Figure 59

Figure 60

Airboat (Hurricane Fiberglass Products Corp.)
P.O. Box 8, Lake Hamilton, Fla. 33851
Phone: 813-439-1152

Dimensions: length 17 ft, beam 7 ft 2 in., depth amidship 24 in.

Cargo Area Amidship: 40 square feet

Payload Maximum: (Excluding weight of operator) 1,100+ pounds

Weight of Airboat: (Excluding weight of operator) 1,425 pounds

Construction of Hull: Fiberglass, semicatamaran hull, nonskid deck

Color of Hull: (Outside) Gelcoat paint - high-visibility yellow; (inside) standard grey (medium)
Metal parts painted: four plus coats Marine top grade epoxy (yellow)

Power Unit: Engine - Lycoming Avco (Model 0-360)
Displacement - 360 cubic inch
Horsepower rating - 180 hp at 2,700 r/min
Starting system - electric, 12-V pushbutton Prestolite starter
Fuel tank capacity - 30 gallons (use 90-100 octane aviation fuel)

Propeller: Sensenich Brand Model 66LXL40 - Pusher type

Rudders: 0.90-gage aircraft-type aluminum

Boat modification for weed spraying. - The boat modification consists of the installation of two pontoons, one along each side of the boat, fabricated from 10-inch inside-diameter aluminum pipe, about 18 gage (0.0478 in.), 7 feet 9 inches in length. The leading end of each pontoon is beveled to help reduce resistance while moving through the water. The trailing, or squared, ends were capped and made watertight after the interior was filled with polyurethane plastic foam. The pontoons are attached to a frame built using 1-1/4- by 1-1/4- by 1/4-inch angle iron. This frame is fastened to the boat, across the beam, at about the center of the boat (52-inch beam by 14-foot length). Figure 60a shows the pontoons extended and other equipment assembled as it would be used for spraying at a reservoir site.

The pontoons extend 24 inches from the sides of the boat while in the water and are folded back over the sides of the boat when

traveling on the highway. Figure 60b shows the equipment disassembled and ready for transporting.

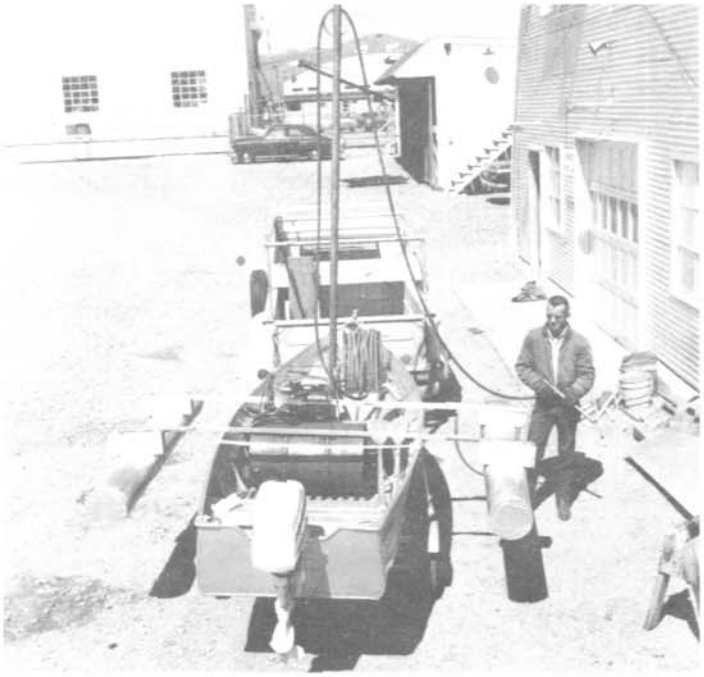


Figure 60a

Figure 60b

Other material needed to modify and equip the boat for spraying include:

- A 30-gallon solution tank.
- A pump and motor.
- Continuous-flow hose reel and hand spray gun.
- A wood mast, 2-1/4 inches in diameter by 8 feet 6 inches in length, with a pulley wheel and swivel mounted at the top.

One difficulty experienced in the past in spraying from a boat was in moving the hose along the slope being sprayed. With the addition of the pontoons to stabilize the boat and the pulley wheel on the mast, it is now possible for the operator to unreel the amount of hose needed (maximum 125 feet). This will clear rock and other ground obstructions as the boat moves along.

Figure 60c shows the equipment in operation at the Bureau's Horsetooth Reservoir, Colorado-Big Thompson project, Colo., which has a shoreline of approximately 18 miles.

Figure 60c

The spray rig has to be fairly light and compact because of launch restrictions and transportation to and from the reservoirs.

Safety factor. - When this boat is being used on a large reservoir or body of water, it has been found much safer to operate. The

addition of the pontoons has made this possible, especially when the wind rises and the occupants are trying to get back to the launch area through rough water.

All-terrain-vehicle mounted sprayer. - The Cushman Motors Trackster shown in figures 61 and 62 has been modified by Red Bluff O&M personnel of the Central Valley project, Calif., for spraying steep slopes and hard-to-reach areas. The spraying system used consists of a 33-gallon used drum, 3-horsepower Briggs and Stratton motor with a 1-inch centrifugal pump, and a "John Bean" handgun.

This spray rig has proven to be very versatile and durable and has saved many man-hours of hand spray operations. The "Trackster" is easily transported by a pickup truck to remote areas as shown in figure 63. The manufacturer of this equipment has advised that it is no longer being manufactured.

Pickup-mounted spray rig. - the pickup-mounted spray rig shown in figure 64 was constructed by personnel of the Quincy-Columbia Basin Irrigation District, Columbia Basin project. This spray rig is designed primarily as a spot sprayer, but the addition of booms across the rear and on the left side of the pickup enables it to be used as a small boom sprayer. When operated as a boom sprayer, the rig has an effective swath of about 16 feet. Each section of the boom can be operated independently of the other through two valves located near the cab of the pickup, as shown in figures 64 and 65. Each boom section is equipped with five whirl chamber nozzles, on 20-inch spacings. Boom pressure is maintained at about 10 pounds per square inch by a pressure regulator located on the outlet side of the pump.

The centrifugal pump, powered by a small Briggs & Stratton gasoline engine, develops more than adequate pressure to operate the booms or the handgun. The pump has the capacity to refill the 200-gallon tank in a short time from any nearby water source. Refilling is accomplished through the white-banded hose attached to the pump, as shown in figure 66.

The hose reel, mounted on the left rear corner, will carry over 100 feet of 3/4-inch nylon reinforced garden hose. A simple pistol grip type of garden hoze nozzle has proven very effective for spot spraying of noxious weeds.

As shown in figure 66, a 30-gallon drum has been mounted on the pickup to carry the herbicide concentrate. Agitation is provided by the return flow to the tank of the majority of the solution passing through the pump.

Figure 61

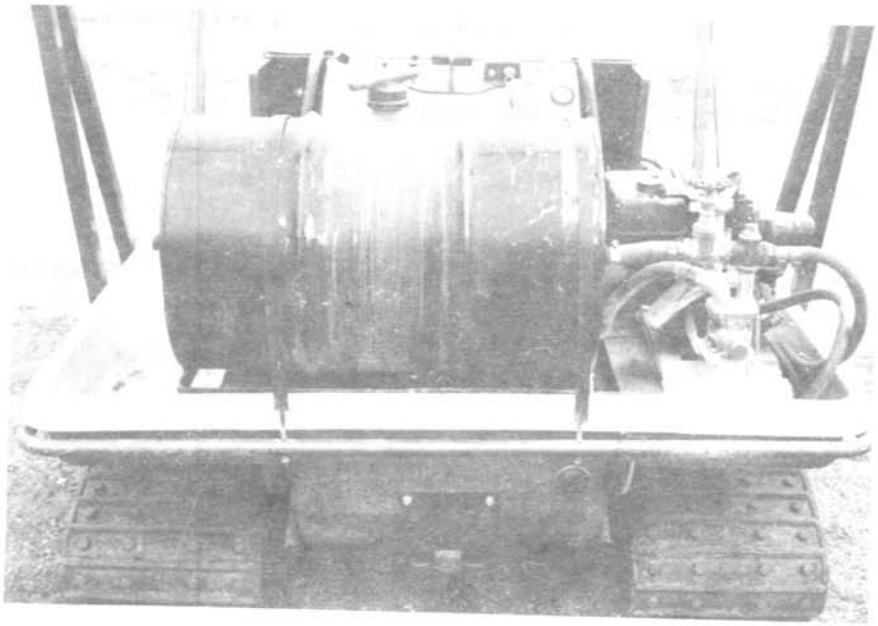


Figure 62

Figure 63

Figure 64

Figure 65

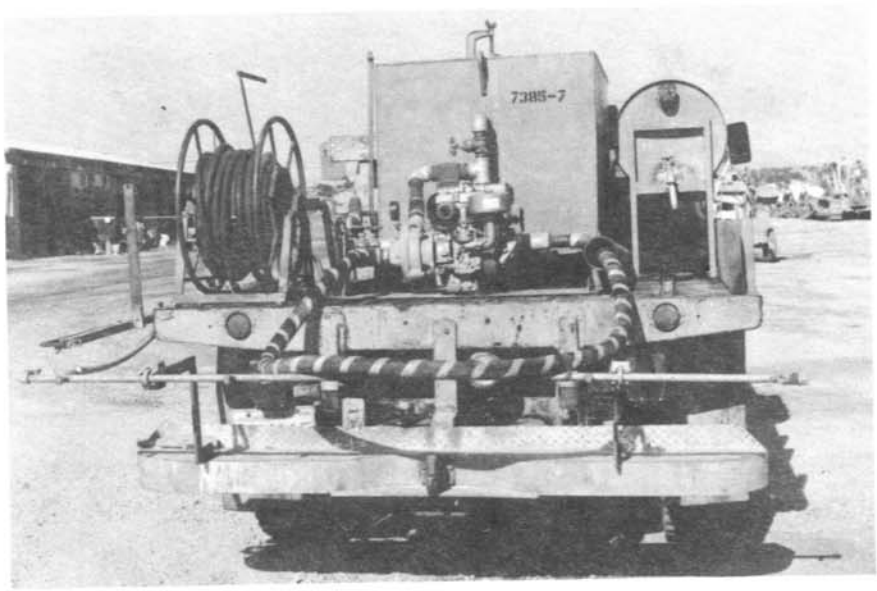


Figure 66

Spot sprayer. - The spot sprayer shown in figures 67, 68, and 69 was fabricated by personnel of the South Columbia Basin Irrigation District, Columbia Basin project.

This spray unit is used for spot spraying of noxious weeds and undesirable perennial grasses along canal waterlines. The 1-1/4- by 1-inch centrifugal pump is powered by a 4-hp Briggs & Stratton engine using a V-belt. The motor also powers the mechanical agitator in the 100-gallon tank by another V-belt. The sprayer can be refilled from a nearby lateral using a 20-foot, 1-1/4-inch translucent plastic suction hose. The use of translucent hose permits the operator to visually determine when water is passing through it.

The spray unit is skid mounted and can easily be removed from the pickup, thus freeing it for other uses.

Road center sterilization spray boom. - In some instances, it is desirable to eliminate all vegetation from the center of O&M roads. The small spray boom for the application of soil-sterilant-type herbicides to road centers shown in figure 70 was developed on the Columbia Basin project. The boom is attached to the front bumper of a spray truck and is controlled by a valve located near the truck cab. The driver can drive the truck and operate the spray boom. A supply line to a boom section is removed from the boom and attached to the valve, and another length of spray hose is connected between the valve and road center boom.

The valve on the operator's platform that controls this supply line is opened and then any further control of herbicide flow is by the driver through the valve located next to the truck cab.

Aerial spraying. - In many areas, particularly on older projects and in swampy or isolated areas, aerial spraying provides the only practical method of weed control, primarily because of the lack of access for conventional weed-spraying equipment. Probably the major advantage of aerial spraying is that these inaccessible areas can be sprayed at the best time for the optimum weed control results. Great care should be exercised in the use of aerial herbicide application to prevent drift problems. (See typical specifications for aerial application below:

> Before a pilot can fly any type of aircraft for a commercial aerial applicator firm, he or she must first obtain a commercial pilot's license. This may be issued by the FAA or a comparable aviation regulatory agency within a state or states

Figure 67

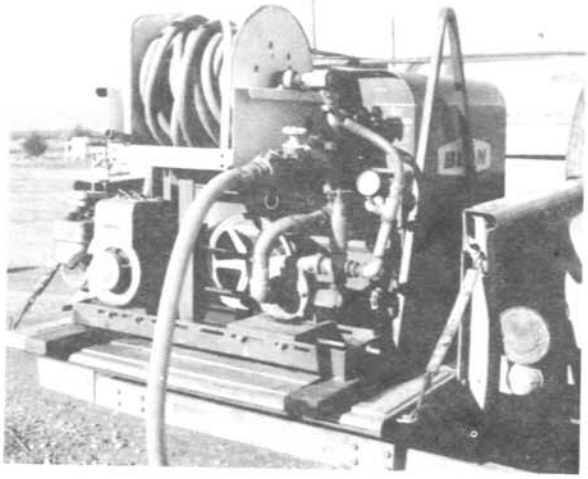


Figure 68

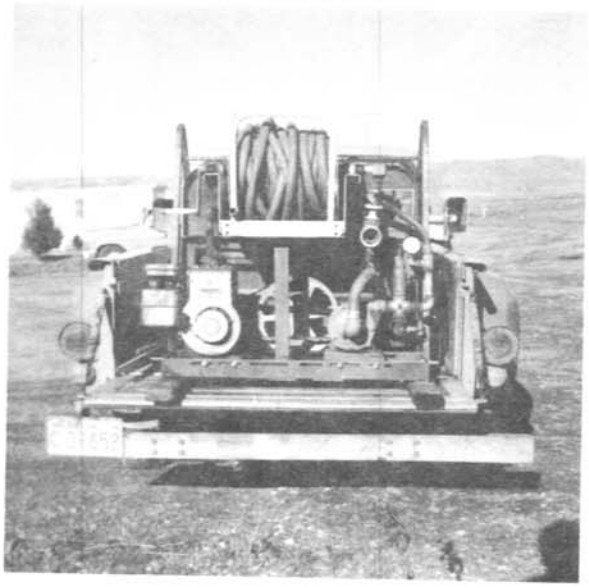


Figure 69

Figure 70

the pilot intends to operate in. State regulatory agencies are empowered to impose more stringent commercial licensing requirements than those administered by the FAA; otherwise, an FAA-issued license will suffice. To qualify for a commercial license, a pilot must meet minimum standards of skill or proficiency in the class of aircraft to be flown for commercial purposes and must have logged a minimum number of flying hours in that particular class of aircraft. The pilot must fulfill additional requirements not necessary to mention here.

In addition to a commercial license, aerial applicators must be licensed or certified to apply pesticides within any state boundaries. These programs are administered by state regulatory agencies. They involve training of applicators to achieve a satisfactory level of skill and proficiency in application of pesticides, including a knowledge of the hazards involved and the precautions necessary to avoid them. These state agencies not only regulate applicators, but also regulate the aircraft they fly and impose conditions on when, where, and how pesticides are applied. For instance, regulations ordinarily do not permit aerial application of herbicides when wind velocity is high enough to possibly cause drift and damage to susceptible nearby crops. Penalties, such as fines and/or imprisonment, may be imposed for infractions. In addition, many states require aerial applicator firms to be bonded to cover damage claims or lawsuits resulting from their operations.

By October 1977, aerial applicators who apply restricted-use pesticides in any state, including herbicides, must be certified to do so under provisions of the Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA), 1972.

For aerial application of herbicides, an irrigation district can choose between fixed-wing aircraft and helicopters. Helicopters offer many advantages and have become the most popular method of aerial application. They can land just about anywhere and thus eliminate the long ferry distances which are both time consuming and expensive. In practice, most, if not all, aerial spraying will be done under contract. Typical specifications for the aerial application of herbicides follow.

SPECIFICATIONS, BID AND CONTRACT

THIS AGREEMENT made and entered into the date set forth below by and between the _____ Irrigation District, a quasi-municipal corporation, hereinafter called the District and the undersigned _____ _____, hereinafter referred to as the Contractor.

WITNESSETH THAT:

For and in consideration of the covenants to be kept and performed by the respective parties, it is understood and agreed as follows:

1. The District's weed control program requires aerial spraying on tracts listed on the attached schedule. The acreage will be sprayed twice; once within a period from May 20 to June 30, and again within a period from September 10 to October 10. Spraying may not necessarily include all these tracts, depending on existing conditions, nor be limited to them; however, the District stipulates that unless mutually agreed the actual acreage for the May - June application will be within 15% either over or under the total acreage as stated for that part of the schedule. The same stipulation will apply to the September - October application with the following exception: If funds are not available from the Bureau of Reclamation to reimburse the District for the spraying on United States tracts within the schedule, they will be excluded from the treatment. These tracts are identified on the schedule as "S&MC Tracts". If such action proves necessary the Contractor will be notified not later than August 15.

Contractor will commence within ten (10) days from the time of written notice to proceed. The Contractor shall conduct aerial spray operations over lands in the District in the order designated by the agent or employee of the District and will complete the spraying as rapidly as possible of the estimated acreages as shown on the schedule.

2. District Materials: The District will furnish all herbicides, adjuvants and thickening agents, delivered at the mixing sites, together with personnel, maps, and descriptions of the spray areas necessary to assist in locating and defining the boundaries of the tracts to be sprayed.

3. Contractor Requirements: Some of the areas to be treated are adjacent to croplands and it will be necessary to avoid any drift of the spray solutions which could damage growing crops in the area; therefore, a highly controlled low altitude application by Contractor's helicopter is required. No application of herbicides will be carried out by the Contractor when the wind is strong enough to prevent uniform and complete coverage. The service will be performed by competent, licensed pilots, experienced in this type of service and all operations shall be carried out in accordance with the best approved commercial practices.

The Contractor shall furnish all necessary helicopter aircraft, labor, equipment, personnel, fuel, and all operating supplies necessary to mix, load, and apply the required solution, including transportation to and from the job sites. Contractor warrants that all helicopter aircraft and other equipment and personnel are suitable and adequate to perform the operations required. At its own expense, Contractor will conduct whatever reconnaissance flying is necessary to acquaint the pilot with the location and boundaries of the tracts to be sprayed, if the pilot is not satisfied that he is adequately acquainted with them from the maps and descriptions provided by the District representative.

Reconnaissance flying performed by the Contractor to allow District personnel to inspect sites of the work or other adjacent areas will be done at the District's expense.

4. Herbicides and Spray Solutions: LOW DRIFT METHODS OF APPLICATION WILL BE REQUIRED. Low drift methods will require a minimum of 10 gallons of water per acre. Such low drift methods may include use of the microfoil boom, foaming agents or other additives or special equipment for production of invert emulsions.

The Contractor in his bid on low drift method will advise the District of the type of materials and their quantities required per 100 gallons of spray mix. The District will furnish said materials. The total cost to the District per acre sprayed, including bid price and cost of District-supplied materials, will be considered in awarding the contract.

Herbicides applied will consist mainly of 2,4-D amine and Banvel, with possible application of minor quantities of aminotriazole, amitrole-T, and Dowpon-C. With other than invert emulsion application the Contractor shall mix the spray solution with thickening agent, where applicable, in a mixing tank to insure thorough and proper dissolution before loading into the aircraft.

5. Rate of Application: The rate of application of herbicides will be confirmed to the satisfaction of the District representative by a trial run prior to actual spraying thereof.

6. Payment: After satisfactory showing by Contractor to District that work has been performed in accordance herewith, and after a statement to the District has been approved by the District's Board of Directors, payment to the Contractor will be made. Payment for the Contractor's work will be made in two parts; the first for and after completion of the May-June application and the second, for and after completion of the September-October application. Statements received by the District on or before the 26th of the month will be paid on approval of the Board of Directors the following month.

7. Bid:

A. Firm Name: _____

B. The Contractor will apply District materials by helicopter aircraft for $ _____ per acre.

C. Reconnaissance flying will be done at the rate of $ _____ per hour or fraction thereof.

D. The Contractor will use the following application method(s).

_____

requiring the following rates of materials in the case that an invert emulsion system will be used: _____

_____

8. Indemnity: The Contractor agrees that it is an independent Contractor and that the application of herbicides required hereunder will be conducted solely for the purpose intended and the District will not be responsible for any damage which may be caused to adjoining property or as the result of this operation.

• The Contractor shall maintain an accurate record of, and shall report to the contracting officer in the manner, and on the forms prescribed by the contracting officer, all cases of death, occupational diseases or traumatic injury arising out of or in the course of employment incident to performance of work under this contract.

If the Contractor fails or refuses to comply promptly with the safety requirements, including the provisions of the publication "Construction Safety Standards", the contracting officer or his authorized representative shall notify the Contractor of the noncompliance and indicate the action to be taken. The Contractor or his representative shall, following receipt of such notice at the site of the work, immediately correct the conditions to which attention has been directed. Such notice, either oral or written, when served on the Contractor or his representative at the site of the work shall be deemed sufficient.

In the event the Contractor fails to or refuses to promptly comply with the safety directive, the contracting officer may issue an order to suspend all or any part of the work. When satisfactory corrective action is taken, an order to resume work will be issued. The Contractor shall not be entitled to any extension of time, nor to any claim for damage or to excess costs by reason of either the directive or the suspension order. Failure of the contractng officer or his representative to order discontinuance of any or all of the Contractor's operations shall not relieve the Contractor of his responsibility for the safety of personnel and property.

The Contractor shall indemnify and hold the District harmless for any and all losses, damages, or liability on account of personal injury, death, or property damage of any nature whatsoever and by whomsoever made, arising out of the negligence of the Contractor, his employees, subcontractors, or agents under the contract. Such indemnity shall include, but shall not be limited to, the failure of the Contractor, his employees, subcontractors, or agents to comply with the safety requirements contained in these specifications.

9. Washington State Pesticide Application Act: Contractor shall comply with all applicable provisions of the Washington State Pesticide Application Act and herbicide regulations orders promulgated by the Washington State Director of Agriculture for control of application of herbicides in specified areas.

10. Bid Bond and Performance and Payment Bonds:

a. The Contractor shall furnish a bid bond or a certified check with the bid in the amount of not less than 10 percent of the bid.

b. The Contractor shall within ten days from award of contract secure, pay for and deliver to the District a surety bond issued by a state-licensed bonding company in approved form the following penal sums:

Performance clause . . . . . 100% of contract
Payment clause . . . . . 100% of contract

11. Insurance and Liquidated Damages:

a. The Contractor shall not commence work until he has obtained and exhibited to the District all insurance required, nor shall the Contractor allow any subcontractor to commence work on his subcontract until all similar insurance required of a subcontractor has been obtained. The Contractor shall carry the following insurance for the duration of this contract:

1. State Industrial Insurance as required by the laws of the State of Washington for all employees on the work.

2. Public Liability Insurance in the amount of fifty thousand dollars ($50,000) for injuries including death to the same limit for each person in the amount of one hundred thousand dollars ($100,000) on account of any one occurrence.

3. Property Damage Insurance in the amount of not less than fifty thousand dollars ($50,000) for any one occurence.

4. Automobile Public Liability Insurance in an amount not less than one hundred thousand dollars ($100,000) for injuries, including death, to any one person and subject to the same limit for each person in an amount not less than three hundred thousand dollars ($300,000) on account of one occurrence.

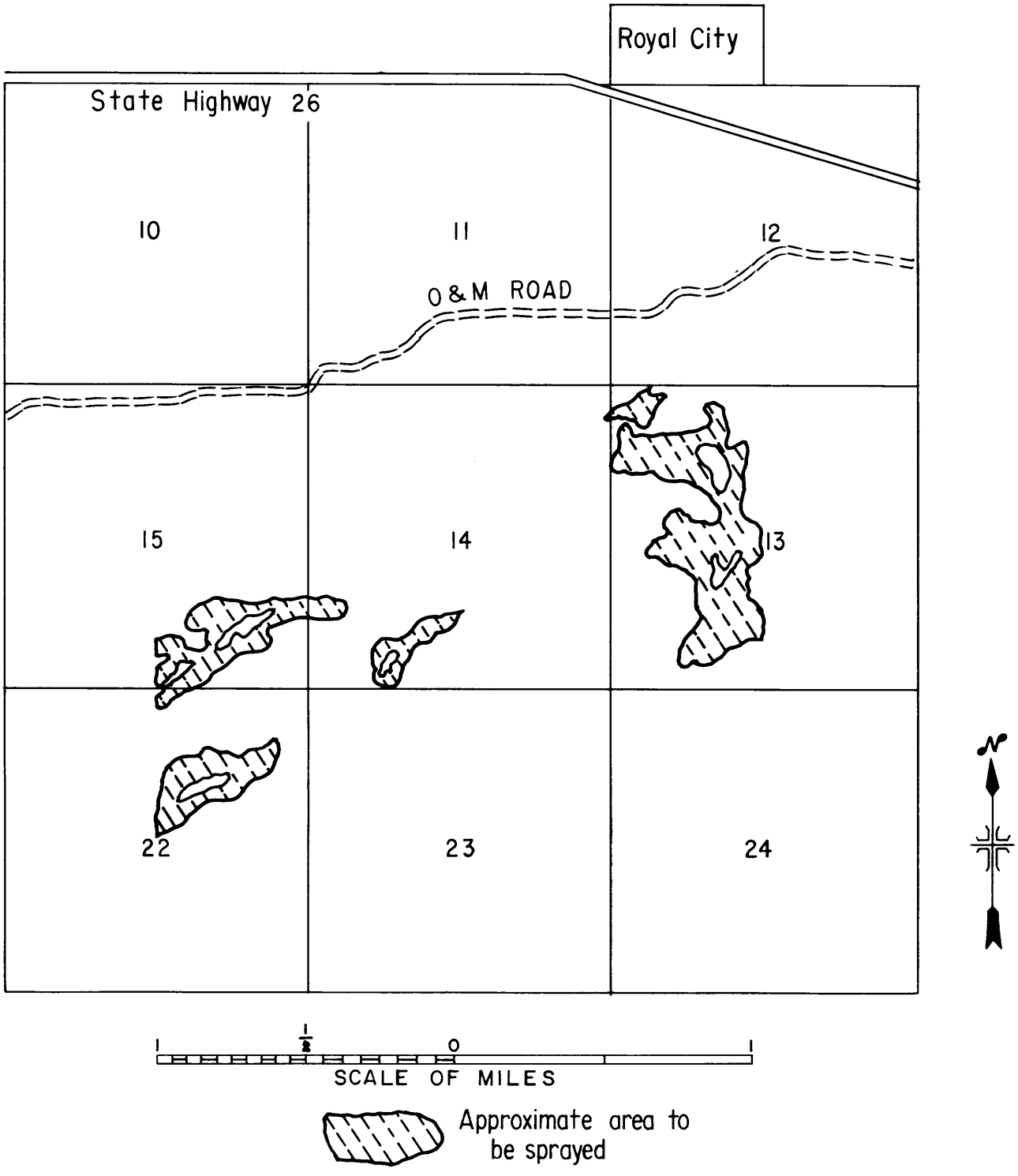
5. Automobile Property Damage Insurance in an amount not less than one hundred thousand dollars ($100,000) on account of one occurrence.

6. In the event that any class of employee engaged in work under this Contract is not protected under State Industrial Insurance status, Contractor shall provide and require each subcontractor to provide adequate coverage for the protection of such employees. Certificates of required insurance shall be filed with the Manager.

b. Liquidated Damages for each calendar day after the last day of the periods above-fixed for completion that the work remains uncompleted, the Contractor shall pay the District the sum of $25.00 as fixed, agreed, liquidated damages. This sum is not to be construed in any sense as a penalty. However, the District and the Contractor by mutual agreement may extend said periods when adverse conditions beyond the control of the Contractor prevents completion of the work as scheduled.

AERIAL SPRAY

ROYAL CITY - OLD BOMBING RANGE
T16N, R 25E, W.M.



* * * * *

Bifluid spraying systems. - Several different types of spraying systems are being used by various projects in an attempt to obtain better weed control and reduce the risk of herbicide damage due to drift of the herbicide during application.

The Pecos River Basin Water Salvage project, N. Mex., uses two bifluid-equipped sprayers for the chemical control of saltcedar. Figure 71 shows one of these units, which has two fiberglass compartment tanks - a 500-gallon tank and a 50-gallon tank. The spray boom has the capacity for spraying a 70-foot-wide swath.

Figure 71

The sprayer shown in Figure 72 is equipped with two fiberglass tanks - a 1,000-gallon tank and a 150-gallon tank - to provide for bifluid spraying. The spray boom has the capacity for spraying a 90-foot-wide swath.

In this particular invert emulsion spray system, the spray is stored in the larger tanks and the invert emulsion is stored in the smaller tanks. The equipment shown in figures 70 and 71 are "Bi-Vac Inverter" systems manufactured by Stull Chemical Company, P.O. Box 6386, San Antonio, Tex. The spray and emulsifier may be mixed in ratios varying from 1:5 to 1:13 as needed.

The major advantages of these systems are to reduce drift and evaporation of herbicides via the use of inverted emulsions. Invert emulsions consist of water in oil rather than the more common oil in water emulsions. An invert emulsion mixture is relatively viscous, similar to mayonnaise.

Figure 72

The Southwest Region reports that they no longer use the bifluid system for application of systemic herbicides for control of saltcedar. There is some evidence that the emulsifiers used in this system kill the foliage before the systemic herbicide can translocate sufficiently in the saltcedar. This reduces effectiveness of the systemic herbicide. The bifluid system is still occasionally used for spraying ditchbanks and rights-of-way on the Rio Grande project near El Paso, Tex.

Garden sprinkler can. - An ordinary garden-type sprinkler can provides a very inexpensive method to treat small, scattered patches of noxious weeds. On some projects in the Northwest the ditchrider carries such a sprinkler can and a small amount of herbicide in a plastic container. When a small patch of noxious weeds is found, it is a simple and brief matter to fill the sprinkler can from the lateral, add the correct amount of herbicide, and apply it to the weeds. This procedure has prevented many small patches of weeds from spreading and creating greater problems.

Dye for weed control chemical. - In field operations, work of a more urgent nature may take precedence over the weed control operation. When this happens a spraying job may have to be postponed. Several days may elapse before operations are resumed. It is almost impossible to see where the operations were stopped. When this happens, there is a good chance of overlapping or missing an area.

Most chemicals, particularly those of the ground sterilant type, are colorless. These chemicals do not affect the weed foliage immediately because rain is needed to activate them. Personnel of the Folsom Field Division, Central Valley project, Calif., have colored the sterilant mixture with a dye.

When a dye is used and the work is resumed, even after several days, a clear outline of the area already sprayed is easily apparent. Accordingly, there is no lost time, and the possibility of over-treating an area is eliminated.

Burning Equipment for Control of Land Weeds

Weed burning may be divided into two phases: (1) *control*, which involves the burning of green weeds during the growing season, and (2) *disposal*, which involves the burning of dry weeds, before and after the irrigation season or at any time of the year. Because the heaviest use of burning equipment is in those areas of green weed control, the burning of dry weeds will be discussed in another section of this bulletin, as a weed disposal practice.

Weed burning is a major weed control practice in those geographic areas which have one or more of the following problems:

1. Nonweedy grasses are difficult to establish as competition to weeds.

2. Effective herbicides are not available, too expensive, or prohibited because of hazards to crops.

3. The combined economic and physical factors favor burning over the cost of change to nonweedy vegetation.

The problem. - Weed burning requires fuel, manpower, and somewhat specialized equipment. Burning usually requires more travel over the rights-of-way than spraying of the hormone-type herbicides. Where burning is feasible, equipment, fuel, and manpower must be available at a reasonable cost.

Irrigation season burning, which may cause ground fires on dry rangeland in some areas, would not be a limiting factor on a fully developed irrigation project which surrounds the canals and laterals. The most significant problem is in designing mechanical devices capable of directing the flame to where the weeds are. Long reaches and slopes are particularly troublesome because of the difficulty in gaining access to the rights-of-way. Another problem is the retention of heat on the weeds. Covers like those used in flame cultivation are usually too combersome for irrigation system burners.

Equipment types. - LP (liquefied petroleum) gases such as butane, propane, and mixtures of the two are supplied under pressure in tanks. Pressures up to 2,000 pounds per square inch are involved. Regulators are provided to supply the fuels in the gaseous or liquid form at a pressure suitable for the particular type of burner. No pumps are required. Pilot lights may be readily attached for remote ignition of the burners.

Fuel oils do not require pressurized tanks, but do require pressure, as from a pump. Certain burners are preheated to burn the oil in its gaseous form. Others burn with an oily residue, which may have a toxic effect on plants. Still other fuel oil burners depend on atomization or spraying of the oil in a fine mist prior to ignition. A recent adaptation of this method incorporates a blower to add air to the atomized and ignited oil.

Liquid gas weed burners. - In the past years an effective burning program for weed control has been implemented in the Southwest Region of the Bureau of Reclamation on projects in New Mexico and Texas. This is possible because of the availability of liquid gas, particularly butane and propane. Although other methods of grass control in distribution systems are effective, burning is still used in the routine weed control program, and is more applicable since liquid gas burners, mounted on both trucks and trailers, have been improved in design and operation.

Several important and beneficial features, which have been incorporated into these burners are shown and described on the following pages. These features include:

1. Vaporization of liquid at the burner.
2. Swinging of booms so that the truck may traverse either bank of a canal.
3. Cables or hydraulic means to raise and lower the burners so that they can be kept in the most effective burning position.

Vaporization of the liquid at the burners eliminates special heat exchangers, which are dangerous, expensive, and burdensome. Some of the burners used on the equipment described were designed and fabricated on several projects by project personnel. They may be maintained in clusters on the burner bars. The bars are usually mounted on black standard pipe which in turn telescopes over smaller pipe attached to the boom. The bars can be moved away from or pulled closer to the truck and can be raised or lowered hydraulically or by cables, pulleys, and cranks, generally by one person.

The burner heads for some of the burners were constructed of old boiler flues; however, the most durable are constructed of seamless steel tubing. A heat-generating burner head is desirable and probably the most efficient, but is not a necessity, as liquid gas will burn without producing much smoke, even when released through an open jet nozzle.

With a swinging boom, the truck can move on either bank of the canal while weed burning. The burners can be swung to the rear of the truck when burning the top of the canal bank, or the boom can be swung to a forward position when moving from one location to another. When there is an operating road on only one side of the canal, weed burning is more convenient and effective, and wind conditions can be tolerated by proper manipulation of the boom.

To burn canals having variable distances from the roadbed to the waterline, most burners shown have easily adjustable burner bars, which can be controlled from the operator's seat and can be maintained in the proper burning position at all times.

There are differences in the design and construction of booms and mountings which reflect the ideas of the builders. The booms may be manually or hydraulically controlled and generally are 25 to 30 feet long. They are usually counterbalanced for ease of manipulation. The manually controlled boom, such as that shown in figure 73, is mounted on a turntable, which permits operations from one side of the truck to the other from the rear of the truck bed. The weeds in a lateral of the Rio Grande project, N. Mex., are being burned by a truck-mounted propane weed burner fabricated by project personnel. The truck speed, when burning dry weeds, may be up to 5 or 6 miles per hour.

Another burner, shown in figure 74, is universal in operation, easily adjustable to meet unusual conditions, and very mobile. This hydraulically operated rig was constructed by project personnel of the Tucumari project, N. Mex. The operator, sitting on the truck bed, turns with the boom, the horizontal and vertical movement of which is also controlled hydraulically.

The burner consumes about 70 gallons of liquid propane fuel per hour under continuous operation. The truck ordinarily travels 1 to 3 miles per hour in burning green weeds and grasses, the rate of travel varying with the height of the canopy and the smoothness of the road. In burning dry weeds, the rig travels 5 to 6 miles per hour.

A 400-gallon tank has been mounted across the truck frame, and the liquid propane is piped from the tank to the burners. A high-pressure regulator set at 50 pounds pressure is used to control the flow of the propane to the burners.

Figure 73

Figure 74

The swinging boom is made of pipe and is mounted on a mast pipe. The mast pipe consists of two pieces of pipe, with the smaller, top pipe mast fitting inside the larger, lower pipe. Roller bearings at the top and bottom of the mast pipe provide for easy movement. A support (made of pipe) mounted on the front bumper of the truck, is provided for the boom to rest upon when traveling from one location to another or when the rig is not in use.

The propane weed burner shown in figure 75 is used on the Las Cruces Branch, Rio Grande project, N. Mex. This burner was manufactured by the Heberlein Manufacturing Company, Ault, Colo. The spring-balanced burner boom operates very efficiently when the vehicle is traveling on relatively smooth roads. The vehicle speed when burning dry weeds may be up to 5 or 6 miles per hour.

Figure 76 shows a LP weed burner operating on an irrigation ditchbank on the W. C. Austin project, Okla. The burner, purchased from the Heberlein Manufacturing Company, was mounted on a truck chassis by project forces. The burner boom is hydraulically controlled. The operating speed when searing green vegetation varies from 1 to 3 miles per hour. The burning operation is greatly enhanced by repeating the procedure in about 7 to 10 days to burn the dead vegetation.

The cost of burning varies from project to project and depends on the amount of liquid gas consumed per hour of operation and the number of burnings required to suppress the vegetation. Ordinarily, liquid gas weed burners are operated on a tank pressure of about 100 pounds per square inch, and each burner head will consume 8 to 12 gallons of liquid gas per hour. The efficiency of liquid gas burners is considered very high as little smoke is evident.

On ditches heavily infested with weeds and grasses, two burnings are ordinarily recommended, the first burning being accomplished with the equipment moving at a rate of about 3 miles per hour. This searing results in an effective top kill, even though there is little immediate change in plant appearance. The second burning, made about a week to 10 days later, consumes the old, dead tops and retards any regrowth of new plants. By continuously burning and reburning when the green plants reach a height of 8 to 10 inches, weedy grasses and undesirable vegetation on the inside slopes of ditches have been successfully controlled.

Oil-type weed burners. - Several projects are using fuel oil operated burners for the control or disposal of weeds.

Because of its light weight and design, the oil-fired burner shown in figures 77 and 78 can be mounted on tractors, pickup

Figure 75

Figure 76

Figure 77

Figure 78

trucks, jeeps, or trailers. This is a "Harsh Silver Jet" distributed by Hydraulics Unlimited Manufacturing Co., Box 207, Eaton, Colo. Lightweight aluminum is used in 90 percent of the parts. The complete unit weighs only 115 pounds. A tripod mounting bracket requires only three boltholes to attach the burner to a vehicle.

Legs on the tripod are hinged to allow for mounting the unit higher or lower. Mounting space is easily adjustable to fit the needs of any operation. The tripod is designed so that the burner can be turned in any direction - throughout a 360° horizontal and a 45° vertical movement. The unit, traveling up to 4 miles per hour, will satisfactorily cover an 8-foot swath and effectively destroy green weeds. Rate of travel, of course, is faster on dry or prekilled weeds.

The commercial burner is available with a 15- or 20-foot boom. All burners are equipped with a fuel gear pump with built-in bypass which automatically regulates fuel flow. The burner heads are constructed of 20-gage steel and burn at a rate of 5 to 25 gallons of fuel an hour, depending on the task involved. The burner comes equipped with both an industrial (concentrated flame) and a standard (swath-type) burning head.

There is no danger of flashback. The burner is designed to operate at low pressures, which eliminates the possibility of flashback. An electric ignitor operated from the central control area insures added safety to operators.

Paragraph 233.7.3 of *Reclamation Instructions* is concerned with weed burning. It reads as follows:

> "Weed Burning. All weed burning shall be under careful and competent supervision.
>
> "Weed burners shall be carefully selected or designed and built to minimize the hazards of their use. They shall be rigidly inspected and maintained. At the beginning of each year's weed-burning season, the project safety engineer shall inspect each burner. Workmen shall inspect burning equipment daily to insure that all connections are tight so that no leakage occurs. Safety clamps shall be used on all hose connections. (See RI 365.8, Fire Prevention and Extinguishment; and Department of Labor Standards - 1910 Subparts M - Compressed Gas and Compressed Air Equipment and H - Hazardous Materials.)