excavation surfaces, embankments, spoil banks, and drains, as shown on Drawing No. 271-701-1392, or as designated by the contracting officer, shall be prepared for seeding and fertilized and seeded. All seeding operations shall be in accordance with the provisions of this paragraph.

"(b) Seedbed preparation.—The contractor shall compact or loosen the surfaces of laterals, drain ditches, embankments, and spoil banks as directed prior to seeding, in order to obtain a firm well-packed seedbed. Compaction for seeding may require 2 passes, but not more than 2 passes, with a packer and mulcher similar but not restricted to the 'Western Sprocket Packer and Mulcher' manufactured by the Western Land Roller Company of Hastings, Nebraska. No separate payment will be made for compacting or loosening areas to be seeded and all costs of seedbed preparation shall be included in the unit price per acre bid in the schedule for furnishing and spreading commercial fertilizer and furnishing and sowing grass seed.

"(c) Commercial Fertilizer.—The contractor shall furnish a standard commercial fertilizer of 16 (nitrogen), 20 (phosphorous), 0 (potassium) formula, and shall uniformly broadcast or drill the specified fertilizer at the rate of 100 pounds per acre into the surfaces of the areas to be seeded unless otherwise directed. Fertilizer shall be applied to the prepared seedbed previous to seeding operations, or at the time of seeding if a grass drill with a fertilizer attachment is used.

"(d) Seeding.—The contractor shall furnish and sow a mixture of brome grass and wheatgrass on all the areas to be seeded, except that portion of Ayres Creek Channel Change from Station 34+00 to End Station 44+50. This mixture shall consist of brome grass (Bromus inermis), Lincoln or Achenback strain, at the rate of 14 pounds of pure live seed per acre and western wheatgrass (Agropyron smithii) at the rate of 4 pounds of pure live seed per acre. For that portion of Ayres Creek Channel Change from Station 34+00 to End Station 44+50, the mixture of grasses to be sown and the rates of seeding are as follows: (1) Brome grass (Bromus inermis), Lincoln or Achenback strain at the rate of 10 pounds of pure live seed per acre; (2) Rye (Secale cereale), at the rate of 20 pounds of pure live seed per acre; (3) western wheatgrass (Agropyron smithii), at the rate of 4 pounds of pure live seed per acre; (4) Sand lovegrass (Eragiostis trichodes), at the rate of 1 pound of pure live seed per acre.

Pure live seed - percent of purity x percent of germination
100

"The germination of brome grass and rye shall not be less than 85%, the germination of western wheatgrass shall not be less than 65%, and that of sand lovegrass not less than 75%. Seed shall contain no noxious weed seed or quackgrass (Agropyron repens) and shall contain not more than 4 percent of other weed seed. All grass seed shall comply with the seed laws of the State of Nebraska. The age of seed of the brome grass and rye shall not exceed two years. The sand lovegrass and brome grass seed shall have been produced in Nebraska, Kansas, or Colorado.

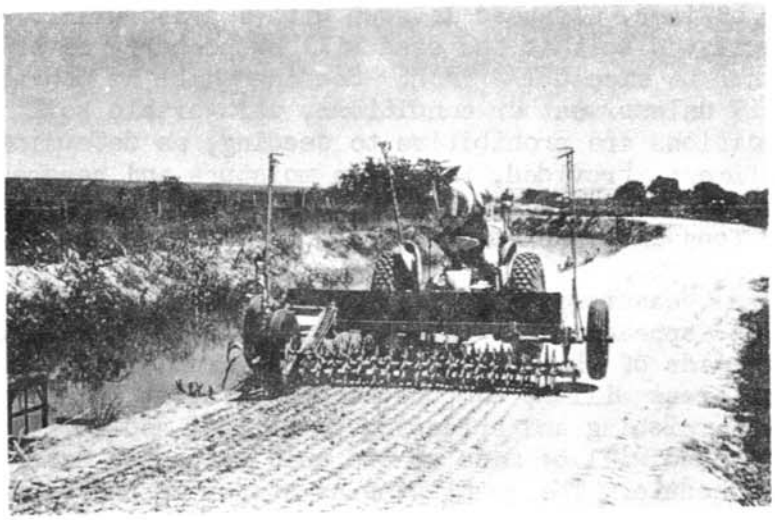
"The seed of brome grass, western wheatgrass, rye, and sand lovegrass shall be separately packaged and labeled so they can be uniformly and thoroughly mixed after they are received on the job. The mixture of grasses specified herein shall be uniformly distributed on the designated areas to be seeded by means of a hand seeder or grass drill. When seed is sown by means of a hand seeder, immediately after broadcasting the seed shall be properly covered with soil to a depth not to exceed 1/2 inch by means of a spike tooth harrow, a treader (rotary hoe run backwards), or any similar implement acceptable to the contracting officer. If seed is sown with a grass drill, the drill shall be regulated so that the seed will be properly covered with soil to a depth not to exceed 1/2 inch. Seeding shall be done from February 1 to April 15 unless weather conditions, unfavorable soil moisture, or seedbed conditions are prohibitive to seeding, as determined by the contracting officer: Provided, that when moisture and seedbed conditions are favorable, the contracting officer may order the contractor to continue operations in a period other than that stated above.

"(e) Measurement and payment.—Measurement for payment for furnishing and spreading fertilizer and furnishing and sowing grass seed will be made of the areas actually prepared, fertilized and seeded. The areas will be computed to the nearest 1/2 of an acre. Payment for furnishing and spreading fertilizer and furnishing and sowing grass seed will be made at the unit price per acre bid therefor in the schedule. The quantities as stated in the schedule for furnishing and spreading fertilizer and furnishing and sowing grass seed are estimates for the purpose of comparing bids and the contractor shall be entitled to no additional compensation above the unit price bid in the schedule by reason of any amount or none of this work being required."

Examination of the specifications will show that they meet several essential requirements needed to get the grass seeding done properly. First, the specification is written to enable Reclamation

to make field changes in the seeding methods. For instance, it may be necessary to require the contractor to compact or loosen the ditch banks prior to seeding. Secondly, the specifications enable Reclamation to direct the contractor to seed miscellaneous spoil areas that are created during construction. In other words, if it is determined during construction that an additional bank will be constructed which is not anticipated in the original specifications for the canal or lateral, provisions are made in the contract that require the contractor to seed this additional area. Flexibility in the contract is also obtained by requiring the seeding of different species of grasses on different areas that are seeded. By going over such areas prior to preparing a specification, it can be determined what grasses are best adapted to the different soil types and drainage conditions encountered.

A special grass seeder has been developed by the Kansas River projects staff working in cooperation with the Soil Conservation Service. The seeder, photograph below, prepares the seedbed and plants the seed in one operation. Excellent results have been obtained with its use. It consists of a native grass seeder and has a tillage width of 8 feet, and weighs 1,050 pounds.



A drawing, No. 271-701-1988, showing the modifications made to a commercial seeder to adapt it for ditch bank work, and any further information relative to the seeding operation can be obtained by writing to the Projects Manager, Kansas River Projects, Bureau of Reclamation, P. O. Box 737, McCook, Nebraska, or the Director, Region 7, Denver Federal Center, Denver, Colorado.

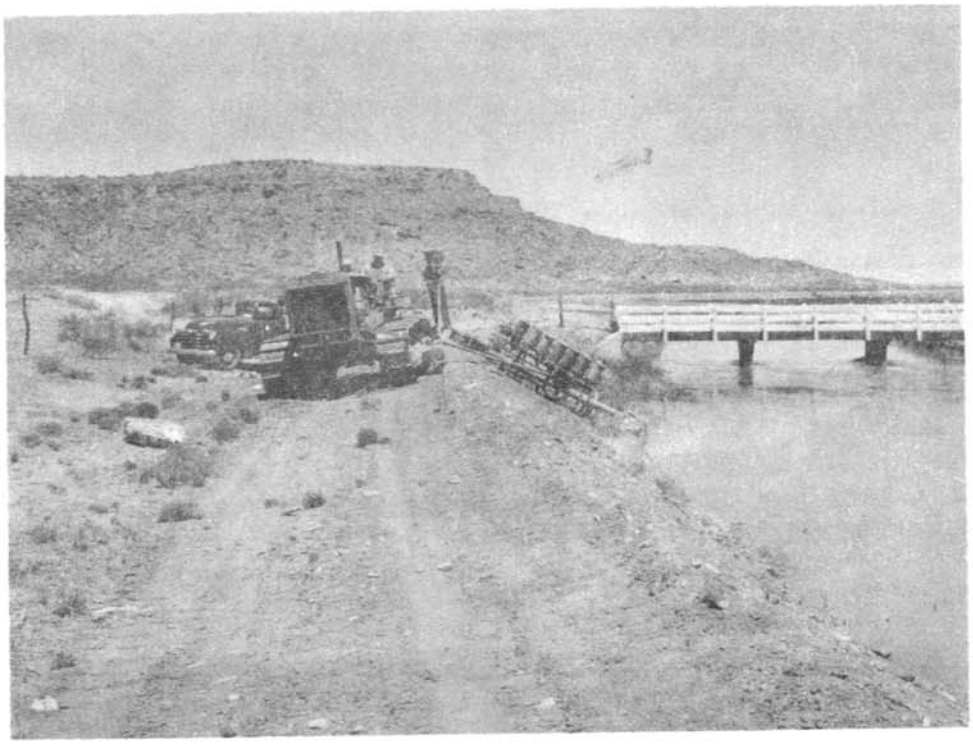
CANAL BANK RESHAPER AND GRASS SEEDER

A good cover of low growing grasses along irrigation canal banks and rights-of-way was effective in reducing the annual operation and maintenance charge by reducing weed growth and canal bank erosion on the Tucumcari project, New Mexico. Prior to seeding the low growing grasses on established canal banks, it is generally necessary to reshape the ditch banks by filling in erosion cuts, and removing most of the weed vegetation. In order to accomplish this phase of the operation a crawler-type tractor was equipped with a special blade as shown in the photographs below.

Construction Details:

The bank shaper pictured has been very efficient and was developed and constructed by maintenance personnel of the Tucumcari project. A similar device is being manufactured commercially. The first shaper developed by project forces and pictured herein was controlled entirely by the tractor operator by means of cables. However, to prevent the blade from "riding" in areas where a large amount of cut is necessary, the hydraulic actuating arm installed on the device has definite advantages for raising and lowering the blade in lieu of the cable control. Another improvement in the shaper blade consisted of placing an extension on the blade at a 45-degree angle to clean the bottom of laterals as well as the slopes. Both adaptations are very useful for the reshaping and cleaning of both small and large canals.

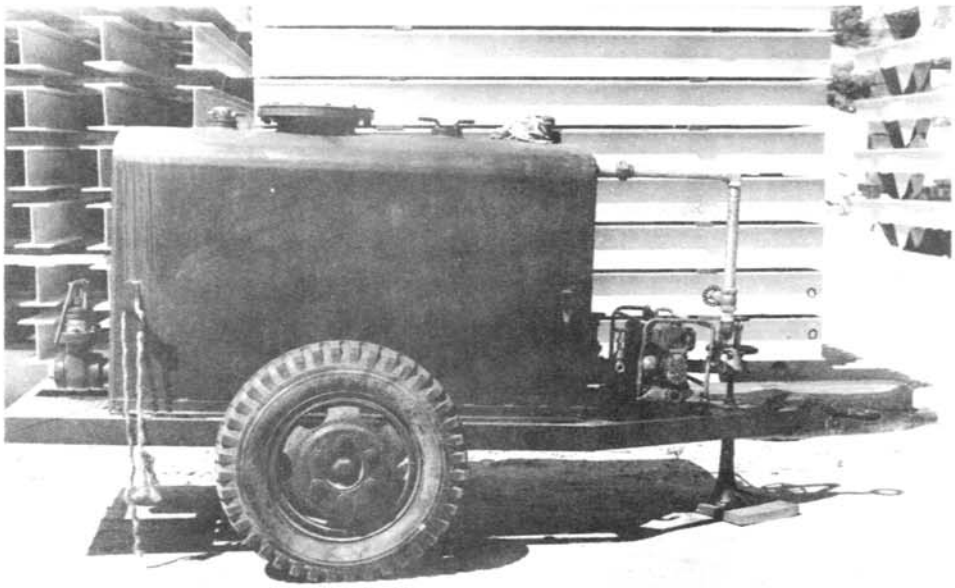
Upon completion of bank reshaping, the blade is removed from the tractor, and a grass drill attached as shown in the top photograph on the preceding page. The grass drill used in Region 5 is adapted to seeding all varieties of grass, either individually or in mixtures. Regulators are installed on the disc to govern the depth of seeding.



The grass drill may be removed from the rig and attached to a conventional wheel type tractor for use in seeding adjacent rights-of-way and reservoir areas.

The unit cost for seeding canals and rights-of-way will average about $10.00 per acre, exclusive of canal bank reshaping and cleaning.

The framework on the tractor and the bank reshaper were shop constructed and the grass drill was purchased commercially. Additional information regarding the work done in this area may be obtained from the Project Manager, Tucumcari Project, Tucumcari, New Mexico, or the Regional Director, Region 5, Amarillo, Texas.



DISPOSAL OF WASTE OILS

The mobile oil spray unit shown above has been developed by the Shasta Division of the Central Valley project and is used effectively for the disposal of waste oils.

Construction Details:

Normally waste oils are disposed of in a dump, but by use of the mobile oil sprayer, 400 gallons of oil may be disposed of at one time. On the Central Valley project the oil is used along the shoulders of roads for weed and erosion control or in areas where dust may be a problem. The oil tank and gasoline-driven pump are mounted on an ordinary trailer which may be pulled by a pick-up truck. If more detail is desired on the unit, contact the Regional Director, Bureau of Reclamation, Sacramento, California.

POWER WAGON MOUNTED WEED CUTTER

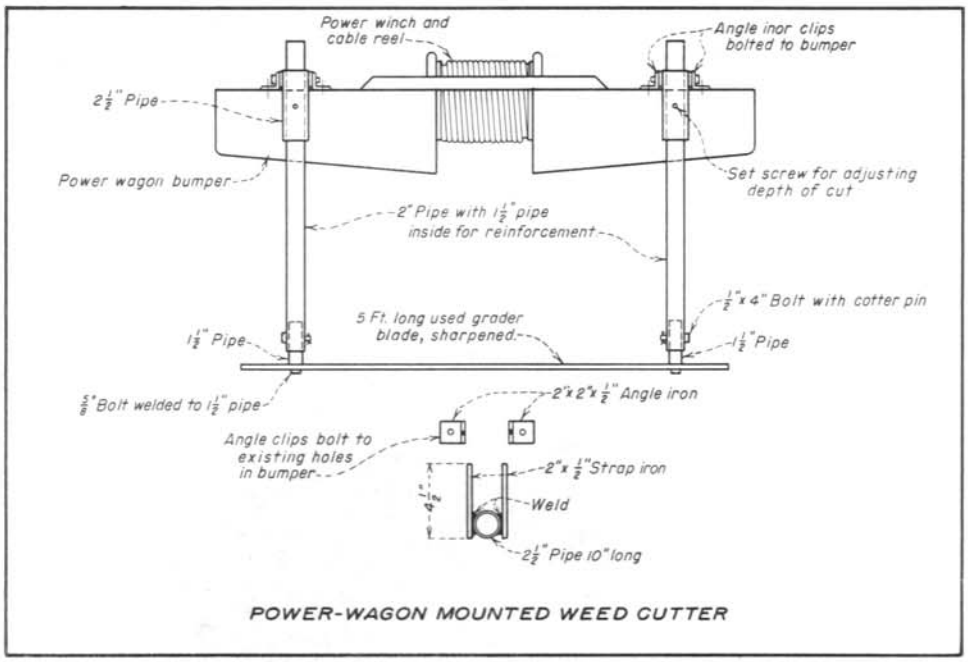
A simple weed cutter which works very effectively in substation yards as a means of reducing maintenance costs has been constructed by the Power O&M crews of the South Platte River District, Region 7. The device was constructed for attachment to the front bumper of the truck as shown in the photograph and drawing below.

Construction Details:

The cutter is reported to work very effectively in gravelled substation yards where the cutter bar is set to cut two or three inches below the surface. In moving forward the blade slides through the gravel cutting the weeds below the surface and bulking and freshening the packed gravel. In backing, the blade drags, pulling out the weeds and leveling the gravel.

The cutter was built at a cost of $22.95, all of which was labor. Materials for construction of the device were obtained from the shop scrap pile. It is estimated that work previously accomplished by two men in 40 hours, is now done with the cutter in about 5 hours.

The success of the first cutter led to construction of a second which is now in use. For further details regarding the weed cutter, contact the Regional Director, Region 7, Denver Federal Center, Denver, Colorado, or Superintendent of Transmission Lines and Substations, U. S. Bureau of Reclamation, Loveland, Colorado.



POWER-WAGON MOUNTED WEED CUTTER

WEED SPRAYING REPORT FORMS

A practical form for maintaining records of ditchbank weed control, suggested by personnel of Region 5, U. S. Bureau of Reclamation, is given below.

WEED SPRAYER & MOWER REPORT SN-512

Name Ditch -
Date -

Station (Start) (End)

Name	: Hrs.	: Rate	: Amount

Miles Traveled			Ditch Miles			Spray Used			
Start	End	Miles	Lt.Bnk.	Rt. Bnk.	Channel	Oil (Gal)	2,4-D (LB)	PCP(Qts)	X-100(Pts)
- -						(Cost)			

Total Cost - - - - -

Name Ditch -
Date -

Station (Start) (End)

Name	: Hrs.	: Rate	: Amount

Miles Traveled			Ditch Miles			Spray Used			
Start	End	Miles	Lt.Bnk.	Rt.Bnk.	Channel	Oil (Gal)	2,4-D (LB)	PCP(Qts)	X-100(Pts)
- -						(Cost)			

Total Cost - - - - -

Name Ditch -
Date -

Station (Start) (End)

Name	: Hrs.	: Rate	: Amount

Miles Traveled			Ditch Miles			Spray Used			
Start	End	Miles	Lt.Bnk.	Rt.Bnk.	Channel	Oil (Gal)	2,4-D (LB)	PCP(Qts)	X-100(Pts)
- -						(Cost			

Total Cost - - - -

PUNCTURE-PROOF TUBES ON WEED MOWERS

REDUCE O & M COSTS

By the use of puncture-proof tubes in the front tires of weed mowers, the Tucumcari project in New Mexico, has made a direct saving of $800 in operation and maintenance costs during 1952. The pneumatic tires on the mowers are subjected to unusually severe operating conditions, as they are used to cut weeds on the steep wide slopes of the canals and borrow pit areas. Pneumatic tires on the weed mowers were continually being punctured by mesquite thorns, other thornyplants, debris, nails, and sharp rocks not encountered by other equipment which normally uses the operating roads exclusively.

The four tractor-mowers used by the project operated during the entire 1952 season without punctures. This is in contrast with the operation of these same machines during the 1951 season, during which the machines averaged one puncture per week, at an approximate cost for repairs of $800 for the season's operation. The repair cost was entirely eliminated by the installation of the puncture-proof tubes, with a resulting increase in operational efficiency which cannot readily be evaluated directly in money saved.

Puncture-proof tubes were not obtainable for the size tire originally supplied with the mowers. It was necessary, therefore, to change the wheels to a size which would permit use of standard automobile tires. This was accomplished by cutting the rims from the original tractor wheels and welding on rims from automobile wheels obtained from an auto wrecking yard at a cost of $1.00 each. It was discovered that 1942 Plymouth wheels would fit the Model B, Allis-Chalmers hubs without alterations. Total cost of the change over was approximately $60 and this included the preparation of two spare wheels.

Interior - Reclamation - Denver, Colo.