

Department of the Interior, Bureau of Reclamation

IRRIGATION OPERATION AND MAINTENANCE

BULLETIN NO. 54

October, November, December 1965

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The Irrigation Operation and Maintenance bulletin is published quarterly, for the benefit of irrigation project people. Its principal purpose is to serve as a medium of exchanging operation and maintenance information. It is hoped that the reports herein concerning labor-saving devices and less costly equipment and procedures, developed by resourceful project people, will result in improved efficiency and reduced costs on the systems of those operators adapting these ideas to their needs.

To assure proper recognition of those individuals whose suggestions are published in the bulletins, the suggestion number as well as the person's name is given. All Bureau offices are reminded to notify their Suggestions Award Committee when a suggestion is adopted.

* * * * *

Division of Irrigation Operations
Office of Chief Engineer
Denver, Colorado



The gate opening of the slide gate position indicator is read directly from the counter, as shown; see article starting on page 7.

P328-D-51653NA

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INTRODUCTION

The fact that good painting practices pay off in terms of lower maintenance costs is emphasized in the article "Maintenance Painting Costs Can Be Reduced," that appears in this issue of the Bulletin, beginning on page 1. Prepared by a protective coating consultant and aimed primarily at industry, the data included is applicable, in part, at least to the protection of irrigation facilities and their appurtenant features. What not to do in surface protection is humorously stressed in the accompanying brief dissertation on page 6, "A Short Course in How to Waste Painting Money." We are indebted to the Editor of Plant Engineering for these two articles.

We are always looking for a better gate position indicator. One now installed on a Missouri River Basin Project in Nebraska is described and illustrated beginning on page 7.

An emblem adopted by the Farm Conference of the National Safety Council to designate slow-moving vehicles is shown on page 11. Suggested to promote safety, an article beginning on the same page describes the emblem and gives a source of additional information.

An "S" shaped rotary mower blade designed for safety is shown and described on page 13. For this and several other useful suggestions appearing in this issue, we are indebted to Grist, a publication of the National Conference of State Parks.

A brief article on the lubrication of wire rope also can be found on page 13; a new type metal grating that can be utilized in many ways is described beginning on page 14; and suggestions toward eliminating the chatter of hydraulic pumps will be found beginning on page 18.

MAINTENANCE PAINTING COSTS CAN BE REDUCED 1/
by C. R. Martinson

Approval of maintenance painting budgets is sometimes difficult to obtain. We have found that we have greatest success when we physically demonstrate the high cost of a premature coating failure; once a plant manager has experienced one of these failures, he is not nearly so anxious to criticize the cost of a quality paint job.

A study of painting expenditures will provide the knowledge needed to reduce the cost of painting plant facilities--yet maintain a high level of appearance and protection. The objective--whether arrived at by experience or calculation--is given by Mr. R. K. Swandby of International Nickel Co. He says: "The desirable economic criterion is the paint system that will give the lowest cost per square foot per year of life."

Maintenance painting has long been regarded as quite unimportant. Paint was paint and no special skill was required to put it on. Many thought if the job didn't turn out well, it didn't really matter; painting didn't cost much.

Few realized that the national average cost for painting (in the chemical industry) was about 7.0 percent of the total maintenance bill, or 0.5 to 1.0 percent of the capital investment. Management, aware of this, began to look for ways to reduce protection costs. They began to see that cheap painting jobs are not a savings--but that maintenance painting budgets provide a fertile field for cost reduction--without sacrificing soundness and appearance. Better--not cheaper--painting is the key to a cost-cutting program.

Unit Costs from NACE

Some unit cost figures for painting today have been developed by Task Group T-6D-1, of the National Association of Corrosion Engineers. For example, these are typical costs:

Hand Cleaning	16.0 cents per sq ft
Sandblasting	23.5 cents per sq ft
Brush	
Application	5.1 cents per sq ft
Spray	
Application	2.6 cents per sq ft
Miscellaneous	5.5 cents per sq ft

1/Reproduced by permission of the editor from an article appearing in Plant Engineering, September 1963, by the author, who is a Protective Coatings Consultant, Monsanto Chemical Company, St. Louis, Missouri.

In the last 10 years, labor costs have increased about 5 percent per year; paint material costs are up about 3 percent. There is close agreement between the NACE figures, and the following figures that were accumulated from a study conducted in our plant.

Labor costs are, of course, controversial. Many factors, including location, affect the rates. These figures, however, are considered typical and show the high cost of painting today. All figures are for direct labor only. They do not include overhead, profit, insurance, taxes, special equipment rentals, or like charges.

A contracted commercial blast-cleaning operation costs from 10 cents per sq ft for storage tanks, to 18-25 cents per sq ft for erected structural steel. It depends upon the size of the item. Light steel (which may average 400 sq ft per ton and up) costs more to clean than medium steel, which may run from 200-400 sq ft per ton. This, in turn, is more expensive to clean than heavy steel (usually figured from 100-200 sq ft per ton).

Shop commercial blastings ranges from 12-16 cents per sq ft plus an additional charge of one cent per sq ft for handling. Comparable blasting at the job site is slightly higher because handling charges are increased to about 1.5 cents per sq ft.

Application labor charges vary with size and accessibility, as well as with the method of application. Brush applications to storage tanks cost about 4.5 cents per sq ft for each coat with an additional one cent per sq ft for scaffolding. For steelwork, brush application costs will range from 5 cents per sq ft for each coat in a fabricating shop, to 10 cents per sq ft erected.

Spraying Costs

Comparable spraying costs for storage tanks are 3 cents per sq ft per coat; for steelwork, 3 to 6 cents per sq ft per coat. A scaffolding charge of 2 cents per sq ft should be added to the application cost for painting erected steelwork.

Material costs range from about 0.9 cents per mil ft for coal tar-epoxies and 1.2 cents per mil ft for alkyds to 2 cents per mil ft for vinyls and epoxies, all at 75 percent theoretical coverage.

Average thicknesses for these materials in three coats measure: 18 mils for the coal tar-epoxies; 5.7 mils for alkyds; 6.7 mils for vinyls; and 6.2 mils for the epoxies. The cost figures for vinyls include the required thinners, and the epoxy figure is for the completed mix or kit. Average costs per square foot for three coats of these materials are:

Coal tar-epoxies	16.2 cents per sq ft
Alkyds	6.8 cents per sq ft
Vinyls	13.4 cents per sq ft
Epoxies	12.4 cents per sq ft

The applied direct cost of a three-coat alkyd system on erected steel-work may be compared to a similar cost for a vinyl system by means of this example. Assume that the prime coat is brushed and the two-finish coats are sprayed. The direct labor charge of 43 cents per sq ft includes scaffolding.

Cost comparison of the alkyd and vinyl systems are:

	<u>Alkyd</u>
Blast Application	22 cents per sq ft
Labor	21 cents per sq ft
Paint	6.8 cents per sq ft
	49.8 cents per sq ft
	<u>Vinyl</u>
Blast Application	22 cent per sq ft
Labor	21 cents per sq ft
Paint	13.4 cents per sq ft
	56.4 cents per sq ft

The lower material cost for alkyd systems has been attractive enough in the past to induce widespread use of them in place of more resistant systems. This is false economy in the long run, in most chemical environments. The relatively short life of the alkyds creates the need for costly spot repairs much more often.

On a long-range basis, the alkyds are economically competitive with vinyls and epoxies only when: (1) the environment is so destructive even vinyls and epoxies have a short protective life; and (2) the alkyd exhibits a high degree of resistance to the environment. Table 1 on the following page shows the relative economy of the three types of paint--vinyls, epoxies, and alkyds. These are average figures taken at various locations in our plant. The "life factors" are the time intervals to the first spot repair; they indicate relative protective life.

Cost data for the materials were based on these assumptions: vinyls and epoxies cost 2 cents per mil ft and their average thickness is 7 mils; alkyds cost 1.2 cents per mil ft and average thickness is 5.5 mils.

STATION	COST COMPARISON					
	LIFE FACTORS (Year)			COST (cents/sq ft/yr)*		
	VINYLS	EPOXIES	ALKYDS	VINYLS	EPOXIES	ALKYDS
Wet	5.5	1.9	1.1	2.6	7.4	6.0
Salt	2.7	1.4	0.4	5.2	10.0	16.5
Sulfuric	4.9	1.7	2.2	2.9	8.3	3.0**
Caustic	4.9	2.6	0.8	2.9	5.4	8.3
Phosphoric	4.0	1.9	1.2	3.5	7.4	5.5
Ammonia (EI)	4.0	1.5	1.2	3.5	9.4	5.5
Ammonia (Lu)	5.4	3.8	—	2.6	3.7	—
Ammonium Nitrate (EI)	4.7	1.4	0.8	3.0	10.0	8.3
Ammonium Nitrate (Lu)	3.9	2.9	1.3	3.6	4.8	5.1
Nitric	2.1	1.2	0.4	6.7	11.6	16.5
Hydrochloric	0.9	0.4	—	15.5	35.0	—
A-15	4.6	2.9	2.6	3.2	4.8	2.5**
Weather	5.5	15.3	2.0	2.6	0.9	3.3
Atmospheric	6.2	6.1	1.8	2.3	2.3	3.7
Department 3	4.4	4.1	2.7	3.2	3.4	2.4**
Building 40	2.1	1.5	1.5	6.7	9.3	4.4**

*Cost for the Interval of the Life Factor.
**Alkyd is economically competitive.

Table 1

Let's compare the cost of an alkyd system with a vinyl system. Adding 10 percent for payroll taxes and insurance to the direct labor charge, 15 percent for overhead, and 10 percent for profit, boosts the total applied costs to about 65 cents per sq ft for the alkyd system. The total cost becomes 72 cents per sq ft for the vinyl. This similarly high unit cost may be calculated for work performed by painters in plants where overhead charges are approaching 100 percent of direct labor. The cost of painting today is nearing \$1.00 per sq ft! It pays to do the job with care.

Figure 1 on the following page relates direct labor charges to the number of coats on medium steel. Here general cost data--as described for commercial blast cleaning, handling, scaffolding, and application are used. Material costs are taken as 2 cents per mil ft at 2 mils per coat, or 4 cents per sq ft per coat.

Economic advantage offered by applying the complete system before erection is evident; it is about 20 percent cheaper to paint on the ground. Practical experience indicates that mechanical damage incurred in handling and erection is minor; it has no appreciable effect on over-all costs.

Environment Is A Big Factor

Data for the mild weather and atmospheric stations are interesting. They show alkyds are not economical choices here, even when costs are considered only to the time of first spot repair. If the basis for comparison were a 10-year interval, you would see the number of repair intervals for alkyds would be greater than that for vinyls or epoxies, in most instances.

Depending upon environment, these data help show that properly selected coatings can cost as little as one-fifth the annual cost of cheaper, non-resistant coatings. A good average figure shows a unit cost--in cents per square foot per year--only one-half that for the poorer coatings.

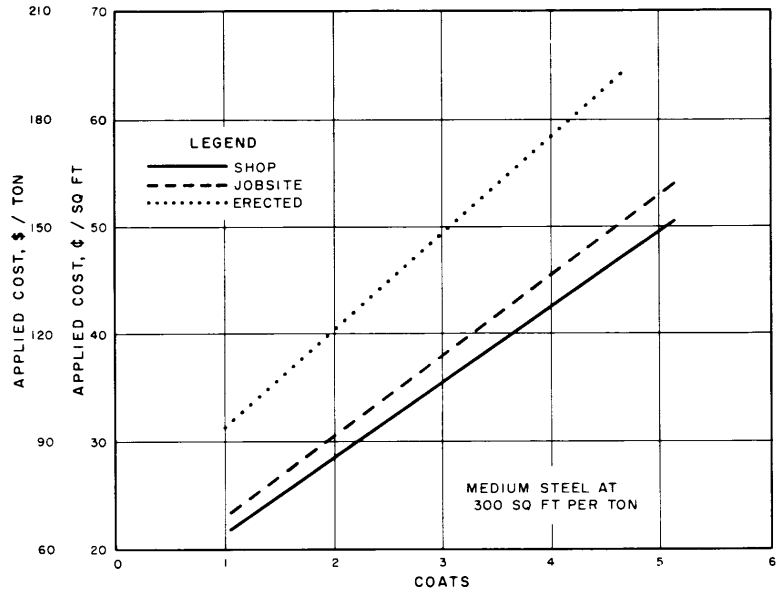


Figure 1

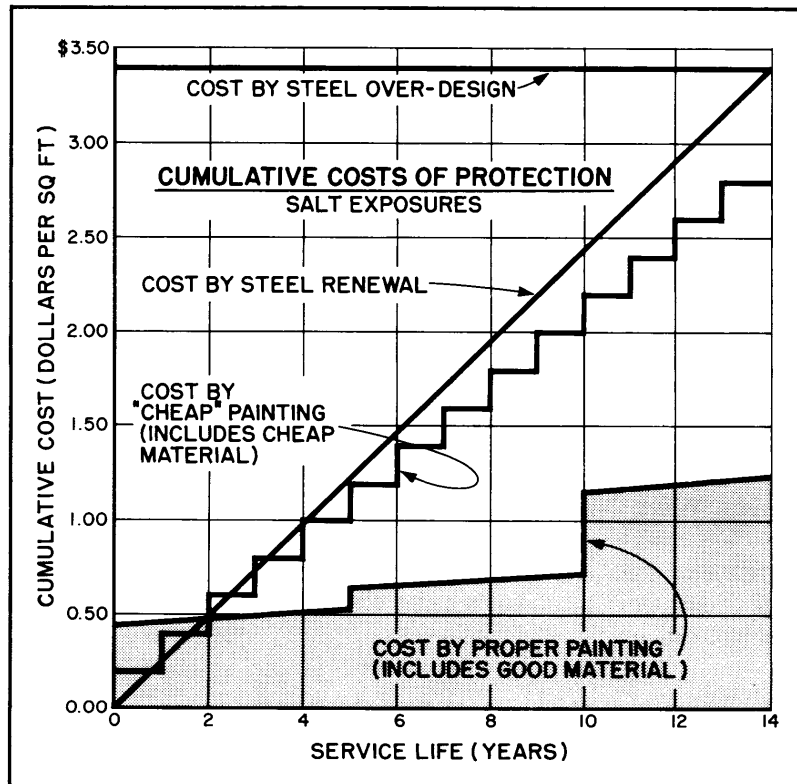


Figure 2

The addition of a fourth coat of paint, a common practice with relatively low-building alkyds, increases the applied cost by about 20 percent. Most of this added cost can be avoided by using three-coat vinyl or epoxy systems which provide protective thickness in three coats.

Figure 2 shown on the preceding page charts the cumulative costs of protection to steel structures exposed to salt atmospheres.

The values determined are not calculations or projections; they were determined in actual practice. They show clearly that good painting practices pay off in terms of lower maintenance costs.

*A SHORT COURSE IN HOW TO WASTE PAINTING MONEY

I. Millscale Failing

Don't sandblast. Paint over millscale. When it pops in a year, it will take the paint with it. This way, more than 50 cents per sq ft can be wasted the first year. If you're interested in the big picture--in the U.S. alone we lose more than a billion dollars a year simply by painting over millscale. This is primarily paint waste--add to it corrosion loss or product contamination. That's losing money in a big way!

II. Test Panel--Severe Paint Failure

Choose the wrong paint. Pick one that failed almost as soon as you put it on. This way, a good 30 cents per sq ft can be wasted without even trying.

III. Structure Needing Complete Repaint

Don't be in a hurry about spot repairs. Wait until the steel is all chewed up. Then start all over. True, it maybe a two-year wait, but not only the expensive surface preparation is lost. Painting will cost more than the first time. That's pretty good wasting!

IV. Spot Repairs With No Surface Preparation

Don't clean before a spot repair. Let the rust break right through again. This is a superb way to waste the \$50 per man day estimated for this type of work.

*This article accompanied the preceding article by Mr. C.R. Martinson in Plant Engineering, and is reproduced here by permission of the editor.

V. Shop Construction--Shop Primed Only--Rusting

Don't specify complete painting of shop fabrications. Specify only the primer and then let the steel lie in the mud awhile. This is a neat way to waste the shot blast and primer and create added expense. The waste measurement here is only fair at 20 cents per sq ft, but an "A" is given for effort.

VI. Good Paint on Tower--Improperly Mixed

Don't mix paints the recommended way. Poor mixing can create a nice eyesore while wasting \$50-\$75 per man day.

VII. Skips and Holidays

Don't inspect. Pay the laboratory for evaluating a paint system and the engineer for drafting the specifications around it. Then accept a coloring job without looking at it until it's too late to do anything. A lot of labor, sand, and paint can be wasted--or saved, depending upon which side of the contract is considered.

VIII. Misuse

Finally, don't coddle paint systems. Use a live steam hose on them before they're dry. Lots of good paint can be wasted this way--think of the extra labor at \$4.00 an hour.

This was a short course but it covered a lot of material. Fortunately anyone can flunk; he has only to paint properly the first time and follow up with good spot repairs on schedule. Painting costs can be brought down to a realistic level.

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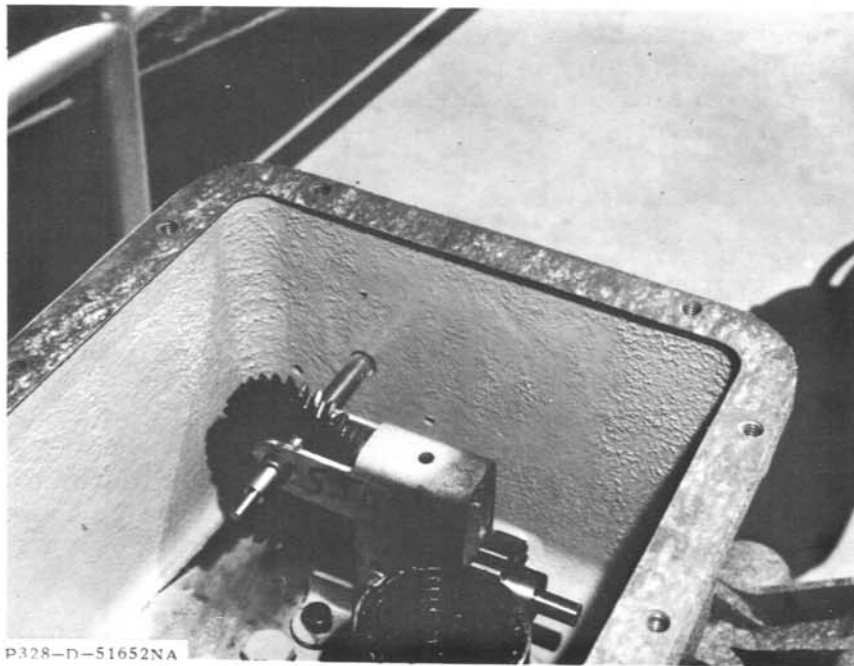
SLIDE GATE POSITION INDICATOR

Operating personnel on the Red Willow Diversion Dam, Red Willow Unit, Frenchman-Cambridge Division, Missouri River Basin Project; have modified the position indicator on the vertical lift gate hoist to permit very close adjustment. The original installation as shown in Photograph No. 1 on the following page, was a dial-type indicator of relatively small diameter with the full travel of the gate being indicated by one complete revolution of the pointer. The gear train driving the pointer is shown in Photograph No. 2.

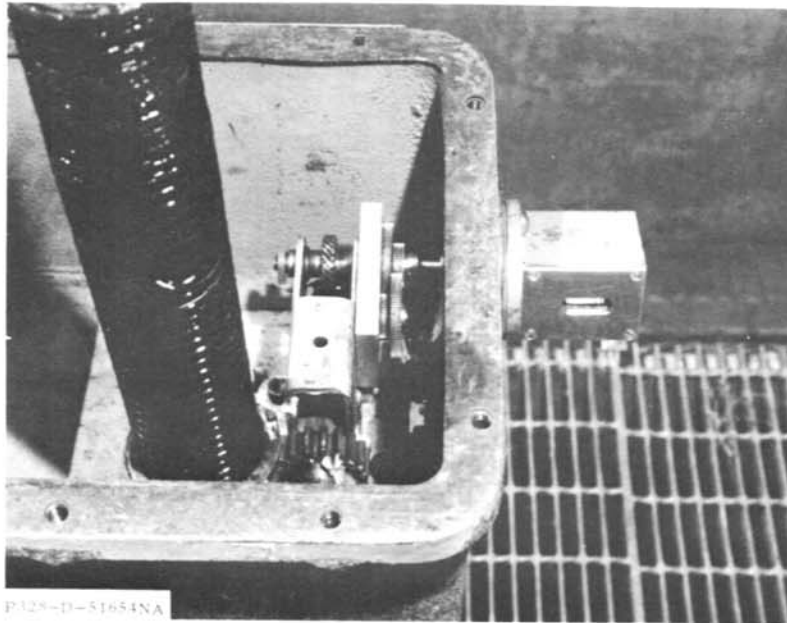
In order to permit closer adjustment of the gate and to indicate the gate opening in feet, tenths and hundredths; the gear train shown in Photograph No. 3 was designed and connected to a revolution counter



Photograph No. 1



Photograph No. 2



Photograph No. 3



Photograph No. 4

type indicator in place of the dial and pointer originally provided. The gate opening is read directly from the counter as shown in Photograph No. 4.

The revolution counter units were fabricated at a cost of about \$150 each. The Kansas River Projects Office reports that the counters are expertly made and are very accurate. They recommend this type of gate position indicator.

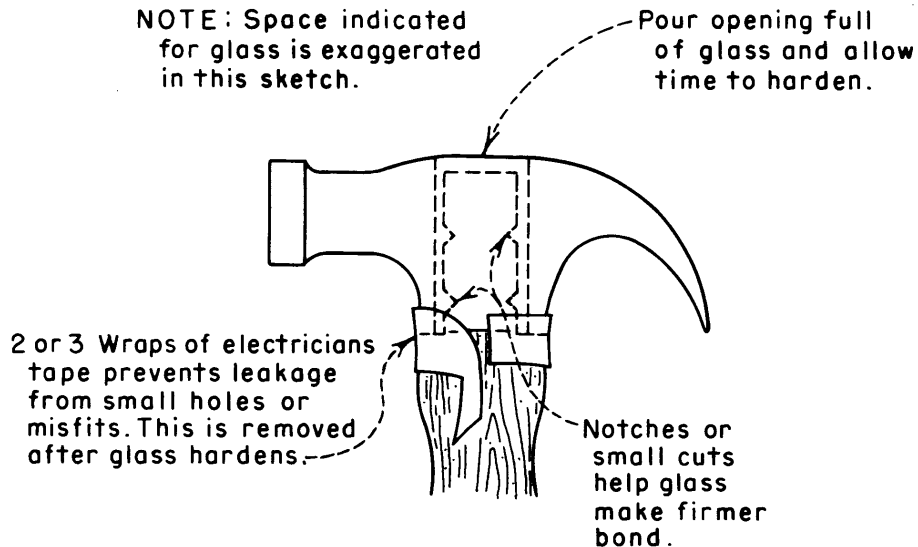
If additional information is desired, write the Chief Engineer, Mail Code D-410, U.S. Bureau of Reclamation, Denver Federal Center, Denver, Colorado 80225.

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HOLDING TOOL HANDLES WITH LIQUID GLASS

(Reprinted by permission of PLOWBACK, September 1964 issue, a publication by the National Park Service, Washington, D.C.)

When placing handles of hammers, axes, mauls, and other tools, Maintenance Foreman Eugene J. Koevening, Mount Rushmore National Memorial, uses what he calls liquid glass to hold the head firmly on the wooden handle. The material used is actually a catalyzed polyester liquid plastic similar to the type of material used to fill fiberglass cloth utilized in covering boats and in repairing other wooden objects. Mr. Koevening uses a material similar to Herter's Resinote obtainable from sporting goods and some hardware stores. The sketch below shows how he does it, and the method used eliminates tedious precision



HOLDING TOOL HANDLES WITH LIQUID GLASS

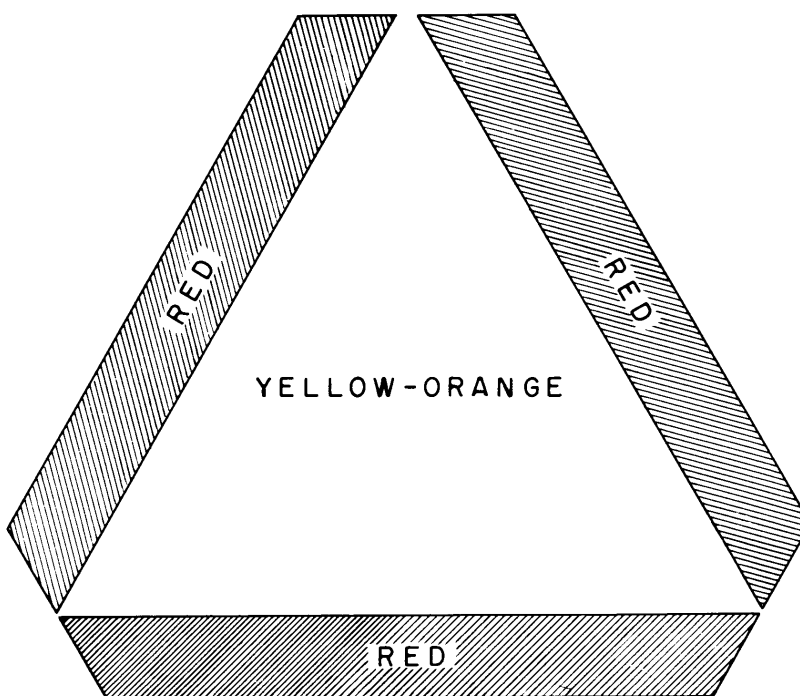
fitting of wood to metal or the use of wedges to hold heads in place. Heads will not loosen, and the handles are actually strengthened by a complete bond. Time required to do the job is reduced 50 to 60 percent by using the liquid glass.

Should the new handle break, the glass may be removed by burning it out.

Mr. Koevening says that this material has withstood all normal use without fracturing.

* * * * *

SLOW-MOVING VEHICLE EMBLEM



The Farm Conference of the National Safety Council, recently adopted the following statement concerning the Slow-Moving Vehicle emblem: "The Farm Conference of the National Safety Council recommends the use of the approved Slow-Moving Vehicle emblem as a unique means for aiding in the identification of slow-moving vehicles."

The new American Society of Agricultural Engineers Recommendation defines the usage of and includes specifications for Slow-Moving Vehicle emblems, and is intended as a guide for those who use and make the emblem so that uniformity will be achieved.

Among the items covered by the new Recommendation are:

1. The SMV emblem is not intended to replace tail lights or warning flags, but to supplement such devices.
2. The center shall be a yellow-orange fluorescent film and the border shall be a reflective red material, the center suitable for daytime viewing and the border for nighttime viewing. The fluorescent and reflective materials used shall be tough, flexible films suitable for application on metal surfaces.
3. The background material shall be metal and of sufficient strength and thickness to withstand normal physical distortion and exposure to the elements.
4. The SMV emblem shall be mounted point up in a plane perpendicular to the direction of travel and whenever practical shall be placed at the rear of the vehicle, at the center of mass, 3 to 5 feet above the ground. It shall be visible day and night at least 500 feet from the rear.
5. The emblem is intended as a unique identification and shall be used only on vehicles which by design move at 25 miles per hour or less on the public roads. The emblem is not a clearance marker for wide machinery, nor is it intended to replace the required lighting and marking of slow-moving vehicles.
6. Neither the color film pattern and its dimensions, nor the backing shall be altered to permit the use of advertising or other markings.

All interested groups and organizations are urged to promote the SMV emblem in their states and communities. Active promotion is needed to gain wide emblem usage and to educate drivers on what the emblem means. Emblems can help protect both slow vehicle operators and motor vehicle operators only if the driving public is aware that this emblem is a unique device to identify slow-moving vehicles. Therefore, building public recognition of the unique emblem "message" is just as important as getting farmers to use emblems.

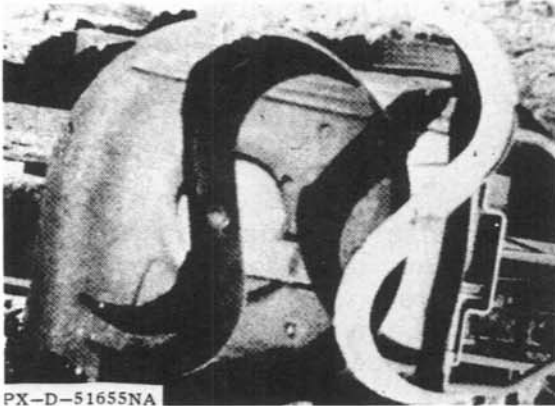
Additional detailed information on the SMV emblem (such as where emblems can be secured) can be yours by contacting the Farm Department of the National Safety Council. Write to either the Farm Department or the American Society of Agricultural Engineers for a copy of the SMV Emblem Recommendation.

* * * * *

"S" FOR SAFETY MOWER BLADE

(Reprinted by permission of GRIST, July/August 1963 issue, a publication by the National Conference on State Parks, Washington, D.C.)

Last year there were more than 96,000 accidents involving rotary mowers. Safety in the mowing operation is a matter of high concern to park people with thousands of acres to be mowed. Now comes an "S" shaped blade, with impellers, which insures that objects are gently swept from its path without damage to bystanders, property, or mower.



Photograph No. 1

The new blade operates in such a way as to avoid tangling of material about the blade or its drive shaft. For instance, wire is picked up into a ball and rolled aside. The "S" design minimizes vibration and allows the mower to operate at slower speed, thus saving engine wear.

Hardened well within safety tolerances as determined by insurance company research laboratories, the blade is shatterproof, withstands impact without breakage. Soft grasses

and heavier growth of grass, weeds, grain stalks, etc. are all cut smoothly and efficiently. The principal of this "S" blade is entirely new and unlike any other now on the market, according to the manufacturer.

For further information, please write Chief Engineer, Attention: Code 400, Bureau of Reclamation, Building 53, Denver Federal Center, Denver, Colorado 80225.

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LUBRICATION OF WIRE ROPES

The lubrication of wire ropes, including stainless steel ropes can be improved by the use of Lubriplate No. 63AA, or equal, thinned with solvent to a consistency permitting easy penetration into the interior of the rope. After brushing the thinned lubricant onto the rope, the solvent will evaporate and leave the lubricant in the rope to serve its purpose.

* * * * *

INTERLOCK GRATING

A relatively new product now on the market consists of a one-piece metal grating steel plank that can be used for catwalks, step treads, maintenance walkways, staging platforms scaffolding and for similar uses, as shown in photographs on the following pages.

The planking can be obtained as a one-piece pierced section or in smooth panels. The latter being particularly useful as a flooring for platforms or for shelving.

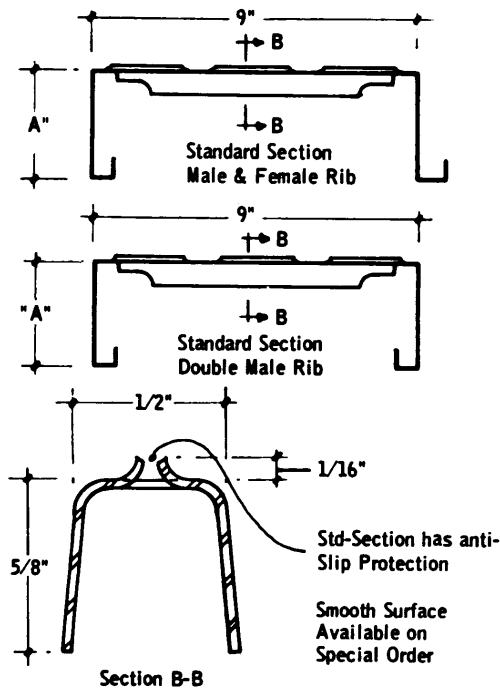
The grating is interlocking with the interlocking ribs being 2-1/2, 3 or 4 inches deep. They have both male and female ribs that interlock to give a width of any multiple of 9 inches. Double male planks are available for making a finished edge, or where the interlocking feature is not required.

Planks are stocked in lengths of 20 feet, but on special order, shorter lengths can be obtained. For assembling longer lengths, punched splice-plates are available, and can be attached to any designed supports by various means such as J-bolts, standard bolts, or by welding. Standard

sizes available are shown in the sketch below.

STANDARD SIZES

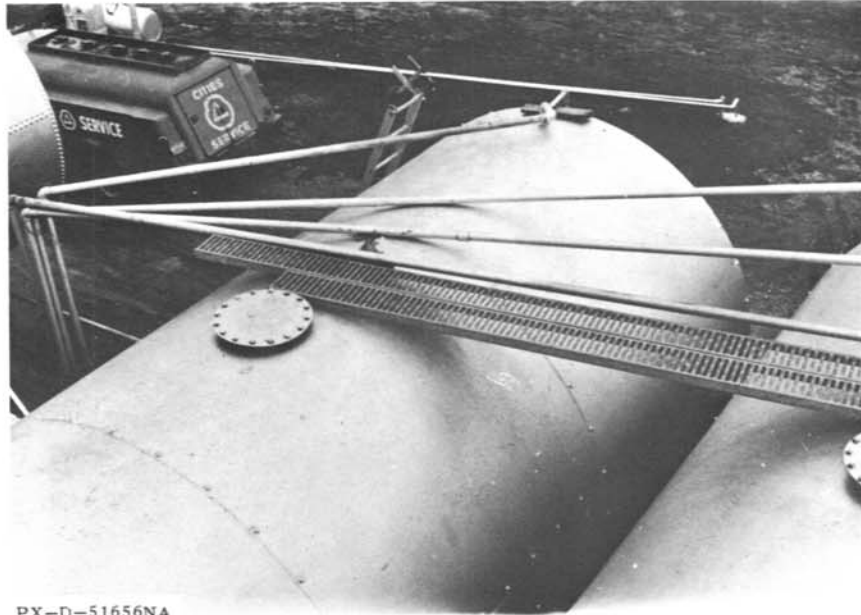
Width	Depths	Gages	Lengths
9"	2½", 3", 4"	14, 16, 18	20' Max.



The material used in the grating is a high-quality steel, coated with zinc by the continuous hot-drip process at the mill prior to fabrication.

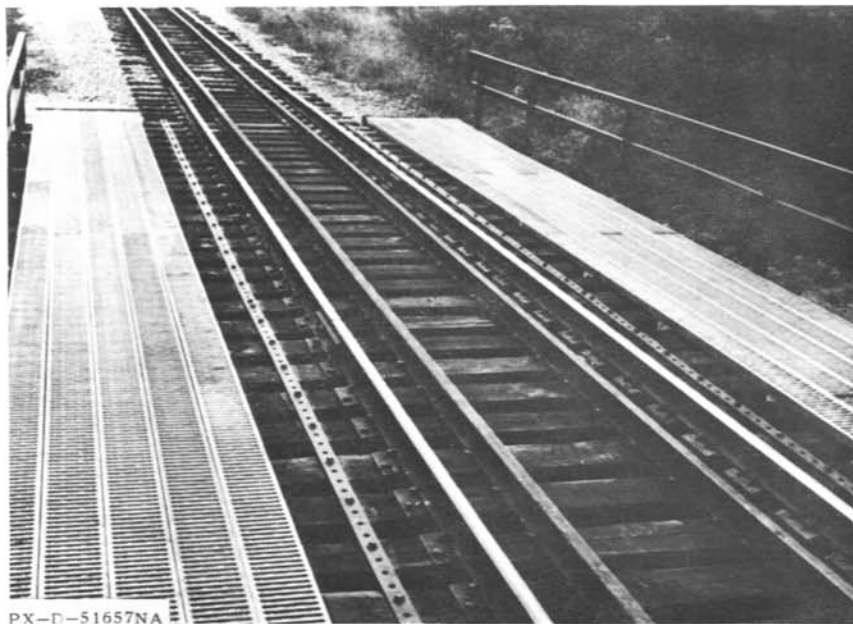
Grating surface is made by deforming the face of the planks into a series of transverse ribs, with shoe gripping ridges and slots approximately 1/16-inch high on the transverse tread ribs.

The manufacturer suggests that the grating can easily fit into construction or architectural plans, being simple in design and requiring only a minimum of support and connection. It has a wide range of load carrying capacity and by means of upturned slits, maximum skid-proofing and sure footing are provided.



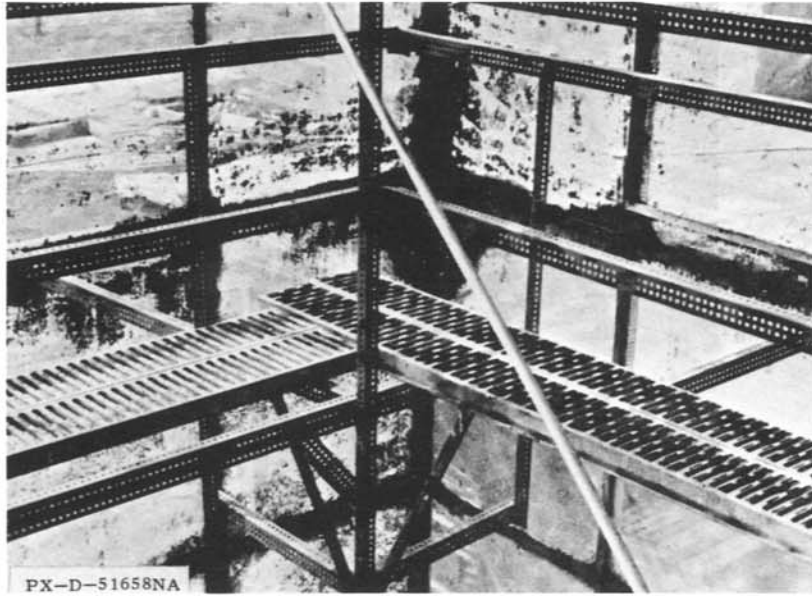
PX-D-51656NA

Photograph No. 1



PX-D-51657NA

Photograph No. 2



Photograph No. 3



Photograph No. 4

Raw edges of the grating are largely protected against corrosion by the sacrificial galvanic action of the zinc. Therefore, long life is claimed by the manufacturer under all normal conditions.

Another advantage could be the removal of the grating with little loss where changing conditions might require its use elsewhere.

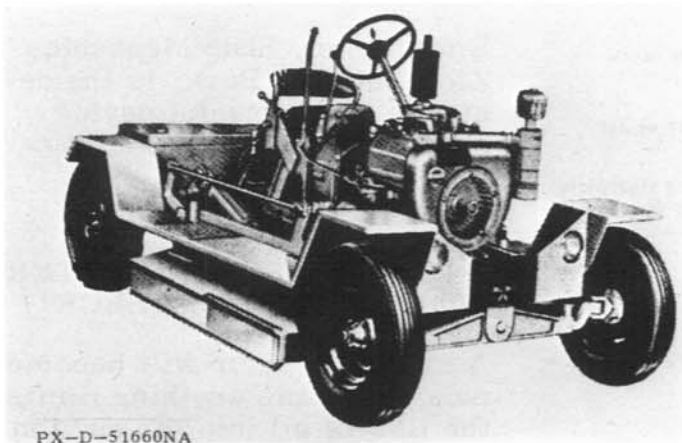
If further information is desired, write the Chief Engineer, Bureau of Reclamation, Attention: Code 410, Denver Federal Center, Denver, Colorado 80225.

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CUT GRASS AT 36 MILES PER HOUR

(Reprinted by permission of GRIST, November/December, 1963 issue, a publication by the National Conference on State Parks, Washington, D.C.)

Something new in the way of a fast-moving, self-powered grass and weed mower was demonstrated earlier this year to National Park Service officials near Washington, D.C. Manufactured in Springfield, Missouri, the machine might be mistaken for a jeep at a distance, but as the photograph shows, it can be seen to be a 60-inch rotary mower riding under a sturdy four-wheel frame.



Photograph No. 1

plenty of power for any type of cutting, with speeds up to 36 miles per hour. The tractor-type transmission has four forward speeds and reverse.

The blades are free swinging and covered by a completely enclosed steel housing, making mowing of litter-strewn and rocky areas safe even in congested areas. For further information, please write Chief Engineer, Attention: Code 400, Bureau of Reclamation, Building 53, Denver Federal Center, Denver, Colorado 80225.

* * * * *

CRANKCASE OIL CATCHER

(Reprinted by permission of GRIST, May/June 1965 issue, a publication by the National Conference on State Parks, Washington, D.C.)

The crankcase draining device shown in the photograph and sketch, besides being inexpensive and easy to make in the shop, has some other advantages over commercial receptacles for used oil.

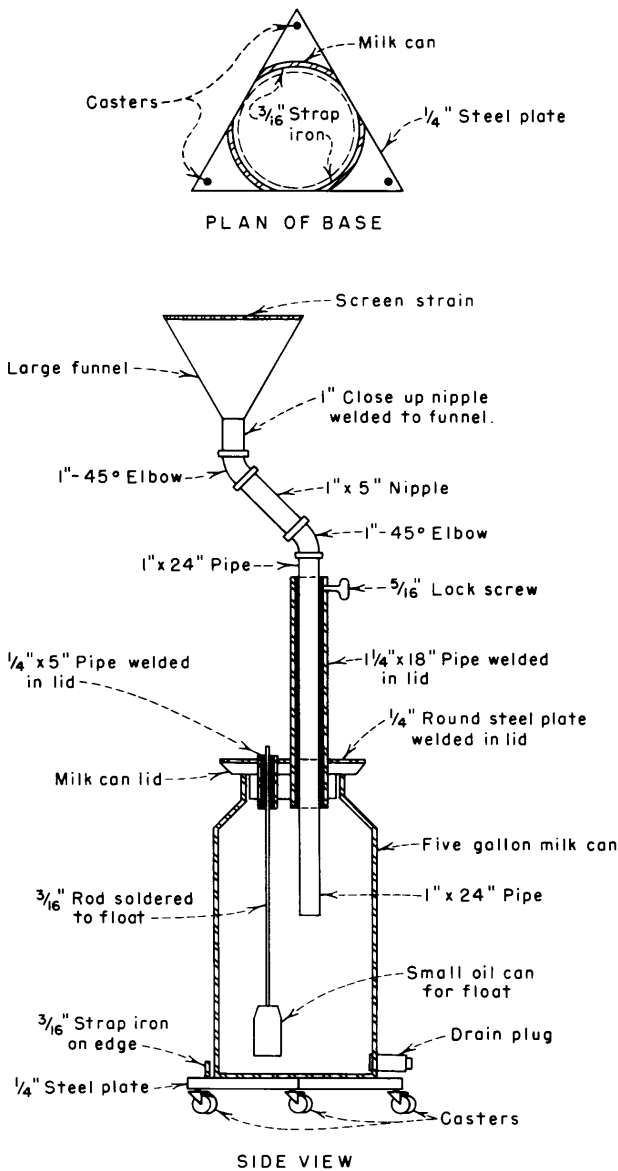


Figure 1

It is made from a five-gallon milk can mounted on a triangular base with casters, so that it may be rolled under vehicles. It can swing in a 360 degree circle and the funnel and pipe can be raised to the needed height, up to five feet.

A float indicates the amount of oil in the can. By removing the top assembly the full can may be removed and an empty one put in its place in minutes. There is also a drain plug at the bottom of each can.

Emil Justet, Shop Mechanic, Zion National Park, is the designer of this useful device shown in Figure 1 at left.

* * * * *

HYDRAULIC PUMP CHATTER: FOUR THINGS TO CHECK^{1/}

A hydraulic pump will become noisy any time anything limits the flow of oil into the suction side.

Since the hydraulic fluid is the pump's only source of lubrication, noise and chatter calls for immediate correction unless you have a relative in the hydraulic pump business.

First: Check the inlet screen to make sure it isn't plugged. If the system is equipped with filters, check the filter to see that it has been serviced at the right intervals. Dirt is death to close fitting hydraulic pumps, so check screens and filters carefully.

Second: Fluid viscosity. If the hydraulic oil is too viscous (thick) at the prevailing ambient air temperature, it will not flow fast enough to feed smoothly into the pump intake. Pump chatter due to wrong fluid viscosity is most likely to occur when the pump is just started up, and may disappear as the oil warms up, and thins out enough to flow quickly into the pump suction line.

Third: Check for an air leak in the pump shaft seal, joints of the pump intake pipe. You can check these leaks by pouring some oil over the point where you suspect the leak may be. The oil will temporarily seal the leak and make the pump sound different.

Fourth: Make sure the oil in the reservoir is right up to the full mark. Otherwise air could leak into the pump intake. Low level may also let the return oil splash into the reservoir instead of feeding in below the surface.

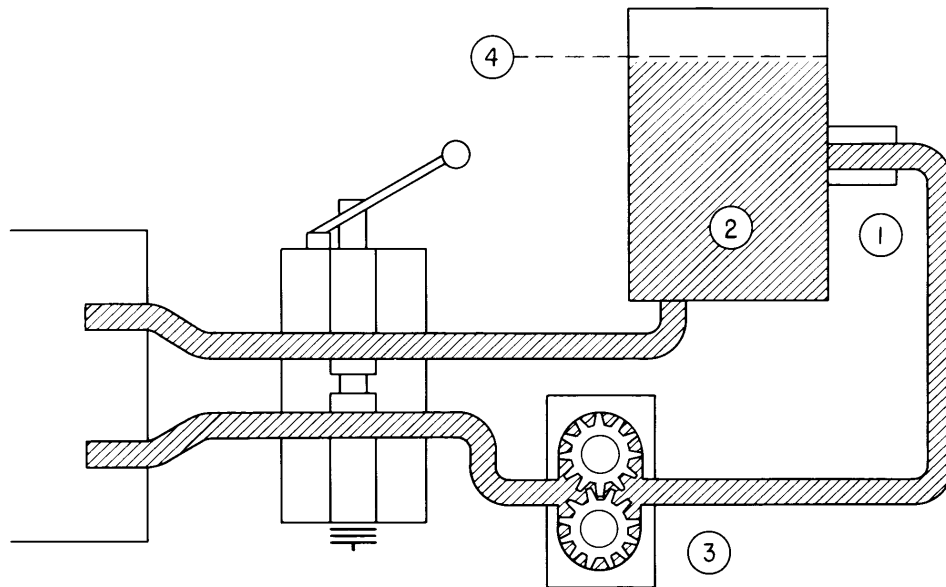


Figure 1

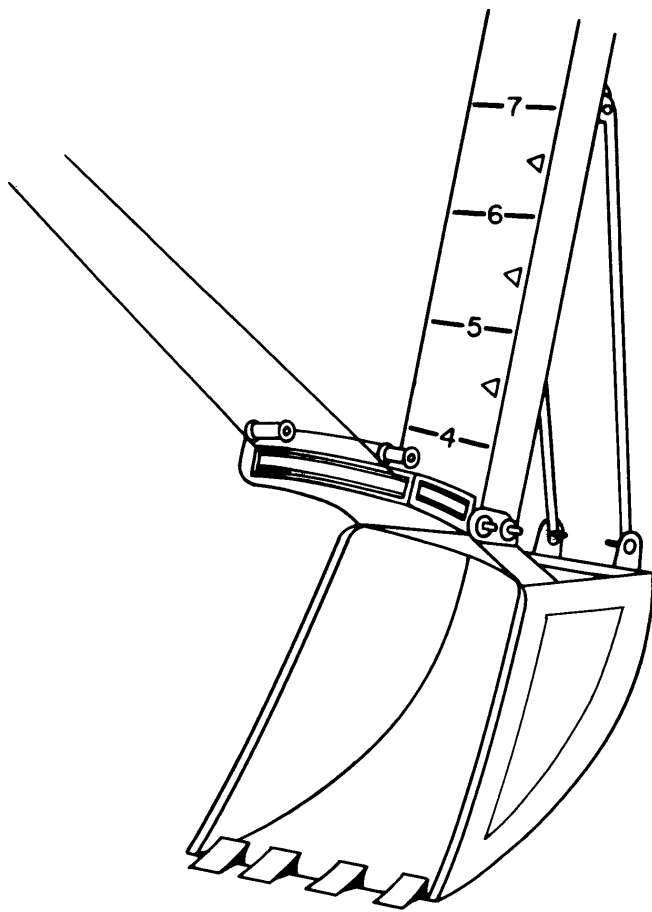
1/Reprinted by permission of the editor of Contractors and Engineers in the May 1965 issue, from "Lube Logic".

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BACK HOE CARRIES ITS OWN YARDSTICK

(Reprinted by permission of GRIST, May 1963 issue, a publication by the National Conference on State Parks, Washington, D.C.)

The "guess-and-by-golly" method of figuring depth of cut for a ditch as used by some back hoe operators can result in a ditch where the grade is wrong and the water won't flow. So usually the operator must wait for frequent interruptions by a surveyor to check grade as the cut progresses. Frank Holst in Yellowstone National Park has found a way to mark the back hoe digging arm so that after the grade line is laid out the experienced operator can judge his distances so accurately that for many ditch cutting jobs there is no need for constant rechecks by the surveyor.



As the picture at left shows, the award winning suggestion is to paint accurate foot marks along the arm of the back hoe, clearly visible to the operator. With this marked arm, one can make cuts 9 feet deep along a 100 foot ditch, coming within 2 or 3 inches of perfect accuracy.

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Photograph No. 1