and with the control handle in opposite position, pressure on the cylinder is relieved and the release of fluid from the cylinder allows the boom and spray bar to lower. A regulatory valve in the line can be provided so that fall of the boom and spray bar can be controlled without any snap. Valve "C" controls the pressure and amount of spray that is delivered to the spray bar. Valve "D" which is not visible, regulates pressure to the control panel.

The "shop-built" highly adjustable and adaptable weed sprayer shown in Figure 70 is so constructed that the entire unit is operated by the truck driver. The spray boom is mounted upon the front bumper of an all-wheel drive vehicle which permits the operator to observe the spraying operations. The spray boom was designed and constructed for use on the Deschutes Project, Bend, Oregon.

Fig. 70

The 32-foot, five-section spray boom with reference to Figures 70 and 71 is supported by a steel frame (D), attached to the front bumper. Uprights (E) support the pulleys for the ropes which raise or lower the side sections of the boom. Guy ropes (F) from each side of the cab hold the boom at right angles to the truck so that when the side sections bump into a fence post, high bank, or other obstruction, the booms will swing backward without damage, and then return to their former position. A steel rack (G) supports the spray boom when

not in use. Swivel connections (H) for the side sections (I) permit them to swing from the traveling to an operating position and to be raised or lowered as required when spraying. Wing sections (J) are hinged so they can be tipped up or down to conform to the contour of the ground or slope of the ditchbank. The hand boom has a 150-foot-long 3/8-inch oil-resistant hose line (K) which is wound on a reel (L) and is supported by a 10-foot swivel mast (M), to keep hose clear of the rig when spraying. A 50-mesh, line screen (N) in the main supply hose traps foreign particles and prevents clogging of spray nozzles. Pressure at the manifold is controlled with a by-pass return hose to the reservoir tank which also serves as an agitator to maintain constant mixing of the spray solution.

The four ropes which raise and lower each section of the boom are attached to short lengths of chains to allow quick adjustment by means of metal clips (O) which hold the chain links firmly in place. The clips are supported by a metal frame (P) mounted on the cab. To control the spray solution to each section of the boom

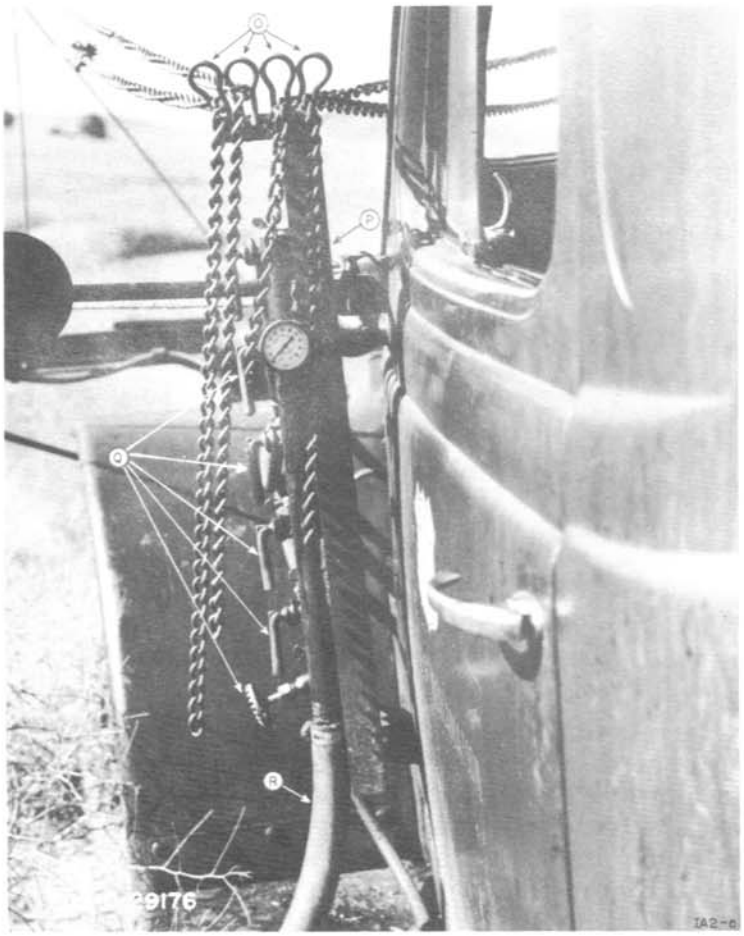


Fig. 71

(including the hand gun) valves (Q) are mounted in a manifold and are connected by 3/8-inch hose lines to each boom section. A 1-inch hose (R) is the main supply line from the pump to the manifold.

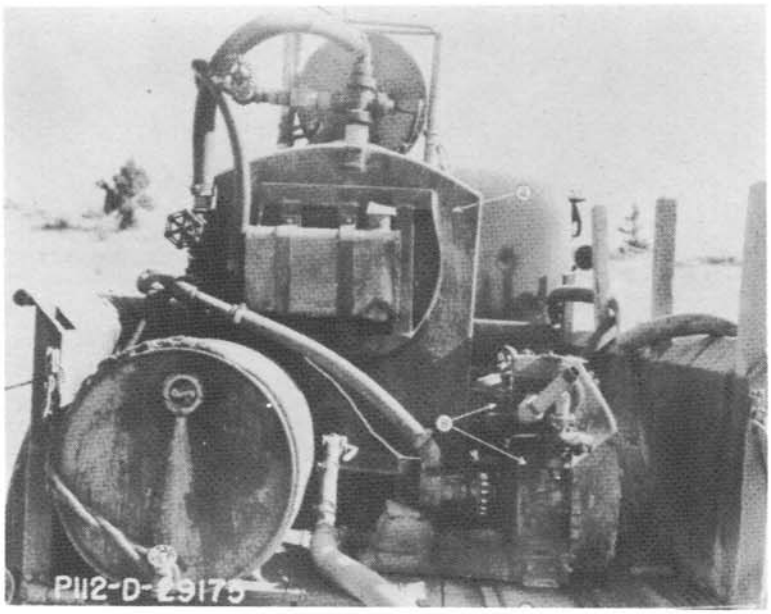


Fig. 72

Just behind the cab, Figure 72, is a 200-gallon tank for the spray solution (A). The 25-gallons-per-minute pump and air-cooled engine are at lower right (B). The 2-inch-diameter suction hose (C), for quickly refilling the spray tank with water from a ditch is fitted with two valves, and the pump either fills the reservoir tank or discharges herbicide into the spray-boom feed line. To the extreme left, with spigot over the tail gate of the truck, is a 50-gallon drum of concentrated chemical.

The spray boom shown in Figure 73 was developed on the Tucumcari Project, New Mexico. Designed primarily to patrol small laterals, a cable adjustment tilts the spray bar for operation against either the inner or outer bank slopes.

A lever adjustment raises or lowers the boom and it swings either front or back against the truck in order to pass obstructions. This sprayer is calibrated to deliver 100 gallons of spray per mile of travel. While more than one man is shown in the photograph, the equipment is being perfected for one-man operation.

A counter-weighted spray or burner boom, shown in Figures 74 and 75 has been constructed and put into use on the Ysleta Branch of the Rio Grande Project, Texas-New Mexico. The boom was constructed to replace older type manually-operated booms.

Fig. 73

Fig. 74

The counter-weighted boom, shown in position of operation in Figure 74, is considerably lighter and much less rigid in construction than booms previously used. It was constructed at a cost of $112.50. The new boom has required considerably less repair for the 1 year operated than heavier booms and it is believed the newer design will last longer in service.

The new boom may be constructed to any desired length. Counterbalancing is accomplished by a weight supported at the boom pedestal, Figures 75 and 76, and attached approximately at the midpoint of the boom by cable. The boom was made of 2-inch galvanized pipe with a 1-inch feed line attached by means of metal straps. The valve for controlling the feed line is a single-pull quick-acting type that is controlled by a rope by the operator. The 1-inch feed line can be extended 4 feet beyond its present length when used as a burner. The method of attaching the supply line to the feed line and the rope which controls the quick-acting valve of the feed line are shown.

The counterweight attached to the cable weighs 85 pounds and the weight on the end of the operating end of the boom is about 78-1/2 pounds. More detail of the boom construction is shown in the drawing in Figure 77.

Fig. 75

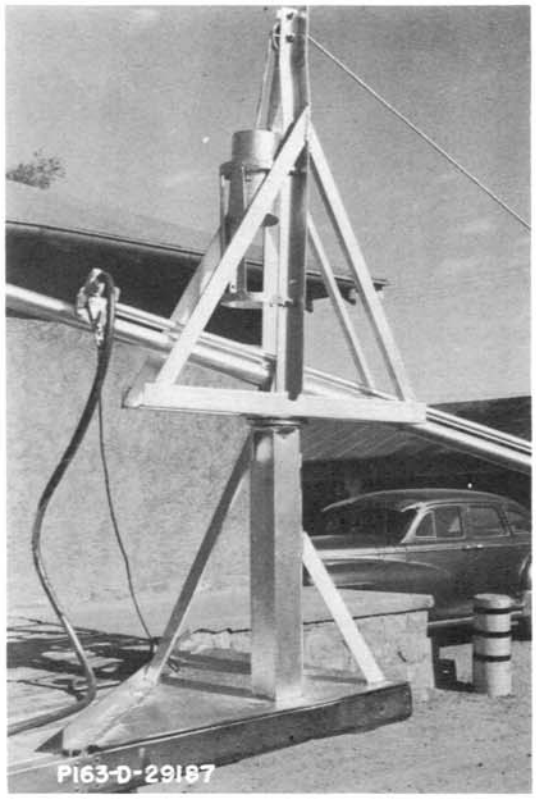


Fig. 76

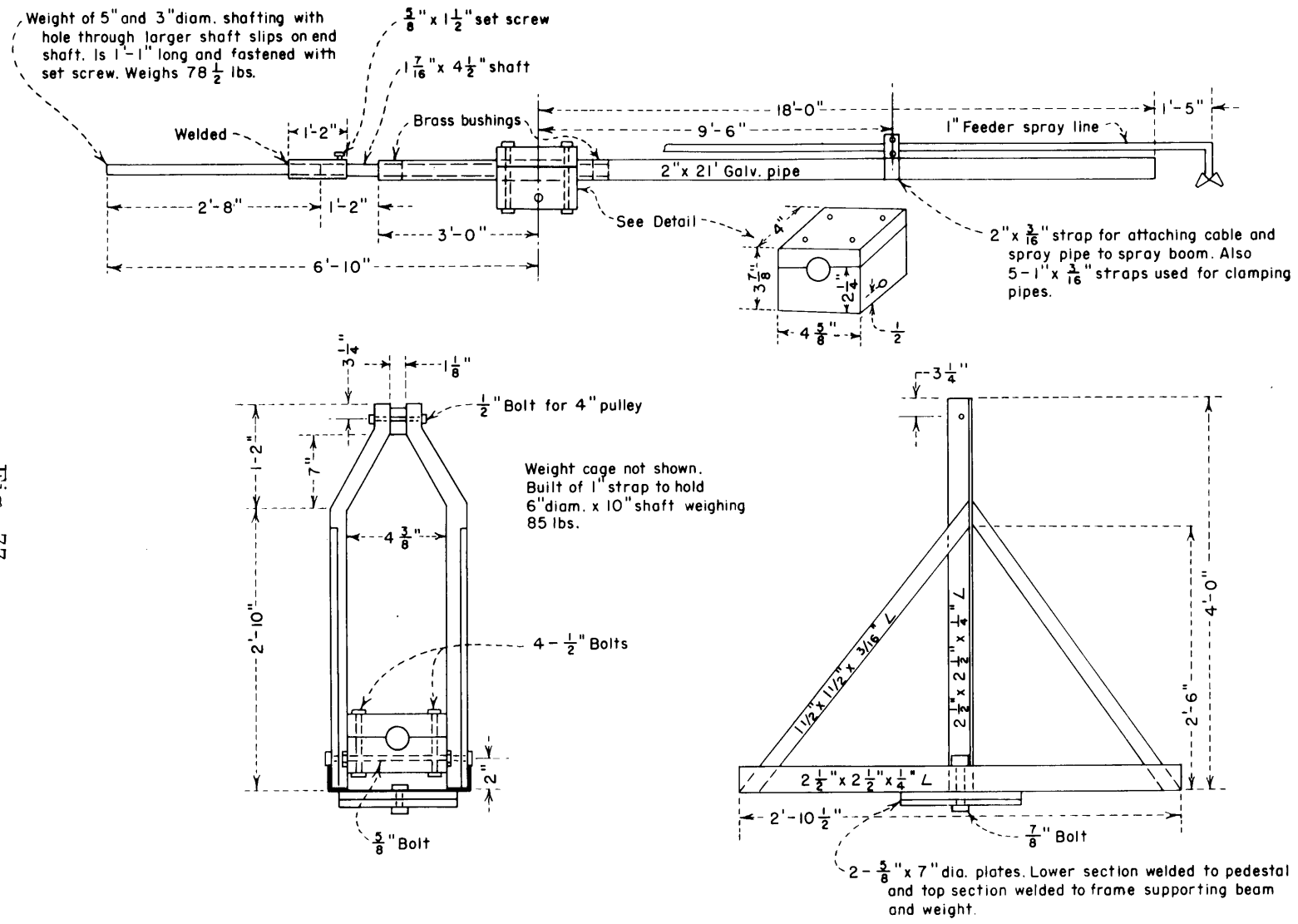


Fig. 77

COUNTER-WEIGHTED SPRAY OR BURNER BOOM

Faced with the problem of spraying cattails in the 75-foot wide bottom of a large wasteway, the Winchester Watermaster Section personnel of the Columbia Basin Project designed, built and operated a weed spray boom long enough to do the job.

Sections of 3/4-inch pipe spray booms were suspended from a cable which was anchored to a truck on one side and the winch of the spray rig on the other side of the wasteway. A separate lightweight plastic hose was coupled to each 20 feet of boom, so that the spray could be shut off over open water. Each boom section contained standard one-piece fan-type nozzles tapped into the pipe. The booms were suspended on wires or light cables coupled by a harness snap to a short piece of bar stock which was welded on the upper side at each end of each boom section. The short bar kept the nozzles vertical.

Height and cable tensions were controlled by the spray rig operator. To install the boom, cable was paid out at a bridge or other crossing. Boom sections were added and the cable end fastened to the anchor truck. As tension was increased on the cable by the spray rig winch, the boom was raised to the proper level and spraying began.

During high volume applications, 150 to 200 gallons per acre, water was supplied by a nurse truck with less expense than unhooking the spray rig to get water. The water in the wasteway was more than 25 feet below the roadway, otherwise it could have been lifted by the sprayer pump.

Hoists

The use of electrically powered hoists for the operation of sprayer booms has been previously described. A spray rig designed and constructed by personnel of the Delta District of the Central Valley Project, California, also made use of an electrically operated hoist.

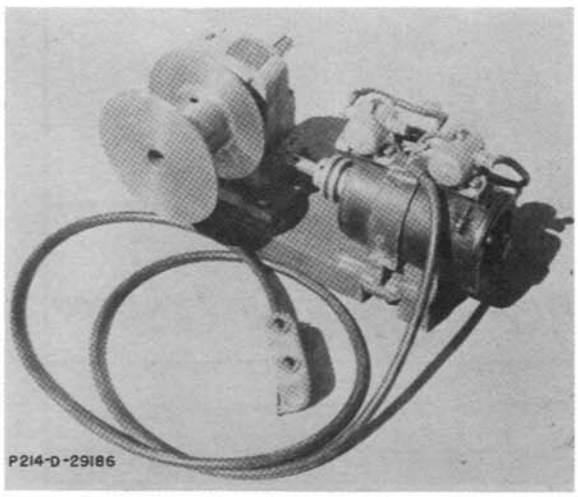


Fig. 78

The hoist was fabricated from a starter motor converted to a reversible motor and connected to a commercial 60 to 1 heavy-duty gear reduction box as shown in Figure 78. The cable drum is keyed to the gear reduction shaft.

A schematic wiring diagram for the motor and controls is shown in the drawing, Figure 79.

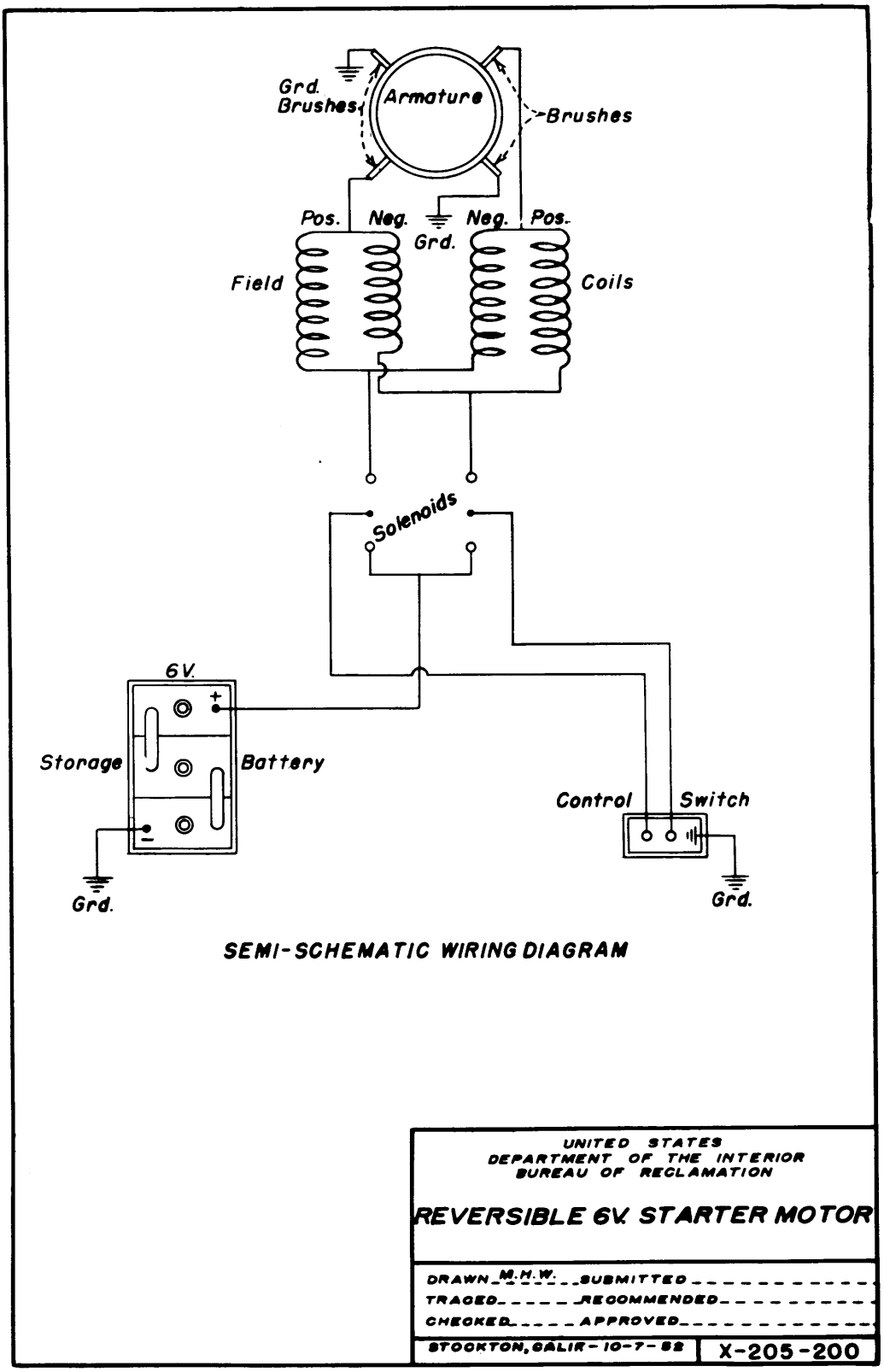

Grd. Brushes
Armature
Brushes
Pos.
Neg.
Grd.
Neg.
Pos.
Field
Coils
Solenoids
6V.
Storage
Battery
Control
Switch
Grd.
Grd.
SEMI-SCHEMATIC WIRING DIAGRAM
UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF RECLAMATION
REVERSIBLE 6V. STARTER MOTOR
DRAWN M.H.W. SUBMITTED
TRACED RECOMMENDED
CHECKED APPROVED
STOCKTON, CALIF - 10-7-52
X-205-200

Fig. 79

Spray Rig Gasket

A section of 1-1/4-inch outside diameter discarded spray hose makes an excellent gasket to prevent spillage around the filler opening of a bean spray rig. This is a practical method employed on the Central Valley Project California, as illustrated in Figure 80. The gasket solved the problem of weed control oil slopping out around the cap of the filler opening and creating a mess of the rig and the bed of the pickup truck used in the spraying of weeds.

Fig. 80

Valves

Molasses valves permit rapid dumping of herbicide concentrates. Piggyback tanks, to the left and right in Figure 81, have a capacity of 50 gallons each. They are mounted on top of a 400-gallon main spray rig tank.

A measuring well into which the herbicides are dumped contains a foot valve in a funnel-like bottom. Up to 3 gallons of herbicide may be measured, by quarts, before dumping into the main spray rig tank.

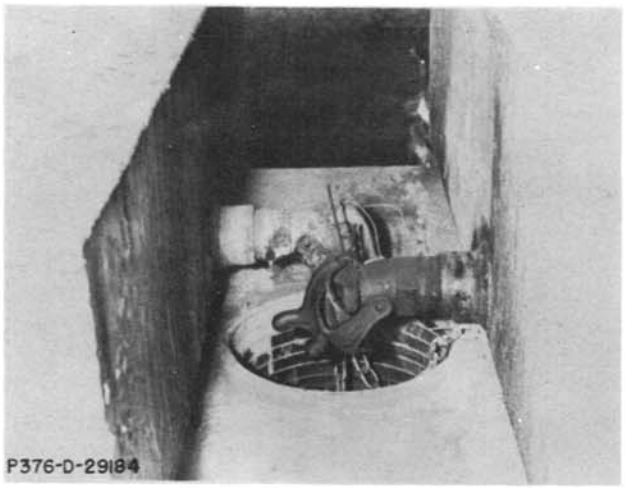


Fig. 81

Agitators

Where a paddle-type agitator is impractical to include in a weed sprayer design, a screw or propeller type can be employed which operates by direct coupling to the gasoline engine supplying power for the spray pump. The propeller shown in the drawing, Figure 82, operates satisfactorily at speeds as high as 2,600 revolutions per minute on the Columbia Basin Project, Washington. Oil-water emulsions are adequately agitated at speeds of 1,600 revolutions per minute in a 400-gallon tank.

The propeller shaft and engine crankshaft should be well alined. Coupling may be accomplished through a short section of fabric reinforced rubber hose clamped and pinned in place.

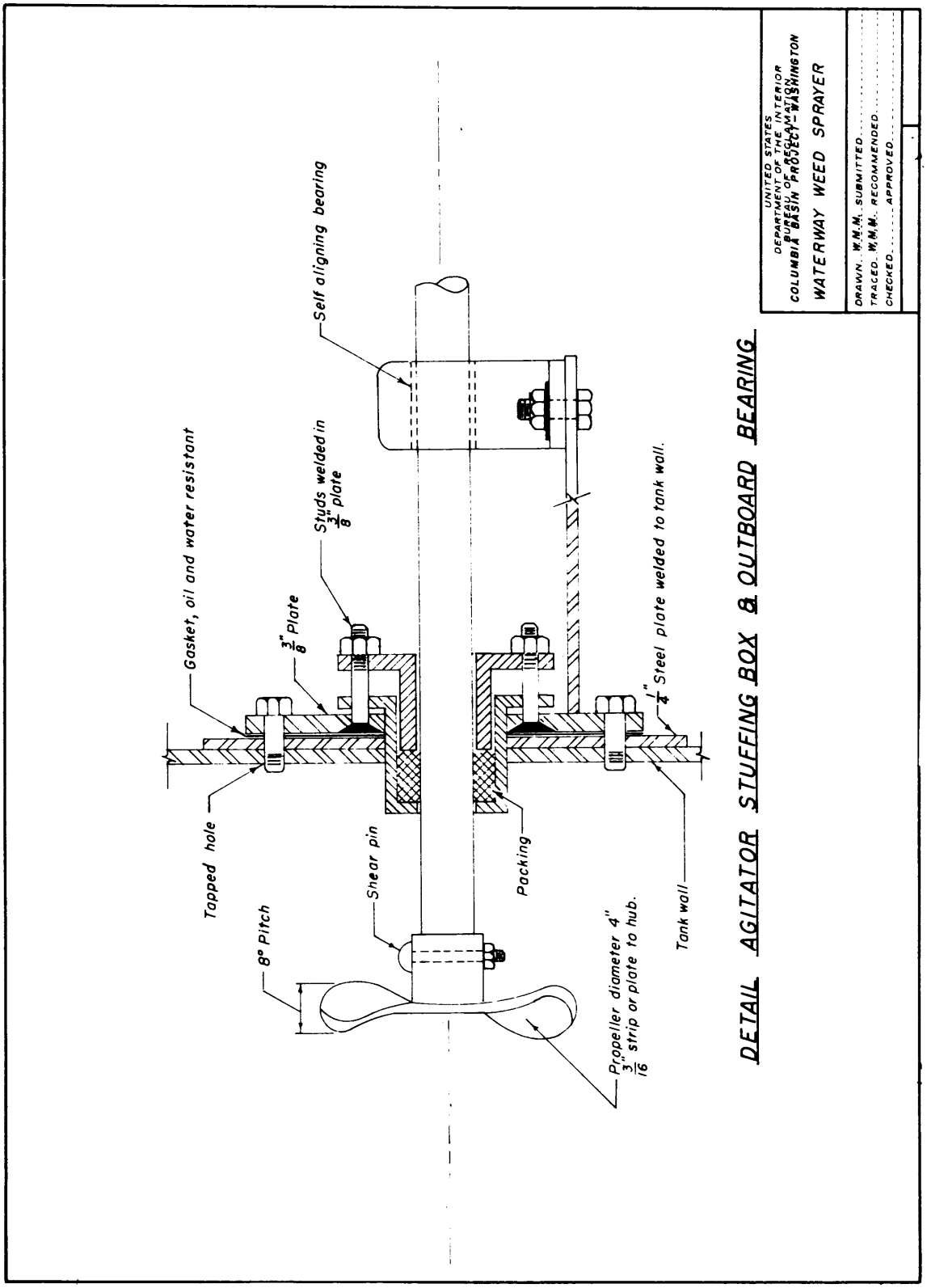

Self aligning bearing
Studs welded in
3/8" plate
3/8" Plate
Gasket, oil and water resistant
1/4" Steel plate welded to tank wall.
Tapped hole
Shear pin
Packing
8° Pitch
Tank wall
Propeller diameter 4"
3/16" strip or plate to hub.
DETAIL AGITATOR STUFFING BOX & OUTBOARD BEARING
UNITED STATES
DEPARTMENT OF THE INTERIOR
COLUMBIA BASIN PROJECT - WASHINGTON
WATERWAY WEED SPRAYER
DRAWN W.M.M. SUBMITTED
TRACED W.M.M. RECOMMENDED
CHECKED APPROVED

Fig. 82

Small Sprayers and Spraying Devices

Few sprayers of any size are single-purpose rigs. The nature of their construction is such that they may be used to spray many kinds of liquids which have a viscosity near that of water or fuel oil. However, smaller sprayers have been constructed with a single purpose in mind, because most parts are readily available for their assembly.

The small sprayers described in this bulletin are types which contain a power supply of some sort. Some are powered with small gasoline engines, electric motors, or are made a part of a larger piece of equipment such as a tractor which supplies needed power. Other devices utilize gas or air pressure for a source of power.

Many back-pack sprayers are available which are operated by hand, the pressure being exerted by direct pumping or by air pumps. Where drift is a highly important consideration, spraying may be done at very low pressures, less than 1 pound per square inch.

The nozzle is the one component of a special spraying device that may not be readily available. Where the quantity of fluid applied is small, or the distribution of the fluid critical, the proper orifice or nozzle is the controlling factor. Nozzles and pressure regulators were described by Wesley E. Yates, Assistant Professor of Agricultural Engineering, University of California, Davis, California, in the fall 1960 issue of the periodical "Down to Earth."

An ordinary gun-type nozzle can be used as an effective weed spray-gun, where high volumes of liquid at low pressures are required. Under these conditions, the coarse droplets produced by the garden nozzle provide good wetting with a minimum of drift. The spray pattern is not uniform, but can be adjusted to cover a distance of 20 to 25 feet, in willows, cattails, or other tall weeds.

Nozzles for a variety of needs are made by several companies for agricultural and industrial use. A county agent may be able to direct you to a source of supply.

Tractor-mounted Spray Unit

The tractor-mounted spray unit shown in Figures 83, 84, and 85, was constructed in the shops of the Flathead Irrigation Project, St. Ignatius, Montana.

This compact unit mounted on the small crawler tractor makes it possible to gain access to areas where a truck could not travel. More detail of the spray unit and manner in which it is mounted can be seen in Figure 84.

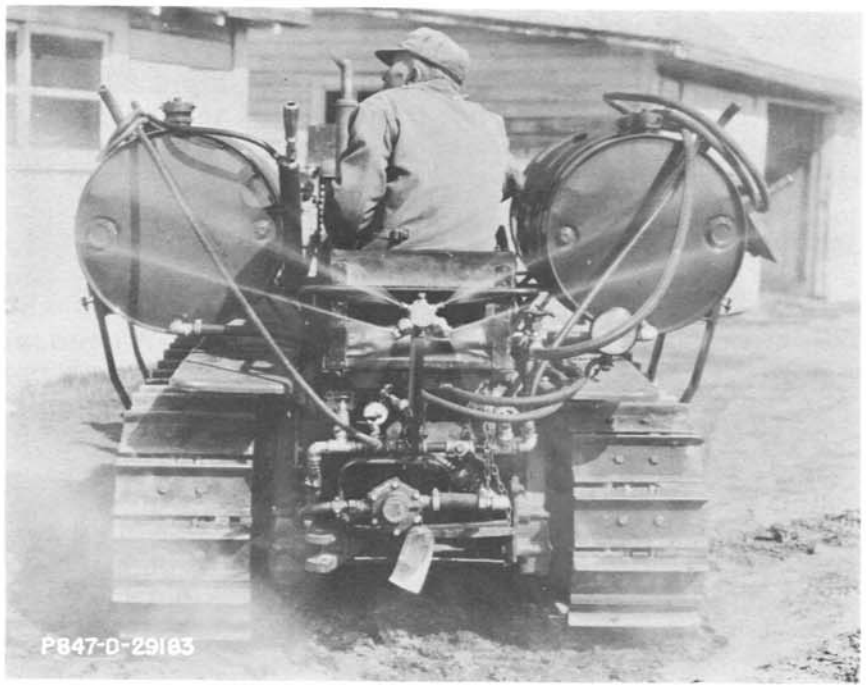


Fig. 83

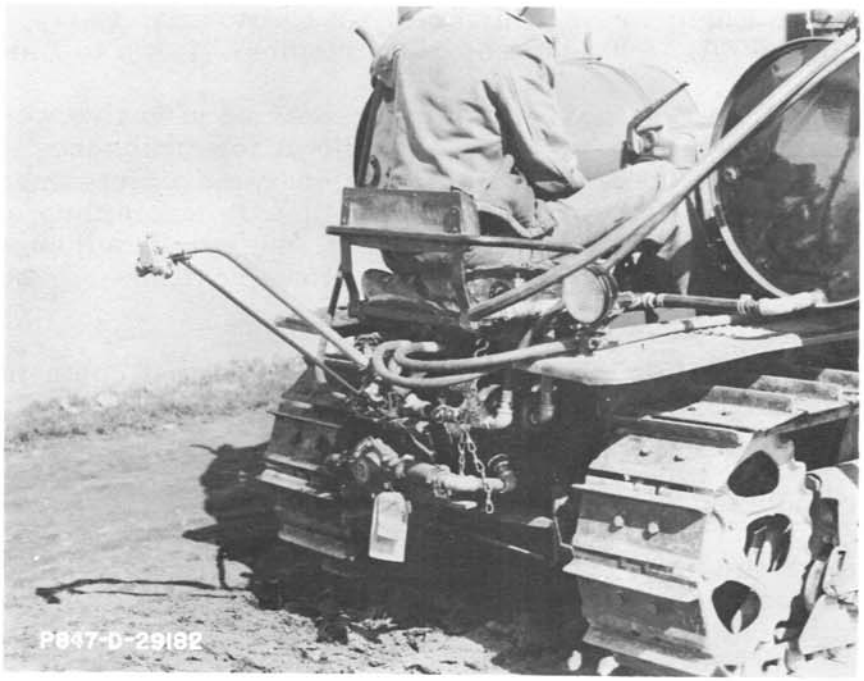


Fig. 84

Fig. 85

The spray pump kit was purchased and the hook-up modified with material on hand to fit the requirements of the installation on the tractor. The two 55-gallon drums mounted over the tractor treads provide an ample supply of spraying material without having to stop too frequently for refilling.

The unit can be used for the broadjet spraying of a canal or lateral, a borrow area or other similar area, as shown in Figure 83, or it can be used in hand spraying as shown in Figure 85. One-man operation of the tractor and conveniently located controls of the spraying equipment simplifies the operation and reduces operational expense.

Weir Pool Weed Sprayer

Use of the weir pool weed sprayer, shown in Figure 86 on Deschutes Project, Oregon, results in considerable savings in time, more weir pools and isolated areas being sprayed, and the spraying operation being much better than that usually performed with less efficient 3-gallon back-pack-type sprayers. The new device delivers the spray material from the spray wand held in the operator's hand in response to his pressing a button on the handle of the wand.

The unique feature of this unit is the elimination of a gas engine for power. The pump and reel are both operated by two 6-volt starter motors with remote controls on the boom handle which gives the operator finger tip control when spraying 100 to 200 feet from the machine.

The unit is built on a metal base which can be placed in any 1/2-ton pickup with room to spare. It has a tank capacity

Fig. 86

of 50 gallons. A diagram of the complete unit is shown in Figure 87, and a wiring diagram and details of the hollow bronze shaft are shown in the sketches in Figure 88.

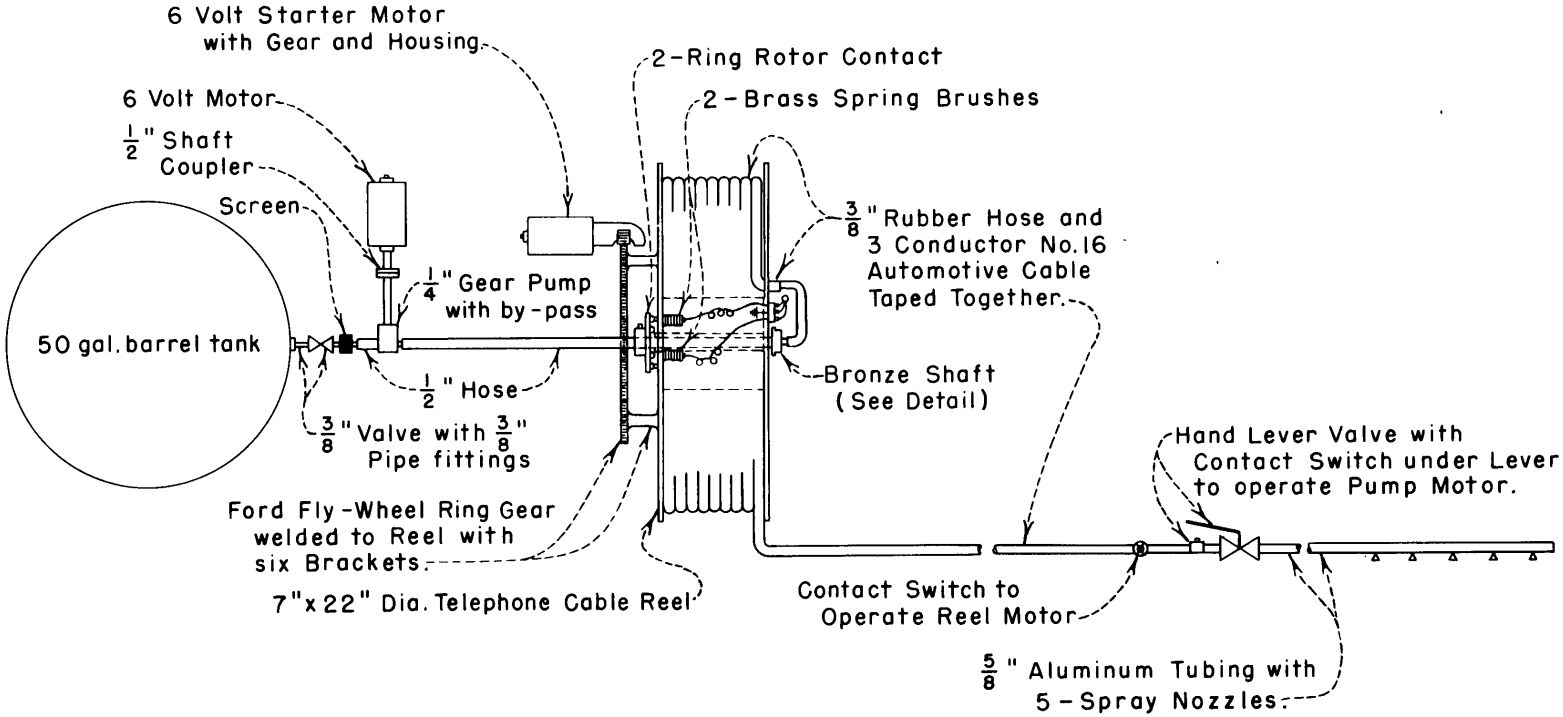
Compressed-air Weed Sprayer

The compressed-air weed sprayer mounted in a four-wheel drive vehicle, Figure 89, photo courtesy of Bureau of Entomology and Plant Quarantine, 301 Metropolitan Building, Minneapolis 1, Minnesota, has been used successfully and in hilly or in mountainous country for barberry control work. Several hundred feet of 1/4-inch neoprene hose is used to reach isolated weed patches in areas where the vehicle cannot be driven.

Construction details include:

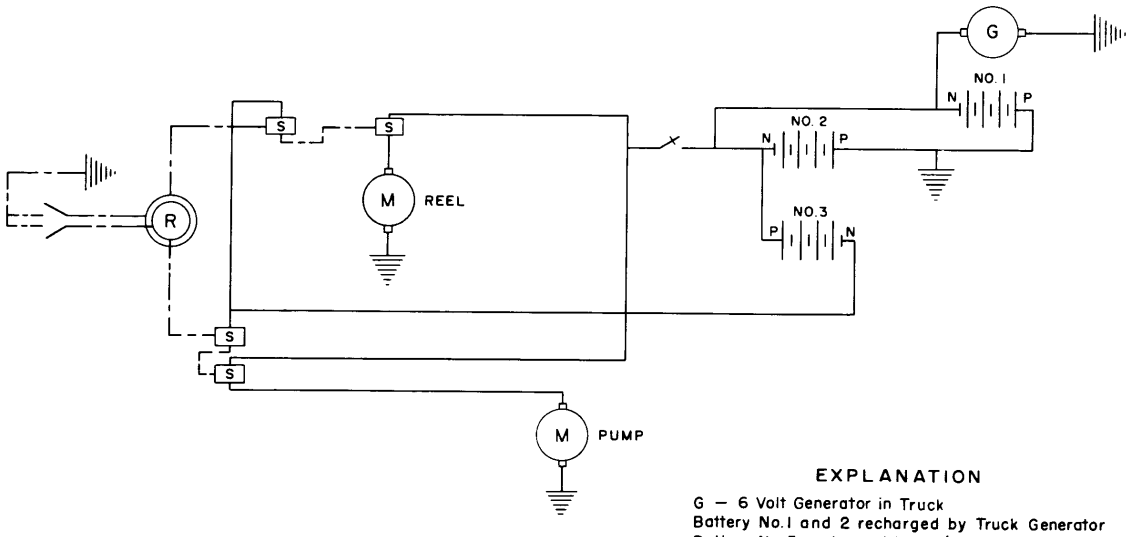
(1) Opening into 60 gallon tank for filling with solutions or emulsions (suspensions cannot be used as agitation in tanks has not been provided.)

(2) Outlet valves on each end of tank insures discharge regardless of quantity of material in reservoir or the slant of the truck bed. Each outlet pipe extends almost to bottom of the tank.



WEIR POOL WEED SPRAYER

Fig. 87



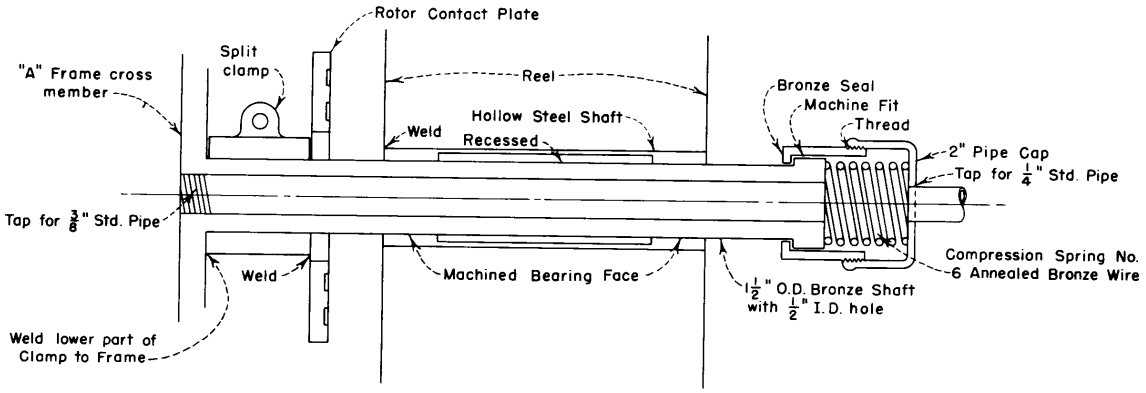
NOTES

For 150 Ft. Hose – 12 Volts are required to operate solenoid switches (Batteries No. 2 and 3)
For 75 Ft. or less – 6 Volts is sufficient to operate solenoid switches and Battery No. 3 could be omitted.

EXPLANATION

G – 6 Volt Generator in Truck
Battery No. 1 and 2 recharged by Truck Generator
Battery No. 3 recharged in Shop
M – 6 Volt Automobile Starting Motors
S – 6 Volt Automobile Solenoid Switch
R – Rotor Contact (2-Rings) for Transmission through Reel and Spray Control.
—— 300 Amp. Battery Conductor Cable.
– – – No. 16 Automotive Conductor.

WIRING DIAGRAM



HOLLOW BRONZE SHAFT DETAIL

Fig. 88

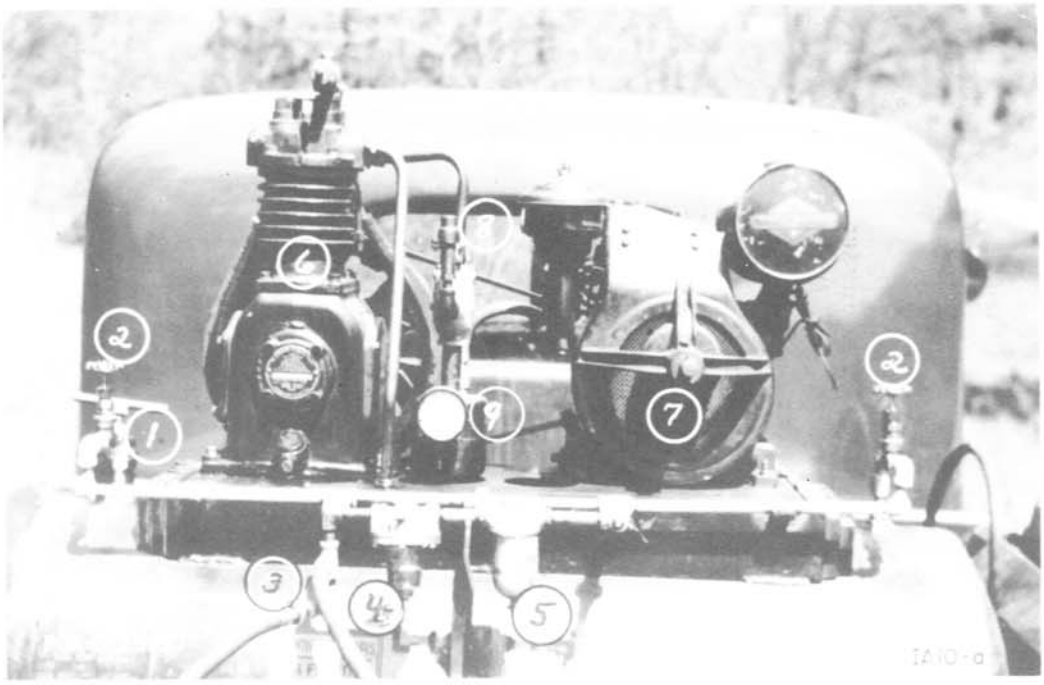


Fig. 89

(3) Two outlet connections to 1/4-inch feeder hose. Snap-on-type connectors are used to facilitate rapid coupling of the feed lines.

(4) Adjustable pressure regulator

(5) Line filter

(6) Compressor

(7) Air-cooled gasoline engine

(8) Air tank safety or relief valve.

(9) Air pressure gauge

Portable Sprayer for Reservoir Waterlines

Control of noxious weeds on the waterlines of reservoirs storing water for irrigation is often delayed by lack of equipment suitable for spraying. High volume sprayers of the land rig type are usually too heavy for a boat, or are not suitable to travel the rough terrain necessary to spray the waterline from the land side.

A compact lightweight unit developed on the Columbia Basin Project, Washington, offers no weight problems in a 14-foot aluminum boat, yet can supply ample volume of spray material for tall weeds.

The unit as shown in the diagram, Figure 90, consists of a three-horsepower air-cooled gasoline engine coupled by a belt to a single stage centrifugal pump (input 1-1/4 inches, output 1 inch).

Fig. 90

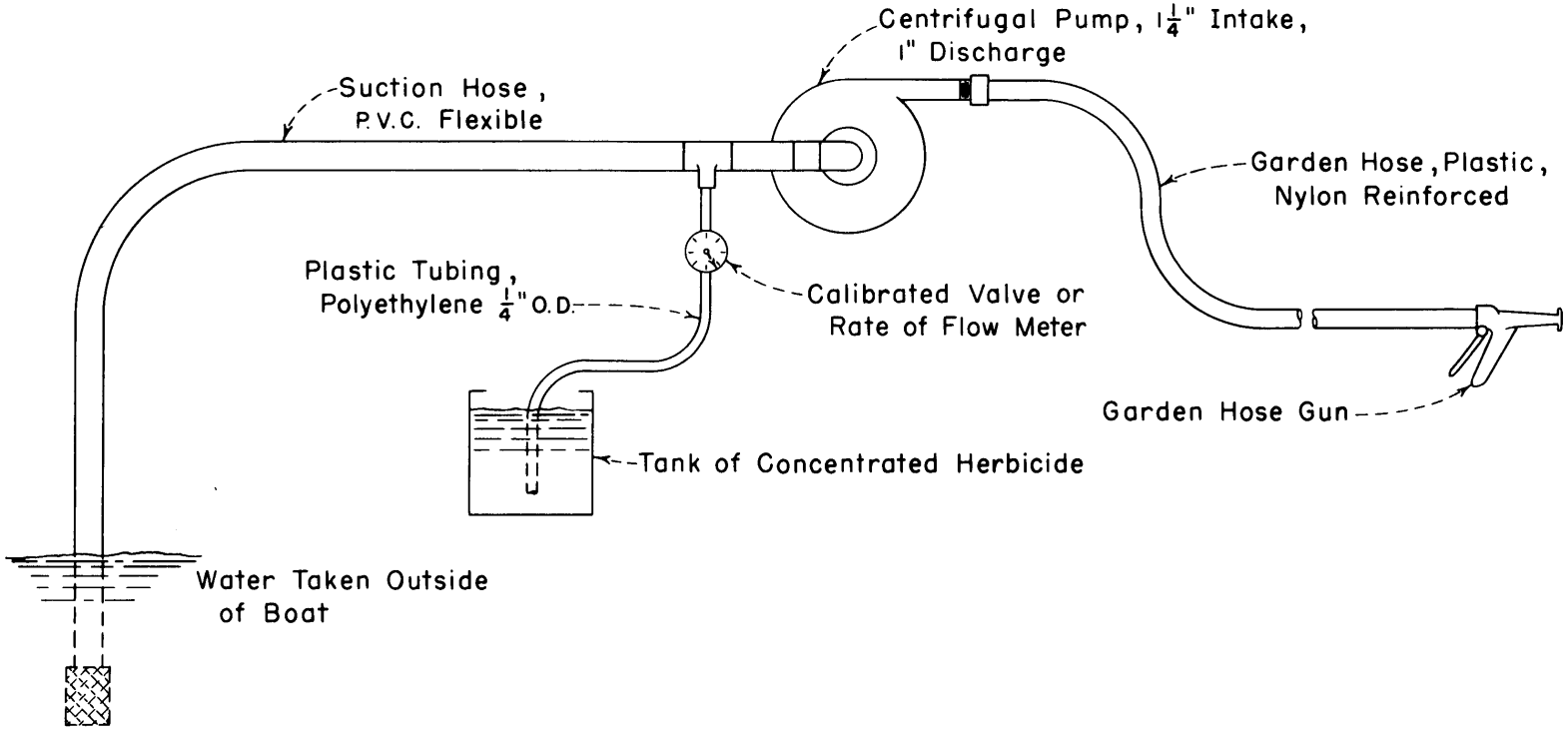


DIAGRAM FOR ASSEMBLY OF BOAT MOUNTED SPRAYER
FOR USE ON RESERVOIR WATERLINES

COLUMBIA BASIN PROJECT
EPHRATA, WASHINGTON

Herbicide concentrate in liquid form is added to the suction side of the pump in a definite proportion which is controlled by a small orifice or valve. Where 2, 4-D is used at 100 to 300 gallons per acre, proportioning is reasonable accurate at 100:1 (water: herbicide); by diluting the concentrate, 200:1 to 500:1 concentrations may be obtained. Lower proportions may be obtained by using a larger orifice.

In practice the pump and engine are clamped to the front seat of the boat, and a 100-foot reel of reinforced plastic hose is clamped to the transom. The suction hose with strainer is trailed in the water over the side of the boat. A foot valve-strainer combination would be helpful in holding the prime of the centrifugal pump. A piece of 1/4 inch - 3/8 inch plastic (polyethylene) tubing is attached at one end to the pump suction hose, through an automotive gasoline valve. The other end is submersed in a 5-gallon container of the concentrated herbicide. An orifice may be inserted in the inlet end of the tube if a fixed proportion is desired. A more flexible, but less accurate control is obtained by affixing a dial on the valve, and marking the various proportions after calibration.

Small patches of weeds may be sprayed from the boat without beaching. Larger or more distant patches may be sprayed by beaching and unrolling up to 200 feet of 3/4-inch hose. An ordinary gun-type garden hose nozzle similar to that shown in Figure 91 is adequate where these large volumes of water are available. At 30 pounds of pressure good coverage can be had 30 feet from the operator. For longer distances, higher pressures and special guns would be desirable.

Five gallons of 2, 4-D at 4 quarts per acre sprays 5 acres, as much as a man can handle in one day on large patches. The total weight of the apparatus (pump, engine, hose, and reel) and chemical is approximately 150 pounds.

Two operational factors are important:

1. A centrifugal pump must be primed each time air is allowed to enter the case.
2. Small orifices are susceptible to stoppage and should be adequately screened against dirt.

Portable, Two-Tank Sprayer

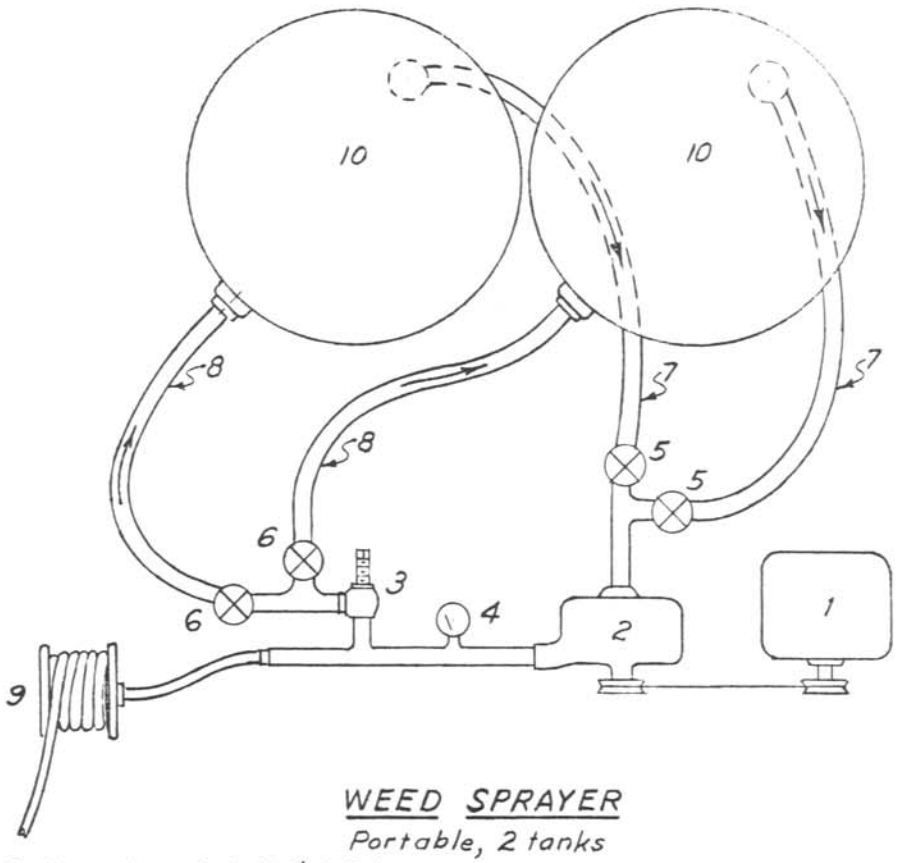
A portable, two-tank sprayer was designed and built by Mr. Floyd Oliver, Grant County Weed District No. 1, Quincy, Washington. It consists essentially of a 1.5 to 2.0 horsepower, aircooled engine and and a 1-1/2-inch inlet, 1-inch outlet centrifugal pump, with necessary fittings.

Fig. 91

The tanks as shown in Figures 92 and 93 were constructed of milk can tops welded to bottoms of 55 gallon steel drums, with the necessary hose connections made to existing plug holes in what would have formerly been the tops of the drums. A schematic diagram of the weed sprayer is shown in Figure 94.

Fig. 92

Fig. 93



WEED SPRAYER

Portable, 2 tanks

1. Engine, aircooled, 1.5-2.0 h.p.
2. Pump, centrifugal, 1¼" inl, 1" oull.
3. Relief valve, 1".
4. Gauge, pressure, 0-100 p.s.i.
5. Valve, 1¼".
6. Valve, 1".
7. Pipe, 1¼", polyethylene with nylon fittings.
8. Pipe, 1", polyethylene with nylon fittings.
9. Reel, garden hose, heavy duty, wall-mount type with 100 foot of 5/8" i.d. vinyl hose, nylon reinforced.
10. Barrell, 55 gallon with milk can mouth, shoulder welded on top.

NOTE

Designed by Floyd Oliver, Grant Co. Weed Dist. No. 1, Quincy, Wash.

UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF RECLAMATION
COLUMBIA BASIN PROJECT, WASHINGTON

WEED SPRAYER
SCHEMATIC DIAGRAM

DRAWN O.D.S. SUBMITTED
TRACED E.S. RECOMMENDED
CHECKED APPROVED

Fig. 94

Portable Sprayer

The small portable sprayer shown in Figure 95 weighs less than 60 pounds and has been used successfully for low-volume application of weed control herbicides to test plots and small areas which are inaccessible to more bulky equipment. The sprayer also has been used for applying aromatic solvent to control submersed aquatic weeds in small-sized irrigation ditches. The unit was designed and constructed by Mr. S. T. Ancall, Agricultural Commissioner, Tehama County, Red Bluff, California.

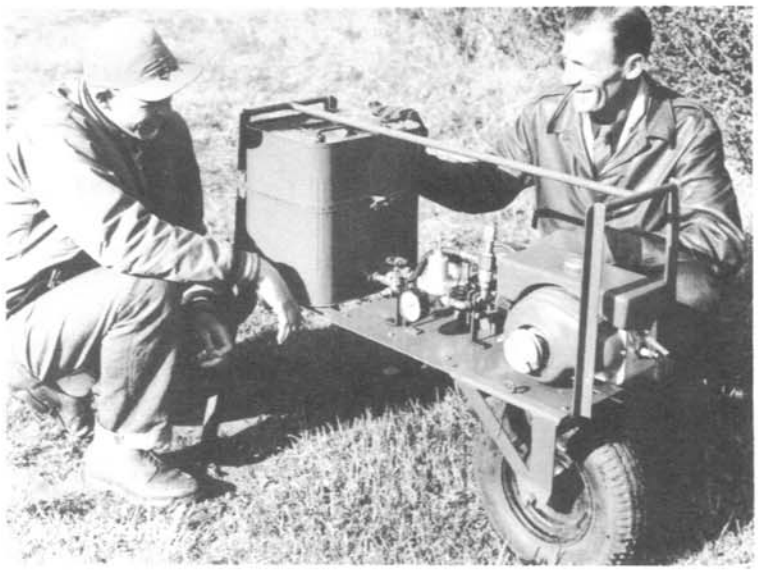


Fig. 95

Two sprayers are shown in Figure 96 to indicate how several additional parts will make the machine a more serviceable unit. A brief description of the numbered parts of the sprayer is as follows:

(1) Feed line from tank to filter is 1/4-inch neoprene hose
(2) Standard gasoline line sediment bowl
(3) Gear pump
(4) Pressure relief valve.

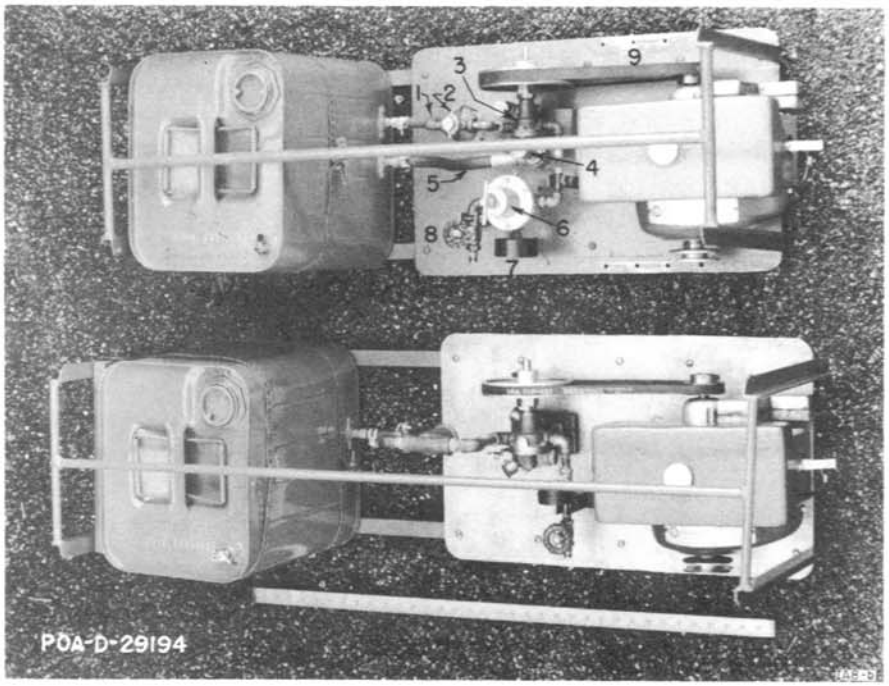


Fig. 96

(5) Neoprene 1/4-inch hose from relief valve to bottom of tank
(6) Pressure control valve
(7) Pressure gauge
(8) Outlet shutoff valve
(9) The two-cycle air-cooled gasoline engine is constructed of aluminum and weighs 17 pounds. The belt drive is a 4 to 1 pulley ratio.

Propane Hand Sprayer

A spray gun similar to a compressed-air paint sprayer has been utilized for weed control by the Bureau of Reclamation, Carson City, Nevada, as shown in Figures 97 and 98. The spray gun is attached by a rubber hose to a tank of liquid propane. The pressure exerted by the propane in the tank is utilized as a propelling force to the herbicide which is contained in the 1-quart spray gun.

Pressure exerted by the compressed propane will remain constant up to 16 times longer than compressed air since additional force results from the propane changing from a liquid to a gaseous state. The gas escaping with the herbicide apparently does not affect results of the chemical treatment.

The spray gun has been modified with an adapter so that standard nozzles with interchangeable tips can be used for applying different quantities of herbicide. A gauge and an adjustable valve are installed on the outlet of the propane tank to regulate the pressure. By controlling the release of gas a constant pressure can be maintained at the gun to obtain very uniform spray coverage of the plot. Generally a pressure of approximately 40 pounds per square inch is used.

The connecting hose is 20 feet in length which allows access to all corners of small experimental areas without moving the tank.

Fig. 97

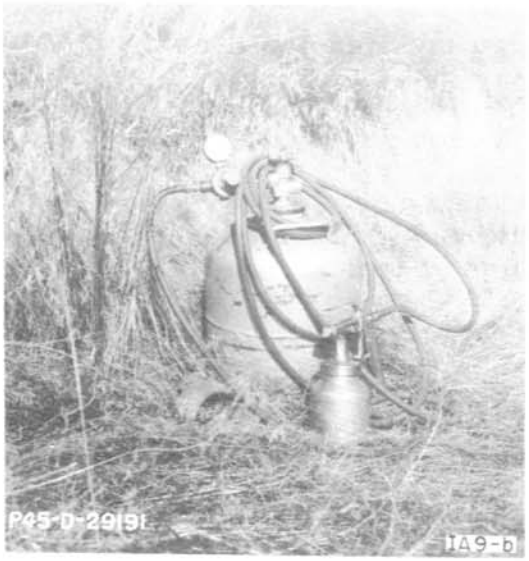


Fig. 98