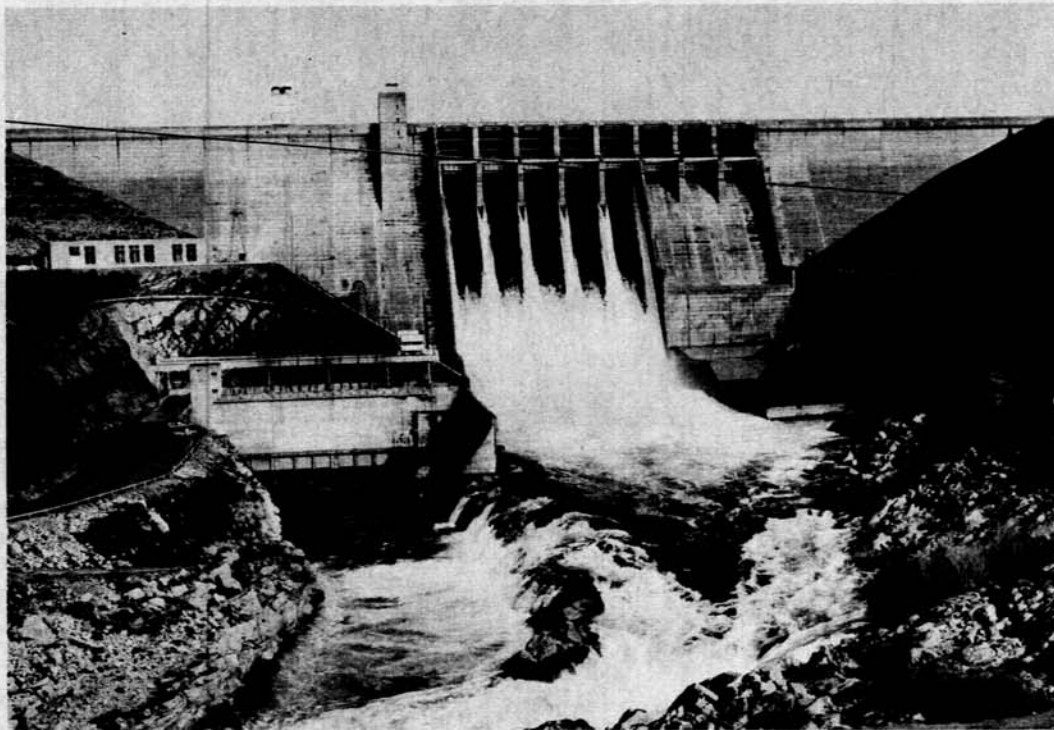


# WATER OPERATION AND MAINTENANCE

BULLETIN NO. 96

JUNE 1976



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REMOVABLE SECTION TRASHRACK

**UNITED STATES DEPARTMENT OF THE INTERIOR**

**BUREAU OF RECLAMATION**

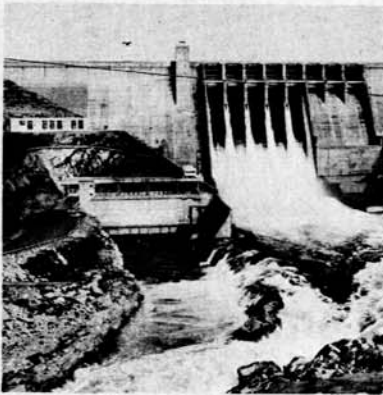
The Water Operation and Maintenance Bulletin is published quarterly for the benefit of those operating water-supply systems. Its principal purpose is to serve as a medium of exchanging operation and maintenance information. It is hoped that the reports herein concerning laborsaving devices and less costly equipment and procedures will result in improved efficiency and reduced costs of the systems for 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.

Any information combined in this bulletin regarding commercial products may not be used for advertisement or promotional purposes and is not to be construed as an endorsement of any product by the Bureau of Reclamation.

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Division of Water Operation  
and Maintenance  
Engineering and Research Center  
Denver, Colorado 80225



COVER PHOTOGRAPH:

Folsom Dam operated by the U.S. Bureau of Reclamation, controls the American River a few miles upstream from Sacramento, Calif. Runoff from a heavy storm is being released through the spillway of the dam.

UNITED STATES DEPARTMENT OF THE INTERIOR  
Thomas S. Kleppe  
Secretary of the Interior

BUREAU OF RECLAMATION  
Gilbert G. Stamm  
Commissioner

WATER OPERATION AND MAINTENANCE  
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June 1976

INTRODUCTION

The article on page 1, describes a different, inexpensive exhaust pipe that was used with great success in removing hazardous fumes from the Delta Pumping Plant, when repairing large pump impellers.

Proper water measurement is just good irrigation practice as pointed out in the article on page 6.

A unique backup warning system for older trucks that was suggested by personnel of the White Sands National Monument can be found on page 8.

"Rollover Protective Bar For Trencher" is the title of the article on page 9 which was built especially for this machine by shop personnel.

Pages 10 and 11 describe in detail some insects and arachnids that employees may be exposed to on or off the job.

Safety can never be overemphasized, especially when working with powered equipment and just being aware of the hazards mentioned in the article on page 12 will be a start in the right direction.

A simple idea for holding a plumb bob steady in the wind is described in a short article on page 14.

Trashracks serve a vital roll in the operation of water supply systems and the trashrack described in the article starting on page 15 is most unique in that it serves a two-fold purpose.

AN EASY, INEXPENSIVE EXHAUST "PIPE"<sup>1</sup>  
FOR USE IN PUMP REPAIR

From time-to-time, inspection reveals that large pump impellers have become eroded and pitted. When this condition reaches a certain point the pump must be stopped, de-watered, and the impeller repaired. The usual method is to cut or grind the pitted areas smooth, which removes a certain amount of material. Then, using a welding machine, stainless steel is layed into the repair area and is ground and polished smooth again. All of these processes generate dust, smoke and heat. Since the work usually takes place in the close confinements of the scroll case all of the undesirable by-products must be removed or dealt with in some way. There are commercial blowers and vacuum systems available and in general use. Such equipment must meet certain requirements, however.

A really powerful blower or exhaust fan in the scroll case would not be possible during the welding process. High-pressure air would tend to blow away the protective envelope of gas over the hot metal. A low-pressure vacuum or blower that exhausts into the pumping plant outside of the scroll case always creates the danger of metal particles being deposited in, and on, the sensitive machines and equipment. A common practice is to rent or possibly buy a canvas "pipe" with blower attachment. This arrangement allows the fumes and dust to be exhausted up out of the pumping levels and into the outside atmosphere. However, with the wear-and-tear of hauling the tube up stairways and around corners, and with the metallic particles being blown under pressure through them, the canvas tubes require frequent repair and cleaning. Using them runs into money. When the time came for repair work down in the Delta Pumping Plant recently, Mr. Tom Hardesty, HEP Mechanic Foreman, was determined to find a better system for ventilating the work.

Activity in the scroll cases would take a total of four to six weeks, since extensive welding was needed. Hauling a canvas exhaust tube around for that time would probably wear it out. There would also have to be several laundering sessions for the cloth tube. With the approval of Bud Byron, his Supervisor, Tom obtained some strips of plastic and some contact tape and tried his hand at improvising.

Description

The plastic sheet was of 4-mil thickness, 36 inches wide and 120 feet long. First Tom laid it out flat on the floor of the Plant, then he

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<sup>1</sup> Reprinted by special permission of the Editor from a recent issue of Technical Bulletin No. 24, a State of California, Department of Water Resources publication.

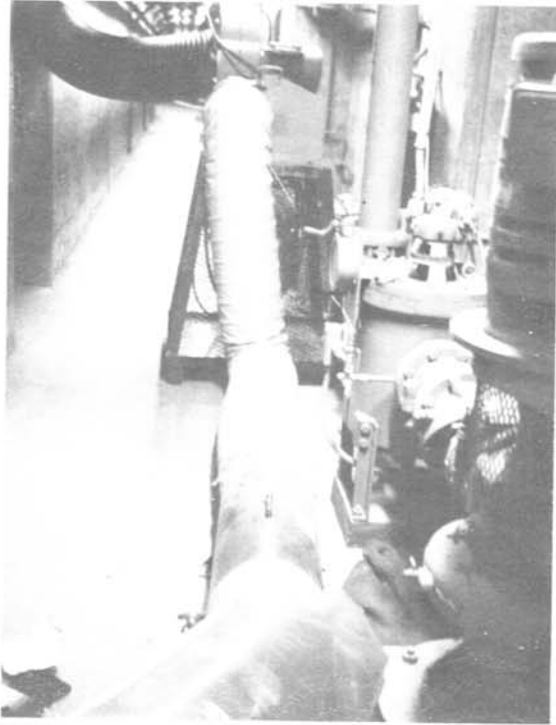


Figure 1

used (Fig. 1) to draw the smoke and dust out of the scroll case. A water-spray attachment allows the majority of the dust to be dampened down and then removed (Fig. 2). The plastic pipe is more durable and wears better than canvas. Even if the pipe wears thin with moving or bending a new section can be taped in place with no difficulty. Also, the plastic does not retain metal particles like the canvas pipe; the plastic does not have to be removed and washed periodically. No special clamp-rings are needed to attach the plastic pipe to the blower. The plastic is simply folded and taped in place.

Total cost for a canvas pipe rented from an equipment firm

folded the two edges over until they lapped. With help, he then sealed the two edges with strips of strong, glass packing tape. For good measure he put some reinforcing rings of tape around the newly-formed "pipe". Several 120-foot sections of this pipe were then taped together to make a continuous tube long enough to reach from the scroll case up the one or two flights to an outside entrance of the Pumping Plant.

In it's journey, the pipe makes some rather sharp 90-degree-bends but the air pressure inside does not seem to be adversely effected and it functions as well as could be desired.

A 5-hp, positive-pressure fan is



Figure 2

for the duration of the job would be approximately \$150. The plastic costs a fraction of that, and can be thrown away at the end of the repair operation.

The following illustrations show some views of the big, plastic hose on it's way up through the stairwells of the Pumping Plant.



Coming Up! The pipe mounting the stairway from the turbine pit.

Figure 3



At the head of the stairs, the pipe makes a series of sharp-angle bends to get to the next flight of stairs.

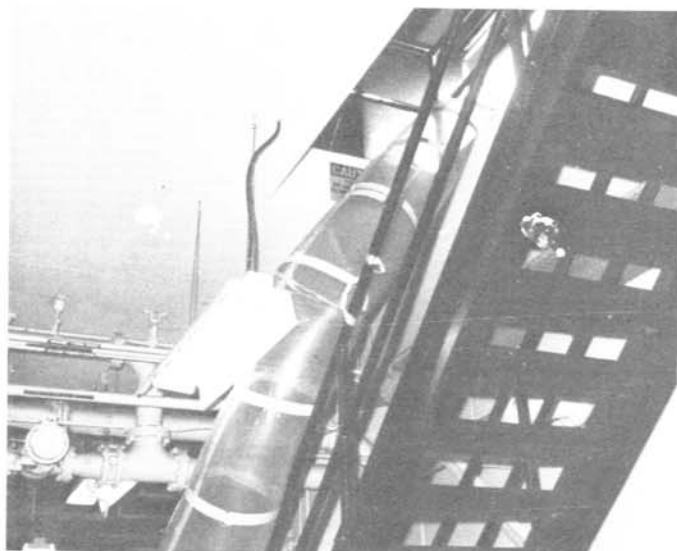
Figure 4





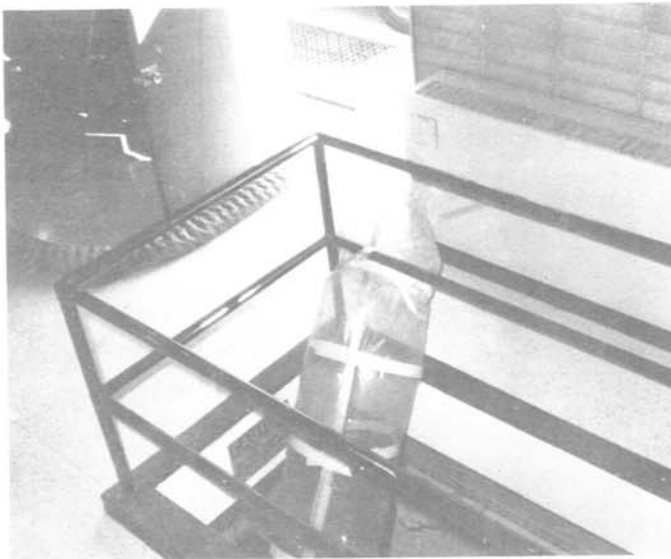
The pipe snakes across the room and up and over the hand rail of the second stairway.

Figure 5



Another view of the pipe crossing over the second stairway in a direct line for the outside door.

Figure 6



A view of the doorway leading to the Pumping Plant parking lot. The pipe is taped to one of the uprights of the guardrailing around the stairwell.

Figure 7

If additional information is desired regarding this unique exhaust pipe arrangement, please write to the State of California, Department of Water Resources, P.O. Box 388, Sacramento, CA 95802

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As the Nation's principal conservation agency, the Department of the Interior has responsibility for most of our nationally owned public lands and natural resources. This includes fostering the wisest use of our land and water resources, protecting our fish and wildlife, preserving the environmental and cultural values of our national parks and historical places, and providing for the enjoyment of life through outdoor recreation. The Department assesses our energy and mineral resources and works to assure that their development is in the best interests of all our people. The Department also has a major responsibility for American Indian reservation communities and for people who live in Island Territories under U.S. administration.

Annual Report - Colorado River Basin 1975



## IRRIGATOR'S ARITHMETIC<sup>1</sup>

Irrigation water management begins with knowing how much water you have available and involves some arithmetic, say Agricultural Engineers. The most common mistake when working with water measurement units is to accidentally substitute one flow unit or volume unit for another without proper conversion. The conversion table below, compiled at Oklahoma State University can help avoid such errors.

**CONVERSION TABLE FOR UNITS OF FLOW**

Units	Cubic Feet Per Second	Gallons Per Minute	Million Gallons Per Day	Acre-Inches Per 24 Hours	Acre-Feet Per 24 Hours
Cubic Feet Per Second	1.0	448.8	0.646	23.8	1.984
Gallons Per Minute	0.00223	1.0	0.00144	0.053	0.00442
Million Gallons Per Day	1.547	694.4	1.0	36.84	3.07
Acre-Inches Per 24 Hours	0.042	18.86	0.0271	1.0	0.0833
Acre-Feet Per 24 Hours	0.504	226.3	0.3259	12.0	1.0

### List of Equivalents

The following equivalents are useful for converting from one unit to another and for calculating volumes from flow units.

#### Volume Units

##### One gallon

- = 231 cubic inches
- = 0.13368 cubic foot weighs approximately 8.33 pounds

##### One cubic foot

- = 1,728 cubic inches
- = 7.481 gallons (7.5 for ordinary calculations) weighs 62.4 pounds (62.5 for ordinary calculations)

##### One acre-inch

- = 3,630 cubic feet
- = 27,154 gallons (27,200 for ordinary calculations)
- = 1/12 acre-foot weighs approximately 113.1 tons

##### One acre-foot

- = 43,560 cubic feet
- = 325,851 gallons
- = 12 acre-inches weighs approximately 1,357 tons

### Conversion Formulas

The following formulas are handy for computing the approximate depth of water applied to a field.

$$\frac{\text{Cubic feet per second} \times \text{hours}}{\text{acres}} = \frac{\text{acre-inches per acre, or average depth in inches.}}$$

$$\frac{\text{Gallons per minute} \times \text{hours}}{450 \times \text{acres}} = \frac{\text{acre-inches per acre, or average depth in inches.}}$$

**Example:** What average depth of water would be applied to an 80 acre field if a farmer pumped 750 gpm for 8 days (pumping 24 hours a day)?

#### Solution:

$$\frac{\text{Gallons per minute} \times \text{hours}}{450 \times 80} = \frac{\text{average depth in inches.}}$$

$$\frac{750 \text{ gpm} \times 8 \text{ days} \times 24 \text{ hours day}}{450 \times 80} = \frac{4 \text{ inches average depth.}}$$

### Using the Table

First locate the known unit of measurement in the left hand column headed "Units". Next, moving to the right, select the appropriate conversion factor listed under the vertical column with the heading of the desired unit of measurement.

<sup>1</sup> Reprinted from the July/August 1975 issue of Irrigation Age.

Example:

A well yielding 750 gallons per minute will supply how many acre inches in 24 hours?

Step 1: Locate the line labeled "Gallons Per Minute" in the left-hand column labeled "Units".

Step 2: Move to the right along the "Gallons Per Minute" line and read 0.053 under the column headed "Acre-Inches Per 24 Hours".

Step 3:  $750 \times 0.053$  equals 39.75. The 750 gpm well will yield 39.75 inches in 24 hours.

Example:

How many cubic feet per second are required to make a 4 inch gross application on 40 acres of land in 72 hours?

Step 1: 40 acres x 4 inches equals 160 acre-inches gross application. The conversion table shows factors for converting acre-inches per 24 hours to cubic feet per second. 72 hours divided by 24 hours equals 3 days. 160 divided by 3 equals 53.33 acre-inches per 24 hours.

Step 2: Locate the line labeled "Acre Inches Per 24 Hours" in the left hand column headed "Units".

Step 3: Move to the right and under the vertical column labeled "Cubic Feet Per Second" read 0.042.

Step 4:  $53.33 \times 0.042$  equals 2.23986. It will require approximately 2 cfs to apply 4 inches of water on 40 acres in 72 hours.

\* \* \* \* \*

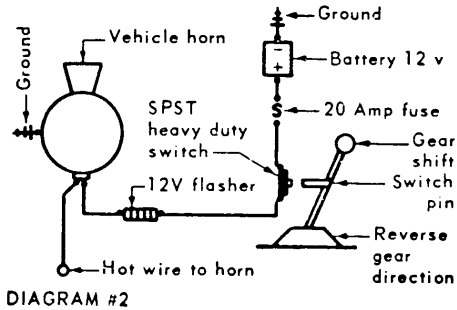
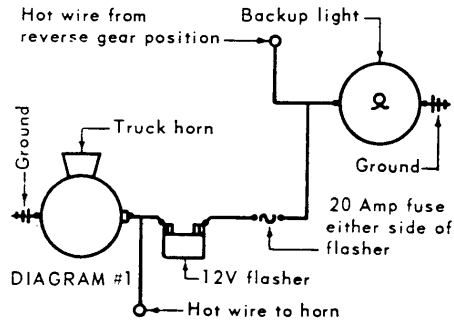
There is a continuing miracle of wealth, productivity, economic stability and growth as a result of the Bureaus project works. This is the 120-year-old reclamation movement - an improvement of our environment and conservation of our natural resources - in which the Federal Government has been an active participant through the Bureau of Reclamation for nearly 75 years.

## MAKE YOUR OWN BACK-UP WARNING SYSTEM

(Reprinted from the November/December 1975 issue of GRIST,  
a publication by the National Conference on State Parks,  
Washington, D.C.)

Most new trucks have automatic back-up warning systems, but older trucks must be fitted with expensive systems which can be avoided by using the suggestions made by Chief Ranger Hugh H. Bozarth and Maintenance Foreman William T. Cunningham of White Sands National Monument.

The men suggest using a 12-volt, heavy duty automotive flasher and a 20-ampere fuse. These are cut into a length of #14 electrical wire running between the hot wire to the truck's back-up light and the terminal to the truck's horn. The flasher is mounted as close as possible to the truck's horn and secured by an easily constructed galvanized pipe strap. Solderless terminals, matching the connectors on the flasher, should be used. See diagram.



Diagram

Splices to the hot horn and back-up wires should be soldered and taped.

When the gear shift is in reverse, current flows along the hot back-up wire to both the back-up lights and the flasher and thus to the horn, causing it to sound off intermittently, warning anyone standing nearby.

\* \* \* \* \*

## ROLLOVER PROTECTIVE BAR FOR TRENCHER<sup>1</sup>

The trencher shown (Fig. 8) is widely used by field personnel of the Mid-Pacific Region, Fresno Central Valley Project Construction Office, Fresno, California. The trencher is equipped with tempered steel rock teeth, located at the front of the unit and not visible in the photograph. It is capable of excavating a maximum depth of 4 feet. These special teeth keep down time to a minimum and are built extra strong to lift rocks from trench without bending or breaking off.



Figure 8










Side controls shown in the center of photograph are used in the operation of the machine. Machine is operated from the side with the operator standing on the ground. The bulldozer blade rotates sideways for easy backfilling of the trench. A safety feature on this machine is the anti-rollbar mounted at rear of the unit. It was especially designed and fabricated for this particular machine.

If more information is desired regarding this piece of equipment, please write to the Project Construction Engineer, USBR, Fresno Central Valley Project Construction Office, 1130 "O" Street, Room 5301, Fresno, California 93721.










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<sup>1</sup> Reprinted by special permission from the Reclamation Safety News, Second Quarter 1975.

SOME INSECTS AND ARACHNIDS EMPLOYEES MAY BE EXPOSED TO ON OR OFF THE JOB

	DESCRIPTION	HABITAT	PROBLEM
 <b>CHIGGER</b>	Oval with red velvety covering. Sometimes almost colorless. Larva has six legs. Harmless adult has eight and resembles a small spider. Very tiny—about 1/20-inch long.	Found in low damp places covered with vegetation: shaded woods, high grass or weeds, fruit orchards. Also lawns and golf courses. From Canada to Argentina.	Attaches itself to the skin by inserting mouthparts into a hair follicle. Injects a digestive fluid that causes cells to disintegrate. Then feeds on cell parts. It does not suck blood.
 <b>BEDBUG</b>	Flat oval body with short broad head and six legs. Adult is reddish brown. Young are yellowish white. Unpleasant pungent odor. From 1/8 to 1/4-inch in length.	Hides in crevices, mattresses, under loose wallpaper during day. At night travels considerable distance to find victims. Widely distributed throughout the world.	Punctures the skin with piercing organs and sucks blood. Local inflammation and welts result from anticoagulant enzyme that bug secretes from salivary glands while feeding.
 <b>BROWN RECLUSE SPIDER</b>	Oval body with eight legs. Light yellow to medium dark brown. Has distinctive mark shaped like a fiddle on its back. Body from 3/8 to 1/2-inch long, 1/4-inch wide, 3/4-inch from toe-to-toe.	Prefers dark places where it's seldom disturbed. Outdoors: old trash piles, debris and rough ground. Indoors: attics, storerooms, closets. Found in Southern and Midwestern U.S.	Bites producing an almost painless sting that may not be noticed at first. Shy, it bites only when annoyed or surprised. Left alone, it won't bite. Victim rarely sees the spider.
 <b>BLACK WIDOW SPIDER</b>	Color varies from dark brown to glossy black. Densely covered with short microscopic hairs. Red or yellow hourglass marking on the underside of the female's abdomen. Male does not have this mark and is not poisonous. Overall length with legs extended is 1 1/2 inch. Body is 1/4-inch wide.	Found with eggs and web. Outside: in vacant rodent holes, under stones, logs, in long grass, hollow stumps and brush piles. Inside: in dark corners of barns, garages, piles of stone, wood. Most bites occur in outhouses. Found in Southern Canada, throughout U.S., except Alaska.	Bites causing local redness. Two tiny red spots may appear. Pain follows almost immediately. Larger muscles become rigid. Body temperature rises slightly. Profuse perspiration and tendency toward nausea follow. It's usually difficult to breathe or talk. May cause constipation, urine retention.
 <b>SCORPION</b>	Crablike appearance with claw-like pincers. Fleshy post-abdomen or "tail" has 5 segments, ending in a bulbous sac and stinger. Two poisonous types: solid straw yellow or yellow with irregular black stripes on back. From 2 1/2 to 4 inches.	Spends days under loose stones, bark, boards, floors of outhouses. Burrows in the sand. Roams freely at night. Crawls under doors into homes. Lethal types are found only in the warm desert-like climate of Arizona and adjacent areas.	Stings by thrusting its tail forward over its head. Swelling or discoloration of the area indicates a non-dangerous, though painful, sting. A dangerously toxic sting doesn't change the appearance of the area, which does become hypersensitive.
 <b>BEE</b>	Winged body with yellow and black stripes. Covered with branched or feathery hairs. Makes a buzzing sound. Different species vary from 1/2 to 1 inch in length.	Lives in aerial or underground nests or hives. Widely distributed throughout the world wherever there are flowering plants—from the polar regions to the equator.	Stings with tail when annoyed. Burning and itching with localized swelling occur. Usually leaves venom sac in victim. It takes between 2 and 3 minutes to inject all the venom.
 <b>MOSQUITO</b>	Small dark fragile body with transparent wings and elongated mouthparts. From 1/8 to 1/4-inch long.	Found in temperate climates throughout the world where the water necessary for breeding is available.	Bites and sucks blood. Itching and localized swelling result. Bite may turn red. Only the female is equipped to bite.
 <b>TARANTULA</b>	Large dark "spider" with a furry covering. From 6 to 7 inches in toe-to-toe diameter.	Found in Southwestern U.S. and the tropics. Only the tropical varieties are poisonous.	Bites produce pin-prick sensation with negligible effect. It will not bite unless teased.
 <b>TICK</b>	Oval with small head; the body is not divided into definite segments. Grey or brown. Measures from 1/4-inch to 3/4-inch when mature.	Found in all U.S. areas and in parts of Southern Canada, on low shrubs, grass and trees. Carried around by both wild and domestic animals.	Attaches itself to the skin and sucks blood. After removal there is danger of infection, especially if the mouthparts are left in the wound.

National Safety News

SEVERITY	TREATMENT	PROTECTION	
Itching from secreted enzymes results several hours after contact. Small red welts appear. Secondary infection often follows. Degree of irritation varies with individuals.	Lather with soap and rinse several times to remove chiggers. If welts have formed, dab antiseptic on area. Severe lesions may require antihistamine ointment.	Apply proper repellent to clothing, particularly near uncovered areas such as wrists and ankles. Apply to skin. Spray or dust infested areas (lawns, plants) with suitable chemicals.	 <b>CHIGGER</b>
Affects people differently. Some have marked swelling and considerable irritation while others aren't bothered. Sometimes transmits serious diseases.	Apply antiseptic to prevent possible infection. Bug usually bites sleeping victim, gorges itself completely in 3-5 minutes and departs. It's rarely necessary to remove one.	Spray beds, mattresses, bed springs and baseboards with insecticide. Bugs live in large groups. They migrate to new homes on water pipes and clothing.	 <b>BEDBUG</b>
In two to eight hours pain may be noticed followed by blisters, swelling, hemorrhage or ulceration. Some people experience rash, nausea, jaundice, chills, fever, cramps or joint pain.	Summon doctor. Bite may require hospitalization for a few days. Full healing may take from 6-8 weeks. Weak adults and children have been known to die.	Use caution when cleaning secluded areas in the home or using machinery usually left idle. Check firewood, inside shoes, packed clothing and bedrolls — frequent hideaways.	 <b>BROWN RECLUSE SPIDER</b>
Venom is more dangerous than a rattlesnake's but is given in much smaller amounts. About 5 per cent of bite cases result in death. Death is from asphyxiation due to respiratory paralysis. More dangerous for children, to adults its worst feature is pain. Convulsions result in some cases.	Use an antiseptic such as alcohol or hydrogen peroxide on the bitten area to prevent secondary infection. Keep victim quiet and call a doctor. Do not treat as you would a snakebite since this will only increase the pain and chance of infection; bleeding will not remove the venom.	Wear gloves when working in areas where there might be spiders. Destroy any egg sacs you find. Spray insecticide in any area where spiders are usually found, especially under privy seats. Check them out regularly. General cleanliness, paint and light discourage spiders.	 <b>BLACK WIDOW SPIDER</b>
Excessive salivation and facial contortions may follow. Temperature rises to over 104°. Tongue becomes sluggish. Convulsions, in waves of increasing intensity, may lead to death from nervous exhaustion. First 3 hours most critical.	Apply tourniquet. Keep victim quiet and call a doctor immediately. Do not cut the skin or give pain killers. They increase the killing power of the venom. Antitoxin, readily available to doctors, has proved to be very effective.	Apply a petroleum distillate to any dwelling places that cannot be destroyed. Cats are considered effective predators as are ducks and chickens, though the latter are more likely to be stung and killed. Don't go barefoot at night.	 <b>SCORPION</b>
If a person is allergic, more serious reactions occur—nausea, shock, unconsciousness. Swelling may occur in another part of the body. Death may result.	Gently scrape (don't pluck) the stinger so venom sac won't be squeezed. Wash with soap and antiseptic. If swelling occurs, contact doctor. Keep victim warm while resting.	Have exterminator destroy nests and hives. Avoid wearing sweet fragrances and bright clothing. Keep food covered. Move slowly or stand still in the vicinity of bees.	 <b>BEE</b>
Sometimes transmits yellow fever, malaria, encephalitis and other diseases. Scratching can cause secondary infections.	Don't scratch. Lather with soap and rinse to avoid infection. Apply antiseptic to relieve itching.	Destroy available breeding water to check multiplication. Place nets on windows and beds. Use proper repellent.	 <b>MOSQUITO</b>
Usually no more dangerous than a pin prick. Has only local effects.	Wash and apply antiseptic to prevent the possibility of secondary infection.	Harmless to man, the tarantula is beneficial since it destroys harmful insects.	 <b>TARANTULA</b>
Sometimes carries and spreads Rocky Mountain spotted fever, tularemia, Colorado tick fever. In a few rare cases, causes paralysis until removed.	Apply heated needle to tick. Gently remove with tweezers so none of the mouthparts are left in skin. Wash with soap and water; apply antiseptic.	Cover exposed parts of body when in tick-infested areas. Use proper repellent. Remove ticks attached to clothes, body. Check neck and hair. Bathe.	 <b>TICK</b>

Reproduced from *Family Safety*.



IT'S EASY TO START IT  
....But CAN YOU STOP IT?<sup>1</sup>

How safe is your equipment when it is shut down? Is it safe to work on---or is it just "not moving now"?

Do all your people know how to shut down all the equipment in their work area?

How much damage occurs when there is a malfunction and no one knows how to shut down the equipment?

What if someone was caught in the equipment and no one knew how to shut it down?

Most operators are taught how to start their operation, but sometimes they are not taught how to shut down so that it is safe to work on or in.

Consider pneumatic and hydraulic systems where you press a stop button to stop the motor, then turn off the switch or circuit breaker and put a lock and tag on it. You should now try the start button to prove that you have locked out the proper switch.

Now you should relieve or release all pressure in the system so you do not have a blowout when you open the system.

Air receiver and hydraulic accumulators are energy storage devices. The release of this stored energy can create the same effect as the unexpected starting of the motor.

Single- and double-acting cylinders and pistons can also be a source of stored energy waiting to trap the uneducated. The accidental operation of a valve can release pressure in cylinders and allow machinery to move unexpectedly.

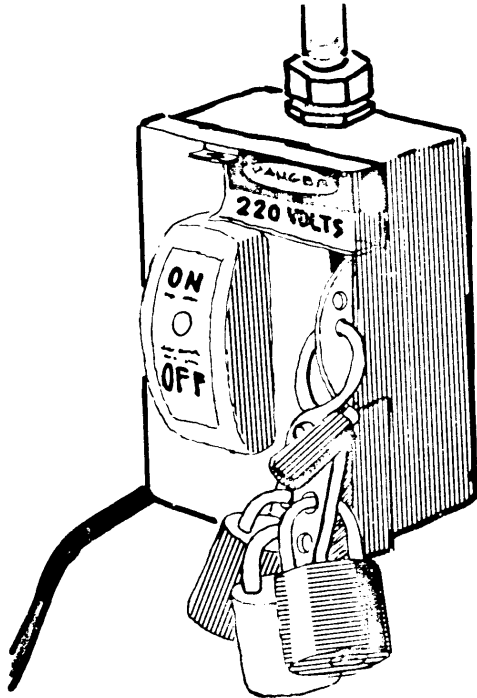
Before anyone works on such equipment, it is necessary to relieve all such sources of trapped energy and allow moving parts of machines to gravitate to their lowest position unless securely fastened at some other position.

Shutting down your pump or compressor may not shut off the control circuit for your machine; it may be necessary to lock out a control circuit switch.

How about that solenoid that creates mechanical action?; what happens when it is de-energized--how do you lock it out?

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When working on interlocked equipment do you lock out each motor, or do you take a chance by locking out the first to start, and hope the interlock system will protect you?

It is necessary to lock out the main power supply switch to each motor because something can go wrong with control circuits and cause unexpected motor starts.

For example, a torch is often used on repair jobs; if it is accidentally turned on a conduit, the insulation on the enclosed wires may be damaged with unpredictable results.

A short circuit can do the same thing as a start button, or it can cause the motor to start and run so that the only way to stop it is to turn off the switch or circuit breaker. Now if you have your power source switch locked out you will not have an unexpected motor start.

If you have only your control circuit locked out, you may have an unexpected motor start up depending on how much of your control circuit is de-energized by your lock out.

If you are in the habit of locking out control circuits, you should consider what would happen if someone manually pushed the contacts of the starter.

This could happen where several crews are working on different jobs and someone makes a mistake and manually closes the wrong starter.

A lock on the power source is much safer than on a control switch. (Furthermore, all persons working on the same equipment should have their own individual locks on the master lock-out, carrying their own keys in their pockets. Then the machine cannot be reactivated until ALL locks have been removed.)

Inclined conveyor belts can also be a storehouse for energy. Did you ever see a loaded belt stop then drift backward?

An empty belt is balanced (the carrier portion weighs as much as the return portion) so it usually does not move unless it breaks--then the balance is disturbed and the belt moves to the lowest level.

A loaded belt may have tons of rock on it, with every bit of the rock trying to make the belt run back down.

Being aware of the above hazards is the first step in resolving them. It may take a coordinated effort of several persons to determine the hazards and the best way to handle them.

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#### HOLD THAT LINE

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

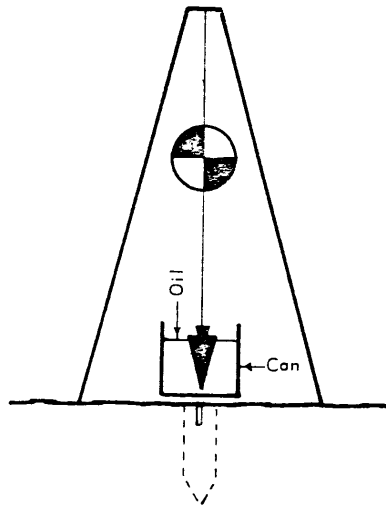


DIAGRAM OF TRIPOD

Figure 9

How many times have you watched a plumb bob sway in the Wind?

Millard W. Wilcox, Civil Engineer at the National Park Service, Denver Service Center, Denver, Colorado, suggests that once a bob has been accurately hung, place an empty pail or can under the bob filling it with oil to near the top of the bob. By dampening or stabilizing the plumb bob, the string or the wire that suspends the bob makes an accurate vertical line about the point. See Figure 9.

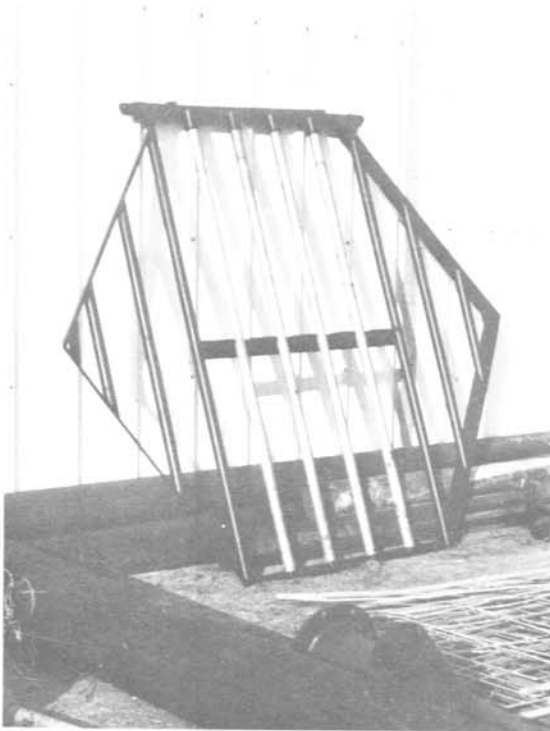
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## REMOVABLE SECTION TRASHRACK

The following article and series of photographs were sent to us from the Solano Irrigation District, Vacaville, California, by Mr. Gordon Johnston. This unique trashrack was designed and built by district shop personnel. The rack was designed so that Solano District personnel could have an easy access to the siphon for inspection and cleaning purposes. This particular trashrack was installed at Station 279+61.96 on the Dally Canal, Dally Canal Unit, California.

The district also noted that the rack serves a twofold purpose; it not only makes it easy to inspect the pipe interior but it does an excellent job in preventing animals, large debris and even people from falling into the siphon.

Mr. Johnston stated that this idea has helped reduce the cost of equipment and substantially reduced their maintenance expenditures, and also helped their safety program.



The photograph at left (Fig. 10) shows the trashrack before being placed at the siphon. The assembly includes the rack and frame with the locking device located at the top.

Figure 10



Figure 11 is a closeup view of the trashracks center section. Construction details of the removable pipe section, pipe pins, notch guides and frame are visible.

Figure 11

Figure 12 shows removable center section with lock bar open and one pipe section being removed which permits access to entrance for inspection. It also shows one of the pipe pins that hold individual pipe sections in place.



Figure 12

The four removable pipe sections are in place in photograph at right and the lock bar is being closed prior to locking in place.



Figure 13

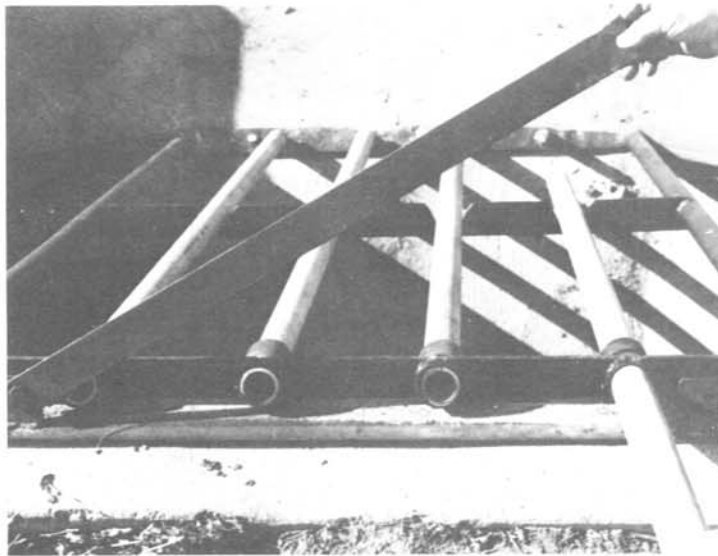


Figure 14

Figure 14 shows a closeup view from the top of the trashrack, showing one pipe section being removed and the lock bar open. Note that the locking bar can be locked to a clip welded on the angle bar.



The Solano Irrigation District provided a price list of materials as shown below, for this particular trashrack. This seems to be a very conservative figure in comparison to the benefits that could be derived from this very unique idea.

Materials Price List

280 lbs. of angle and flat bar steel	- \$ .30 per lb.	= \$ 84.00
72 ft. of 1-1/2 in. galvanized pipe	- \$ .70 per ft.	= \$ 50.40
24 hrs. #13 Welder Machine	- \$ 1.00 per hr.	= \$ 24.00
8 lbs. 6013 Welding Rod	- \$ .75 per lb.	= \$ 6.00
1 gal. paint	- \$10.00 per gal.	= \$ 10.00
34 hrs. labor	- \$ 5.25 per hr.	= \$178.50
Supply Clerk Time	-	= \$ 7.00
		<u>\$359.90</u>

If additional information is desired regarding this idea, please write to: Solano Irrigation District, 508 Elmira Road, Vacaville, CA 95688.

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