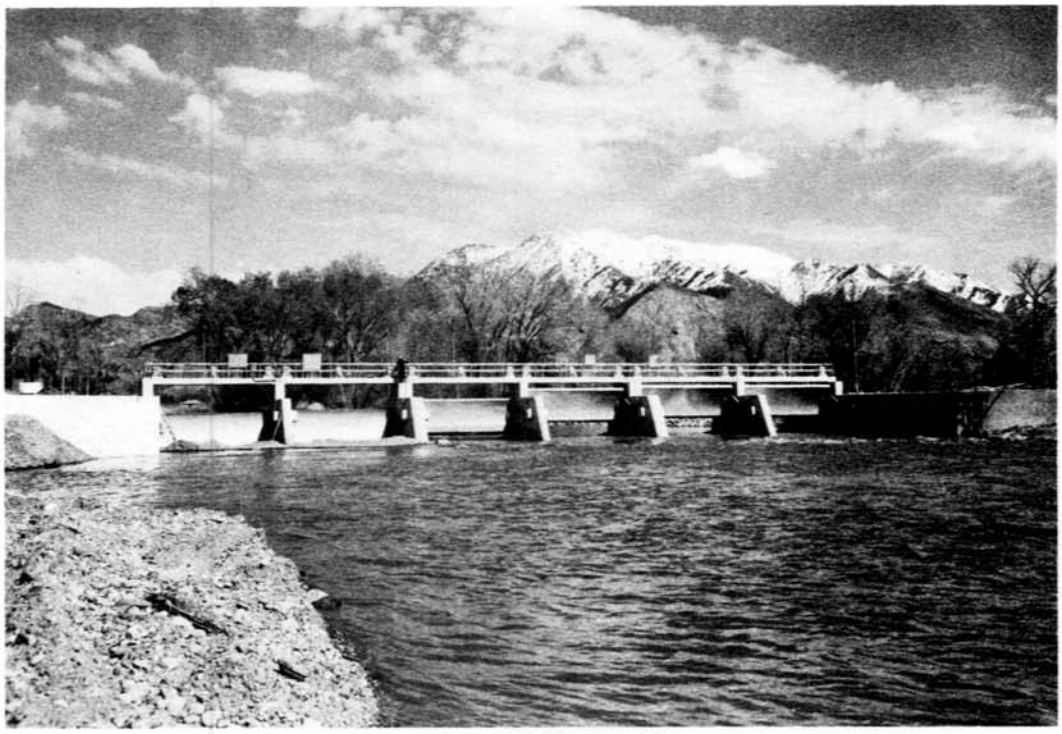
WATER OPERATION AND MAINTENANCE

Bulletin No. 115

MARCH 1981



IN THIS ISSUE

UNITED STATES DEPARTMENT OF THE INTERIOR
Water and Power Resources Service

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 Service offices are reminded to notify their Suggestions Award Committee when a suggestion is adopted.

Any information contained 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 Water and Power Resources Service.

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

COVER PHOTOGRAPH

Slaterville Diversion Dam, Weber Basin Project, Utah. Concrete gate structure on the Weber River, looking upstream, with the Wasatch Mountains in the background.

SI METRIC

On November 6, 1979, the Bureau of Reclamation was renamed the Water and Power Resources Service in the U.S. Department of the Interior.

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INTRODUCTION

A very effective and quick method to paint light and traffic signal poles is described in the article beginning on page 1.

The article on page 5 describes an inexpensive water trailer that was constructed to perform a number of different water delivery tasks.

Covering stock tanks with floating covers can save you money, as well as water. See page 6.

Page 9 illustrates how misuse of compressed air can cause serious injuries.

Daily maintenance procedures will provide efficient performance and extend the life of your crawler trailer. See page 11.

On page 13 is an article that lists 10 good check points to follow in getting your center pivot ready for the season.

Page 15 lists five good tips on how to reduce center pivot wheel tracks.

Electricity is one of our most important energy sources, but it can be dangerous. The article starting on page 16 presents precautions to prevent shock when handling electrical wiring.

First aid for the shock victim is pointed out on page 18.

PAINTING THE EASY WAY[1]

If you were responsible for the periodic painting of 60,000 metal street light poles and traffic signal poles, what would be one of your most important priorities? You would try to find the quickest, least expensive, effective painting procedure. The Potomac Electric Power Co. (PEPCO) of Washington, D.C., may have found that procedure. PEPCO is responsible for painting more than 60,000 light poles in the Washington, D.C. area. Approximately 10,000 poles are painted each year, so that each one is painted every 6 years. The poles vary in height, approximately 50 percent are 8 m (28 ft) high (some are higher). Many of the poles are crowded with traffic signs. Some are steel, others are galvanized steel or cast iron. The company also has concrete poles and aluminum poles which do not require painting.

The painting is accomplished by contract. The present contractor uses two or three two-man crews during the painting season (mid-April through mid-October). A crew consists of a street light patrolman and an equipment operator (foreman). Both are members of the International Brotherhood of Electrical Workers. Each foreman receives training as a street light patrolman before becoming the foreman.

The equipment used by a painting crew includes a boom truck, two deep plastic paint buckets (to keep the paint from splashing out of the bucket), lambs wool mitts (to apply the paint), heavy duty rubber gloves worn inside the mitts (to protect the painter's hands), wire brushes, and paint scrapers. The paints the company used are Butler-Flynn grey and armonized black (the latter paint is for poles in areas under the jurisdiction of the U.S. Park Service). Both paints are enamel. The painter puts on the rubber gloves and mitts, dips the mitts into the paint, then proceeds to paint in smooth, wiping motions, daubing the paint into crevices or tight spots created by signs attached to the poles. Paint runs do not seem to be a problem.

When painting a street light or signal pole, the boom truck driver paints the portion of the pole he can reach from the ground; the foreman in the bucket paints the remainder. To protect the bucket controls, they are wrapped in sheet plastic. The foreman uses an elbow to operate the bucket control levers or he can take off one rubber glove and mitt, if more accurate maneuvering is required.

The steel poles are covered with one coat of paint when they arrive from the factory. The 4.9-m (16-ft) high steel and cast iron poles require a minimum amount of preparatory work and can be painted in 2 or 3 minutes, or less; with numerous street signs attached, the painting will take a minute or two longer. A 4.9-m (16-ft) high galvanized steel pole with several street signs attached can be painted in about 5 minutes; the extra time is required to scrape and wire brush the pole because the previous coat of paint tends to flake.

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[1] Written for this publication by Ed Roper, Water and Power Resources Service, Washington, D.C.

Figure 1.–Wire brushing street light pole.

The lambs wool mitts cost approximately $5 a pair. Although a pair of mitts can be cleaned at the end of the day and used again, a crew occasionally will use as many as six pairs a day, particularly when painting the cast iron light poles (the surface of the cast iron poles is extremely rough and the edges often are sharp). The rubber gloves worn inside the mitts should be large enough so that they can be slipped on and off easily; they are cleaned at the end of each shift. The company purchases paint directly from the factory in quantities that result in minimal shelf storage. Because it is used soon after it has been manufactured, the paint does not have much time to separate, and the need for mixing before it is used is minimized.

Figure 2.–Dipping lambs wool mitts in paint bucket.

Figure 3.–Painting around obstacles.

Figure 4.–Boom enables painter to paint any portion of the pole that cannot be reached from ground level.

Although the method used for painting PEPCO's street light poles is not suitable for all painting, it may be suitable for painting such items as: pipe hand railings, metal ladders, metal light poles, chain link fences, flagpoles, metal standpipes, small pumps, turnout structures, guard posts, pipes, some motors, drive shafts, small tanks, check structure deck equipment, traveling water screens, metal vehicle guardrails, canalside turnout installations, ladder guards, small metal buildings, grillwork, and many timber items (where splinters are not a problem).

The information presented was supplied by Messrs. Bill Gausman and Stanley Bliss, PEPCO; and Mr. Charles Kelminsky, Asplundh Tree Expert Co., Painting Contractor, Washington, D.C.

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HOME-MADE WATER TRAILER IS A VERSATILE UNIT[2]

When the City of Sanibel, Florida, was incorporated in 1974, it was faced with building a public works department from scratch to cope with the various maintenance responsibilities assumed with incorporation. Minimal funding dictated selection of equipment that could be used for a number of different jobs and a continuing search for ways to stretch maintenance dollars.

Many maintenance activities require water for irrigation, beautification and road watering, yet a water source is not often available at the worksite. Use of various unsatisfactory and inefficient means of water transportation showed the need for a better delivery system.

With a little ingenuity, a surplus military trailer, a used 2082-L (550-gal) steel tank, a 50-mm (2-in) self-priming pump with a 3-hp gasoline engine, five 50-mm (2-in) gate valves and miscellaneous pipe and fittings, the Public Works Department Supervisor Carl Reinhardt was able to construct a water trailer that fit all the city's needs.

Figure 5.–Water trailer for maintenance jobs.

By opening the appropriate valves, the unit can perform a number of different tasks. For instance, it can fill itself from a natural water source, spray through a 50-mm (2-in) hose or through a spreader bar, and mix the water in the tank. The unit can also spray water taken directly from a natural source, bypassing the tank and eliminating filling time.

All of this was put together during rainy day "fill-in" times at a cost of less than $700. The water trailer has proved to be so useful that the department is considering building another unit, and many local maintenance contractors are copying the design.

The foregoing information was supplied by Gary A. Price, Sanibel's Assistant City Manager and Public Works Director.

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[2] Reprinted by permission of the Editor, Public Works, from September 1980 issue.

STOCK POND COVERS REDUCING EVAPORATION[3]

Arizona farmers and ranchers in areas of high evaporation could reduce water losses from stock tanks by 80 to 90 percent by using floating sheets of foam rubber.

Spots around Needles, California, for instance, lose about 2.1 m (7 ft) of water to evaporation each year from ponds, lakes, and stock water tanks. In the other Western states, the sun takes from 0.6 to 1.8 m (2 to 6 ft) of water–several times the annual precipitation in many of the areas.

Water hauling costs in the more remote regions run from $10 to $30 per 3785 L (1,000 gal). Cost of water saved by the covers, depending upon the evaporation rate, varies from about $0.75 to $4 per 3785 L (1,000 gal).

"In remote areas where water expense is high–hauling, harvesting, pumping, piping over long distances–an operator will want to save as much water as possible," according to Al Dedrick of the USDA/SEA Water Conservation Laboratory in Phoenix.

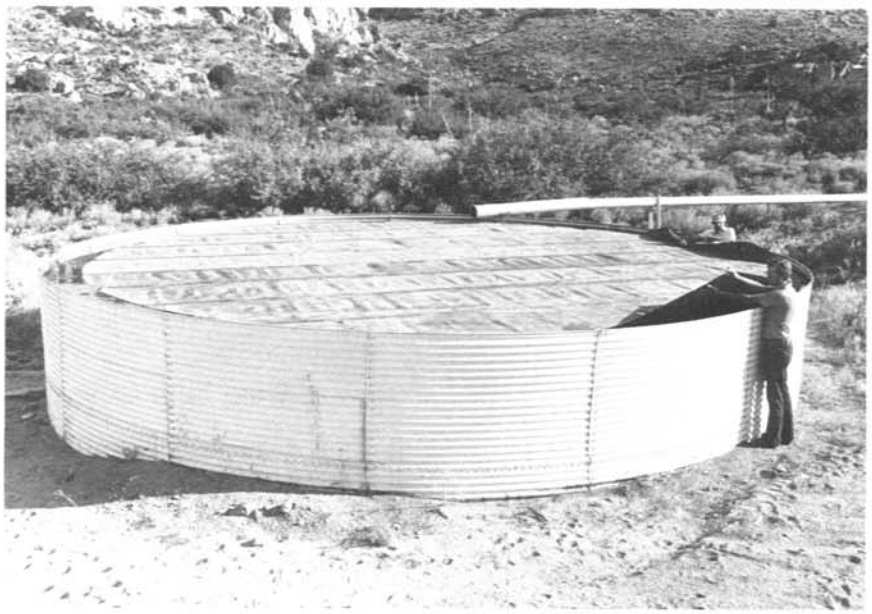

Figure 6.–The cover fits close to, but not flush against, tank walls to allow for easy flotation. The inflow pipe above the tank collects storm runoff from a water harvesting catchment.

[3] Reprinted by permission of the Editor, Arizona Farmer-Ranchman, from August 1980 issue.

Dedrick, who has evaluated the floating covers over a period of time, makes them from low density, closed-cell synthetic sponge rubber having a mass of 0.45 kg for 0.6 m^2 of 6-mm thick sheeting (weighing about a pound per 6 ft^2 of 1/4-in thick sheeting).

It comes in various roll widths up to 1.2 m (4 ft) and costs about $0.30 per square foot. The 1.2-m (4-ft) width is the most practical size.

Figure 7.–Sheet of closed-cell synthetic sponge rubber being cut to size.

Figure 8.–Al Dedrick (foreground) and the BLM's Mark Nolte glue and lap the rubber sheeting together to form the stock pond covers.

Covers are assembled on a hard, flat surface. The sheeting is lapped and glued together to form the cover sized to fit inside the tank. Two men can assemble a 9.1-m (30-ft) diameter cover using 1.2-m (4-ft) wide sheeting in about 3 hours.

The covers are expected to last at least 10 years. The oldest cover was installed on a tank near St. George, Utah, in 1971.

The Forest Service, Water and Power Resources Service, and the Bureau of Indian Affairs are among the many other agencies making use of the covers.

Figure 9.–The cover is being unfolded onto the water's surface. Puncture holes in the cover allow rain water to enter the tank and prevent the cover from sinking. This particular water tank has holes around its rim allowing excess water to leak out.

Detailed instructions for making the covers can be obtained by writing to Dedrick at the USDA Water Conservation Laboratory, 4331 East Broadway Road, Phoenix AZ 85040.

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TAKE CARE WITH COMPRESSED AIR[4]

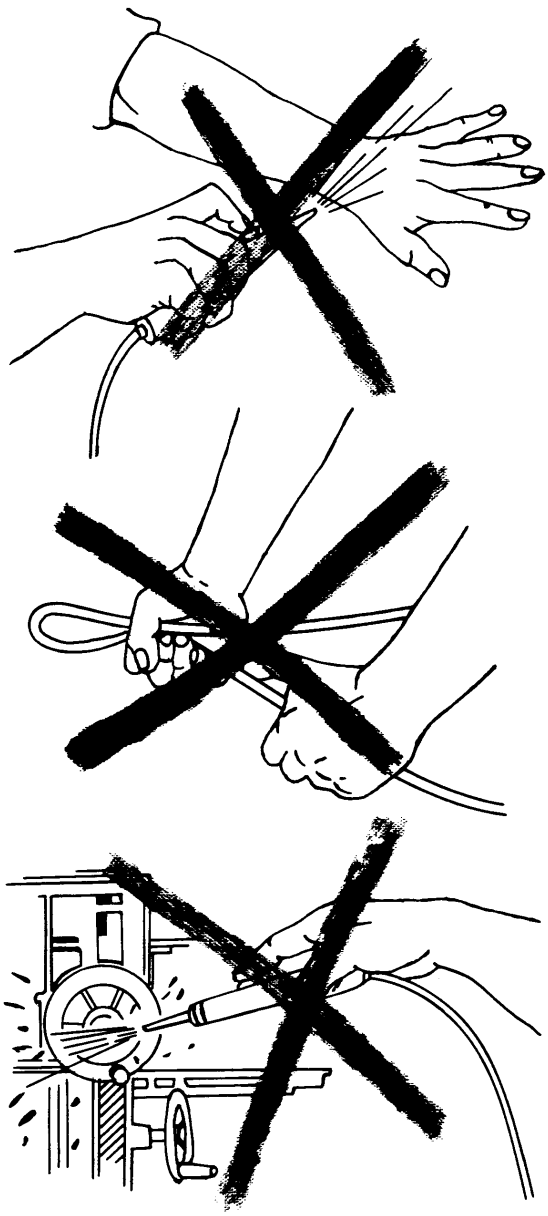
A mechanic with a small cut on his hand washed some machine parts in a solvent. To dry them, he held the parts in a compressed air stream. A few minutes later he told his supervisor he "felt like his body was going to explode."

With such unusual symptoms, the injured worker was rushed to a hospital. Doctors decided that the compresed air had penetrated the cut on his hand and had forced air bubbles into his bloodstream. Although the mechanic recovered from his self-inflicted injury, his mistake could have been fatal if an air bubble had reached his heart.

Injuries caused by the misuse of compressed air have occurred since this energy source was developed. In fact, compressed air is used so much that too many of us take it for granted, ignoring the hazards involved in its use.

In addition to the danger of air bubbles entering the bloodstream through a cut, a stream of compressed air can damage an eardrum or eye or inflate a part of the body.

Many people blow dust and dirt from their clothing, body, or hair with compressed air. Even if the pressure is as low as 138 to 172 kPa (20 to 25 lb/in^2), when directed toward openings in the skin or body, air can penetrate causing serious injuries.



[4] Reprinted from the Industrial Supervisor, November 1980 issue.

In some industries, such as grain elevators, candy factories, and cotton mills, dust accumulations on machinery and equipment can become an explosive mixture if they become suspended in air.

Therefore, it is best to use a vacuum-type cleaner with a brush attachment to help dislodge dust and dirt. Sometimes, however, compressed air may be the only practical method of cleaning machinery unless such equipment is dismantled.

In these cases, you must be sure no one is in the path of flying particles and that eye protection is worn. OSHAct limits the pressure for such jobs to 206 kPa (30 lb/in^2).

To prevent accidental injury when working with compressed air, here are several precautions to follow:

Avoid using compressed air for any type of cleaning except as a last resort, and then only when the static pressure is no greater than 206 kPa (30 lb/in^2) at the orifice, and when effective chip-guarding and proper personal protective equipment are used.

Before operating an air hose, examine all connections to make sure they are tight and will not come loose under pressure; hold the nozzle when turning the air on or off.

Don't kink the hose to stop the air flow; always turn off the air at the control valve.

Check the air hose carefully to make sure it is in good condition before opening the valve to let air into the hose; when the job is finished, turn off the valves on both the tool and the air line.

Keep air hoses out of aisleways where they can be damaged by traffic or be a tripping hazard.

Never point a compressed air hose nozzle at any part of your body or at another person; never use compressed air for a practical joke. There have been cases in which a blast of air playfully directed behind a worker startled him, and caused him to fall against moving machinery.

Before turning on the air pressure, make sure that dirt from the machinery being cleaned will not be blown onto other workers; to prevent dirt from flying about, cover the equipment with canvas; only the operator should be in the immediate cleaning area.

The operator and any other workers who must be in the immediate cleaning area must wear eye protection and other necessary personal protective equipment.

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DAILY MAINTENANCE, THE KEY TO GOOD CRAWLER PERFORMANCE[5]

Whether your operations are seasonal or year-round, it is important to routinely review daily maintenance procedures that will insure continued efficient performance from your crawler tractor, advises the J.I. Case Company. "Getting operators into the habit of thorough daily maintenance checks not only will lead to trouble-free operation, but also can help pinpoint problem areas early so that corrective action can be taken to prevent major breakdowns," states Charles Lagergren, service training manager for Case's Construction Equipment Division.

The first thing that usually comes to mind when someone mentions daily maintenance is the checking of fluid levels, beginning with the engine oil. But performance of maintenance checks by memory instead of by checklist is bad, warns Lagergren. "Establish a checklist, have the operator follow through with it daily and initial it, then keep the list with the maintenance schedule in the operator's compartment."

Other oil levels to check are transmission oil and hydraulic oil. Be sure the machine and its attachments are in the position stated in the operator's manual for making the checks. For example, you will get a false fluid level reading if the hydraulic cylinders are extended or retracted incorrectly. Also, use the right fluid.

Next, check the air inlet: Remove the top and clean it. Some machines have precleaners for use in extremely dusty work conditions–they act as an initial dirt trap and increase the service life of paper filter elements. Remove the air cleaner dust cup, wipe it out with a clean cloth and replace it. Be sure and replace the cup according to the manufacturer's instructions.

Check the radiator coolant level on a daily basis; not checking it and waiting for the heat gage to indicate overheating is playing Russian roulette. "If you add coolant, use the same brand of permanent type antifreeze that is already in the system. We advise against mixing different brands. Remember, modern diesel engines use a 50 percent antifreeze mixture year 'round for better heat dissipation," says Lagergren. Finally, remove obstructions from the radiator core and fins and check fan belts and hoses. Periodically blow compressed air through the radiator core to help remove accumulated dust and debris.

"Adding fuel is second nature, but inspecting filters and draining water from fuel systems also are important parts of the fuel check. If different operators run the machine, point out on the check sheet the locations of the filters, water trap sediment bowls, and particularly fuel line shutoff points. You can save an operator from a red face if he knows that the guy who ran the machine the day before shut off the fuel line. And, if you padlock fuel tanks, make

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[5] Reprinted by special permission of Editor, Public Works, from September 1980 issue.

sure the operator has the key when he goes to the machine; otherwise, he'll have to come and get it–a time waster."

Greasing is another "You didn't have to tell us that" item, but be sure to follow manufacturer's specs and use the right grease. Be especially attentive to pivot points. Locating and marking grease fittings can make this job go faster, and placing clean rags and solvent in a convenient spot can make for efficient operators.

Track tension should be adjusted according to ground conditions. "You may have to do this more than once during the day, depending on the type of ground being traversed," Lagergren says. "Failure to make adjustments can cause premature–and costly–track and undercarriage component wear."

The final daily maintenance check is a walk-around inspection of the machine. You might say this is unnecessary since the operator has already walked around the machine to make the other checks, but he wasn't specifically looking for problems either, so a walk-around to make an overall inspection is a good habit to get into. While performing this check, be sure to look under the unit for fluid leakage.

At the end of the day, it's a good idea to fill the fuel tank to avoid overnight condensation that could gum up the fuel and fuel lines, plug the fuel filter or damage the injection system. It also means one less job to do in the morning. If you do fill up at the end of the day, it is advisable to lock the cap. This should be part of your overall program of securing machines when they are not in use.

"Establishing the daily maintenance program and checklist is the first step in machine care and in extending the productive life of any machine," Lagergren concludes.

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GIVE YOUR CENTER PIVOT A PREFLIGHT INSPECTION[6]

Are you assuming your center pivot will crank right up this season without any problems?

Perhaps a preseason check would be in order. That's the recommendation from Reinke Manufacturing Company, Deshler, Nebraska.

Such a check is easy to do and is an inexpensive way of preventing possible damage to the center pivot and a lot of downtime during the season. Reinke offers the following 10-point check procedure.

1. Visually inspect all equipment for loose or missing bolts and worn or damaged parts. Tighten loose nuts, and check tires on each tower for proper inflation and possible damage.

2. Check all pipes, filters, drains, and water-holding parts to be sure water was drained completely and that no parts have been damaged by frozen water. Inspect pipe gaskets and seals for damage or deterioration and replace if necessary.

3. Inspect hydraulic pump, lines, and motors for leaks or damage on hydraulic-driven center pivots. Add or change oil as needed or recommended by manufacturer.

4. Make sure certain pivot units are firmly anchored to the pivot pad, and lubricate the pivot and drive mechanisms on each tower. Don't overlook wheel bearings. Use recommended lubricants which have normally been selected for their lubricating value, plus their resistance to washing off from repeated exposure to water.

5. Run electrical- and hydraulic-driven center pivots for short periods to check for any stuck or broken parts and to get wheels loose from old ruts before the machine is filled with water.

6. Remove sand trap cap and pump water through the system. This will flush out any foreign material that might plug up the sprinkler heads. This is especially important with newly installed systems. With the sand trap back in place, pump water through the system and check sprinklers for proper operation. The arc of operation of the end gun should be set according to the owner's manual. Check if the system is operating at the pressure for which it was designed. If this pressure has dropped, your well may have to be adjusted or repaired–or the sprinkler nozzles may be worn.

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[6] Reprinted by permission of Editor, Nebraska Farmer, from May 17, 1980 issue.

7. Inspect electrical systems for rodent damage and bird nests.

8. Check electrical connections. Examine seals and gaskets on electrical boxes and equipment.

9. Oil in gear drives, electric motors, and in pumping engines should be changed as recommended. Use proper lubricants only.

10. All sprinklers should be carefully checked for wear, damage, missing parts, and weak springs.

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TIPS TO REDUCE CENTER PIVOT WHEEL TRACKS[7]

With the right management program, problems with center pivot wheel tracks are a lot less than most irrigators think, according to a Lindsay Manufacturing Company official.

Bob Snoozy, the company's vice-president of marketing, said farmers often believe that center pivot wheel tracks will create deep ruts that will bog down the system and cause problems with cultivating and harvesting.

The right management and equipment will eliminate these problems from the very beginning, Snoozy believes. He has these tips:

1. After the field has been worked, the first circle at the start of the growing season should be made with a light application of water to establish the track and compact the soil under the wheels. A properly operating machine will not vary from that track through the remainder of the season.

2. On future applications, apply only as much water as needed. Too many light applications will cause deeper tracks in most soils. Applying too much water the first time in the season promotes the possibility of deeper rutting problems that you will have to deal with all year.

3. In heavier soils where tracking might be a problem, utilizing a combination pipe system with its smaller diameter pipeline and less weight on the outer end will put less weight on the outer tracks. The result is less rutting where most growers think it will be the worst.

4. Make sure tires are the correct size and suitable for your soil conditions. Systems utilizing smaller pipe sizes can use correspondingly smaller width tires that will produce narrower tracks. Narrower tracks will cause the least damage to equipment while performing farming practices.

5. Use the right sprinkler configuration at the proper height and angle. Several options are available to reduce potential rutting problems.

"Check with your local dealer if you have questions about this. He knows your local conditions and can readily recommend a unit with features that will meet your requirements," Snoozy added.

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[7] Reprinted by special permission of Editor, Colorado Rancher and Farmer, from June 1980 issue.

USING ELECTRICITY SAFELY[8]

Electricity is one of our most important energy sources. We depend on it to do thousands of things–light the dark, heat and cool our homes and business, and turn the motors that run all kinds of machinery.

Despite all the good things it does, electricity can be dangerous–it can even kill you.

Each year faulty electric wiring and appliances start over a half million electrical fires that cause millions of dollars of property damage and numerous deaths. Electrical shock kills some 1,100 people a year in the United States.

Unfortunately, some people believe there is no shock hazard in household circuits–the 110-V kind that we have in our homes and here at work. Not true. Statistics indicate that approximately twice as many shock deaths occur at home as at work.

How could you become one of these statistics? By becoming part of an electric circuit.

Electric current flowing through a wire or some other conductor is always trying to escape to a path that offers the least resistance. If your body provides that path, you will receive an electrical shock.

When something goes wrong–perhaps the insulation wears away–you can become part of the circuit by touching the hot wire or metal touching it if you're in contact with the ground or something that is grounded. In other words, the current, which is seeking the easiest path to earth, finds it through you.

The first time you use a piece of equipment with defective wiring, you may feel a little tingle. The next time you may be knocked down or even killed. Why?

The conditions that determine how much electricity will pass through your body are different. The next time your hands may be sweaty, your socks and shoes may be moist, or you may be standing on a damp floor. Moisture permits more electricity to pass through you.

Another important factor is the path the current takes through your body. If it's from one finger to another on the same hand, the worst you're likely to get is burned fingers. But if it's from one hand to the other or from a hand to a foot, the current will travel through your chest and that is very serious.

A small amount of current–about what it takes to light an ordinary Christmas tree bulb–passing through your chest can be enough to send your heart into fibrillation. This condition disrupts

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[8] Reprinted from the December 1980 issue of the Industrial Supervisor.

the rhythmic beating of the heart and prevents the heart from functioning as a life-sustaining pump.

There are several precautions you can follow to prevent shock:

First, never attempt to make electrical repairs on any kind of equipment. Leave electricity to the electricians who've had the training and experience.

Second, before using electrical equipment, be sure your hands and feet are dry. If you have to work on a damp or wet floor, use a Ground Fault Circuit Interruptor. If one is not available, be sure to wear insulated footwear or stand on dry boards or a mat.

Third, before plugging in an extension cord, drop light, or a piece of electrical equipment, examine it for insulation damage or sharp kinks. Check the point where the cord enters the socket or tool for fraying to be sure it is securely fastened.

Fourth, be sure the cord is protected while being used. Avoid running cords across aisleways. Rather, string them overhead.

Fifth, if anything goes wrong with a piece of electrical equipment while you're using it, turn off the power and report the trouble at once.

Finally, electrical accidents and fires can be prevented. Take the time to learn what the hazards involved are and to follow the safe practices necessary to control them.

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FIRST AID FOR SHOCK VICTIM[10]

Never touch a person who is in direct contact with an electrical current. You could receive a serious shock too.

If the accident occurs indoors, pull the plug or shut off the current.

If outdoors, push the wire away from the victim, or the victim away from the wire, with a dry, unpainted pole or board, or pull it away with a loop of dry rope or other nonconductive material. Be sure your hands are dry and you are standing on a dry surface.

Send someone for medical help immediately and start artificial respiration. Continue resuscitation until normal breathing is restored or victim is declared dead by a physician.

Treat for shock after breathing is restored. Lay the victim on his back with the head level with or lower than his feet. Loosen tight clothing. Cover to maintain body heat.

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[10] Reprinted from the Industrial Supervisor from the December 1980 issue.

Some words of wisdom . . . Fear not to ask the stupid question. For that is far better–cheaper, too–than the costly mistake.

(Tom Dodds)