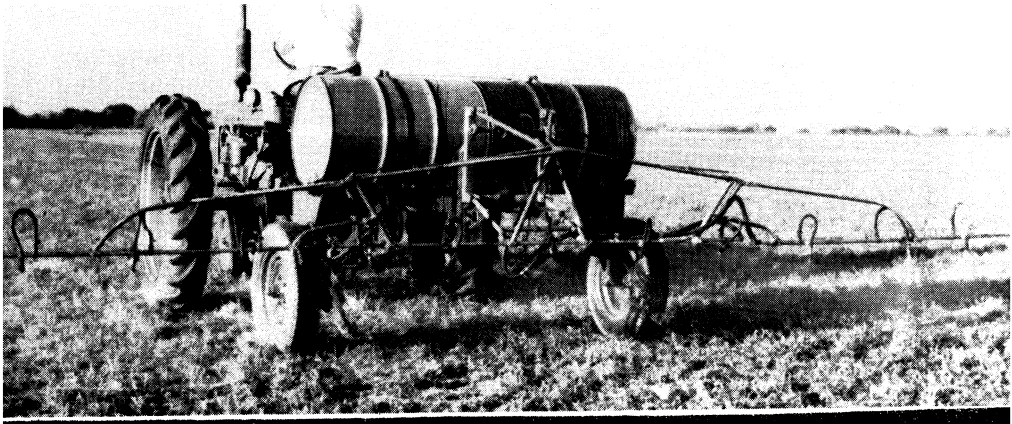

A GENERAL PURPOSE FARM SPRAYER

BY W. S. WOOD AND W. J. OATES

Departmentof Agricultural Engineering

OKLAHOMA AGRICULTURAL EXPERIMENT STATION
Oklahoma A. & M. College, Stillwater
W. L. Blizzard, Director — Louis E. Hawkins, Vice Director

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Agricultural spraying equipment has not kept pace with the advances made in chemical pest control during the past 10 years. As a result, farmers often have had to build machines to do their particular job of spraying; and there has been growing need for an all-purpose farm sprayer.

A sprayer designed to suit other areas or types of agriculture is not necessarily the most suitable for use in Oklahoma. Therefore the authors were assigned the task of designing a suitable machine. This bulletin describes the sprayer developed as a result of that assignment.

MAJOR FEATURES

The Oklahoma A. & M. all-purpose farm sprayer was designed primarily for four major types of work: Weed control, insect and plant disease control, livestock spraying, and cotton defoliation. Other uses might include fighting grass fires, spraying whitewash, and applying disinfectants in livestock buildings.

The sprayer can be used equally well for row crops or broadcast spraying, and would be suitable for a small home orchard. It can be built as a trailer unit, or mounted on a tractor. When tractor-mounted, it is easily attached and removed.

The boom is easily raised or lowered, and is hinged to go through gates. Pump and liquid lines are designed to withstand corrosive chemicals.

Economy of manufacture was carefully considered, since cost is of primary importance in a machine intended for widespread use on small as well as large farms and ranches. The machine could be built in a local machine shop if desired, although the primary objective of the design project was a machine for commercial manufacture at a reasonable price.

STEPS IN DESIGN

The first step taken in designing the Oklahoma A. & M. all-purpose farm sprayer was to consider complaints made by farmers about sprayers already in use. This information was available in results of a 27-state survey made in 1948 and again in 1949.* (That sprayers are rapidly

* "Weed Spraying Profitable." *Farm Equipment Retailing,* March, 1950.

being improved was indicated by a sharp drop in the number of complaints between the 1948 and the 1949 survey.)

Next, for purposes of study and design, the four basic units in a farm sprayer were identified. These are chassis, boom, liquid system, and power source. Each of these may be considered separately, and may be altered, or substitution made, without directly affecting the functioning of the other three.

Simplification of each of these units, and of their interconnections, was a keynote in the designing process.

Various units were assembled or actually constructed, and then different combinations of these units were tested in both shop and field. Field tests were made by five cooperating farmers in actual use on their farms.

THE FINAL DESIGN

The final "prototype" design was built as a trailer. However, the liquid system and boom are readily adapted to tractor mounting.

Chassis

The trailer has 30 inches of crop clearance, and wheel width is adjustable up to 80 inches. It is free from projections that might injure crop foliage, and permits short turns even when hitched to the largest row-crop tractor. It carries two standard oil drums, has a standard boom mount for interchangeable booms, and has space for mounting a power unit.

Trailer details are shown in Figures 1 and 2. Two horizontal transverse members of 2-inch pipe 74 inches long, spaced 15 inches apart, provide both a cradle for two 23-inch diameter drums and rails on which the adjustable wheel mounts may slide for widening or narrowing the wheel width. Two horizontal longitudinal members, of 3-inch channel, spaced 18 inches apart outside, are welded underneath the pipe transverse members at right angles, spaced equally on either side of center of the length of the pipe transverse. These tie the pipes into position, and also serve as a base for the boom mount in the rear, a base for a power unit in front ("A," Fig. 1), and converge at a 45-degree angle in front to provide an anchor for the tongue. The tongue is a box member slanting downward at an angle of 25 degrees and ending in a trailer hitch approximately 16 inches from the ground. The spacing between the hitch and the front transverse pipe is ample to provide short turning with the largest row-crop tractors.

The wheels were mounted on stub axles welded to V members. Each leg of the "V" terminates with a clamp ("B," Fig. 1) which grips the 2-inch pipe and can be loosened to adjust the wheel width. Safety skids ("C," Fig. 1) at the rear of each "V" frame prevent the machine from tipping backward when it is not hitched to a tractor.

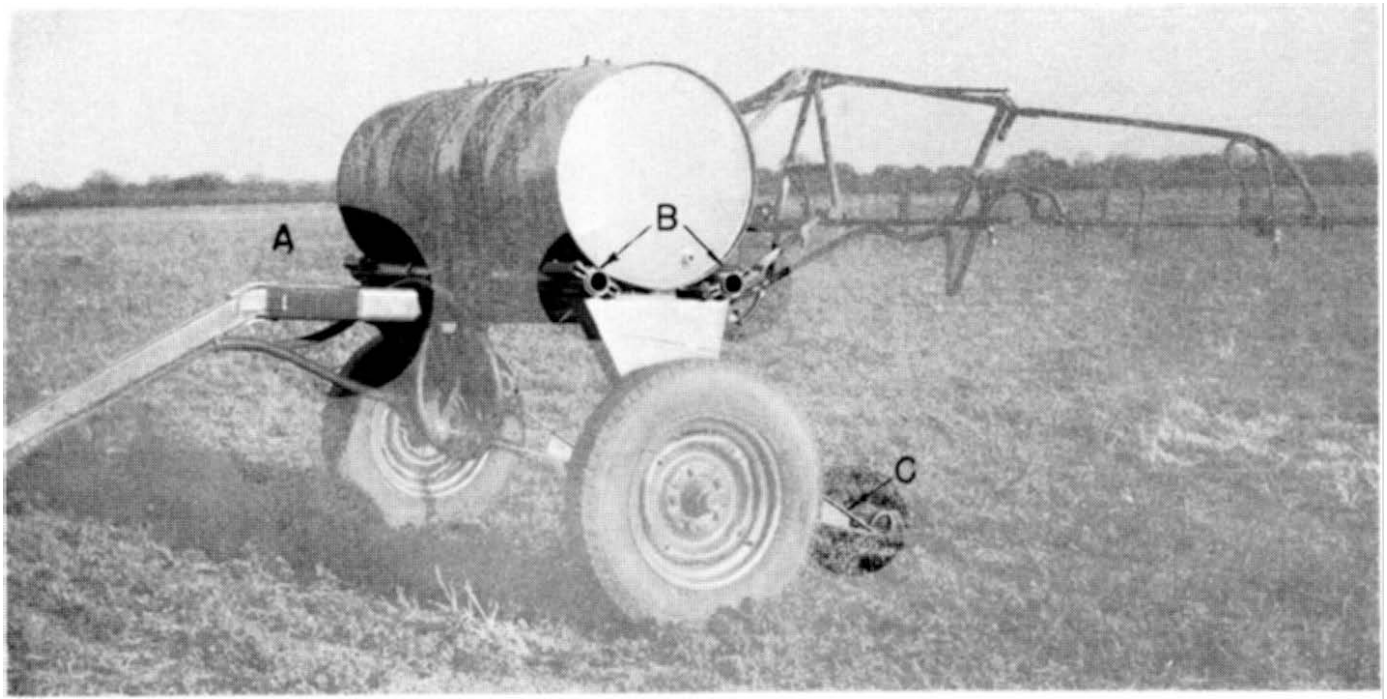


Fig. 1.—The spray trailer has space for a power unit (A), but can also use a pump attached directly to the power takeoff of the tractor. This view shows suction and pressure hoses leading down the trailer tongue to the pump on the tractor. "B" indicates the clamps used to adjust wheel width for row crops. The safety skids (C) keep the trailer upright when it is unhitched from the tractor.

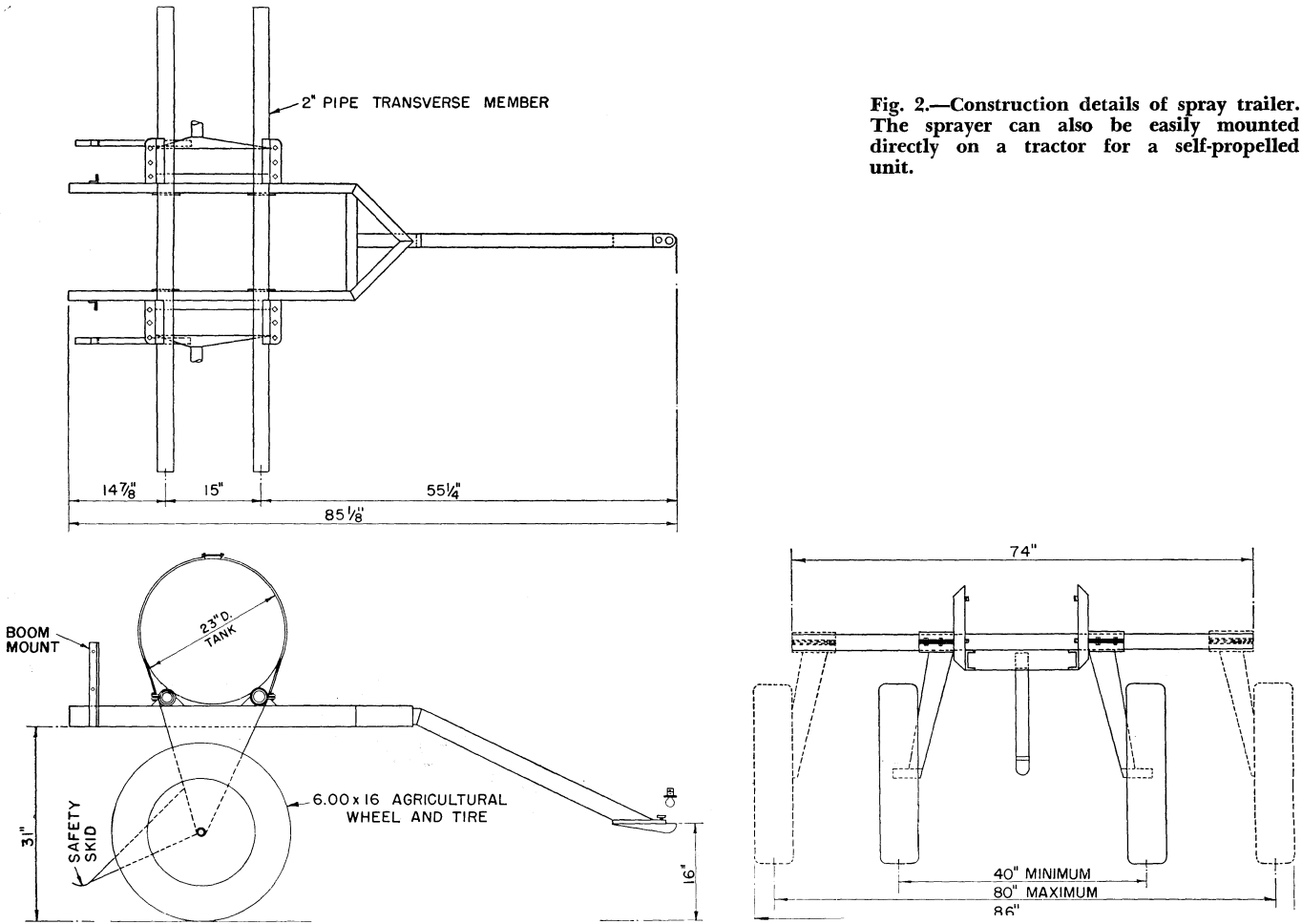
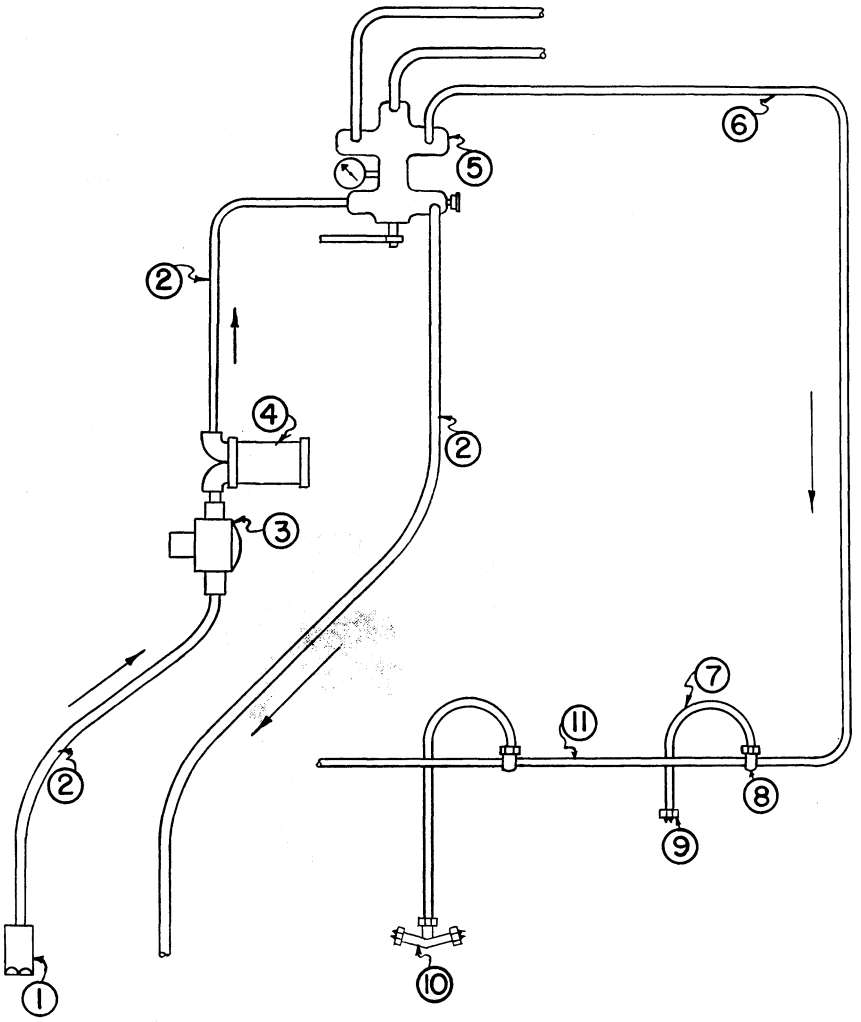


Fig. 2.—Construction details of spray trailer. The sprayer can also be easily mounted directly on a tractor for a self-propelled unit.

Liquid System

For tanks on the test models, 55-gallon drums were selected because they were cheap and easily obtained. Although rusting and scaling is a serious nuisance with steel tanks, they are inexpensive enough to be discarded without undue loss after a season's use.

Figure 3 shows the parts of the liquid system in proper sequence.



1—Suction Strainer
2—Hose, ¾″ I.D.
3—Tractor Pump
4—Line Strainer
5—Spray Control
6—Hose, ½″ I.D.
7—Hose, ¼″ I.D.
8—Eye-Let Tee-Jet Body
9—Tee-Jet Brass Nozzle
10—Double Swivel Tee-Jet
11—Stainless Steel Tube

Fig. 3.—Schematic diagram of liquid system, showing relationship of parts.

A suction strainer is placed in the tank to screen out the larger particles which might damage the pump. The liquid passes through a chemical resistant ¾-inch hose to the pump. It is important that the suction hose have no joints between the suction strainer and the pump. If such a joint is necessary, it should be gasketed and tightly sealed, because a leak in this line will not show liquid on the outside. If a leak occurs, the partial vacuum inside the line draws air into the pump, where it may cause a loss of prime if the pump is not self-priming.

The pump ("A," Fig. 4) finally adopted was selected because it withstood the corrosive action of the material used to spray wheat for green bug infestation during the spring of 1950. The pump is a rotor type which mounts directly on the power takeoff and develops a maximum pressure of 180 pounds per square inch. Screwed directly into the outlet side of the pump is a 200-mesh-screen line strainer ("B," Fig. 4) to remove smaller particles that may pass through the suction strainer in the tank. Liquid from the strainer passes through a ¾-inch hose to the control manifold.

The spray control manifold (Fig. 5) is mounted on a bracket attached to the tractor on the right side of the operator. The manifold

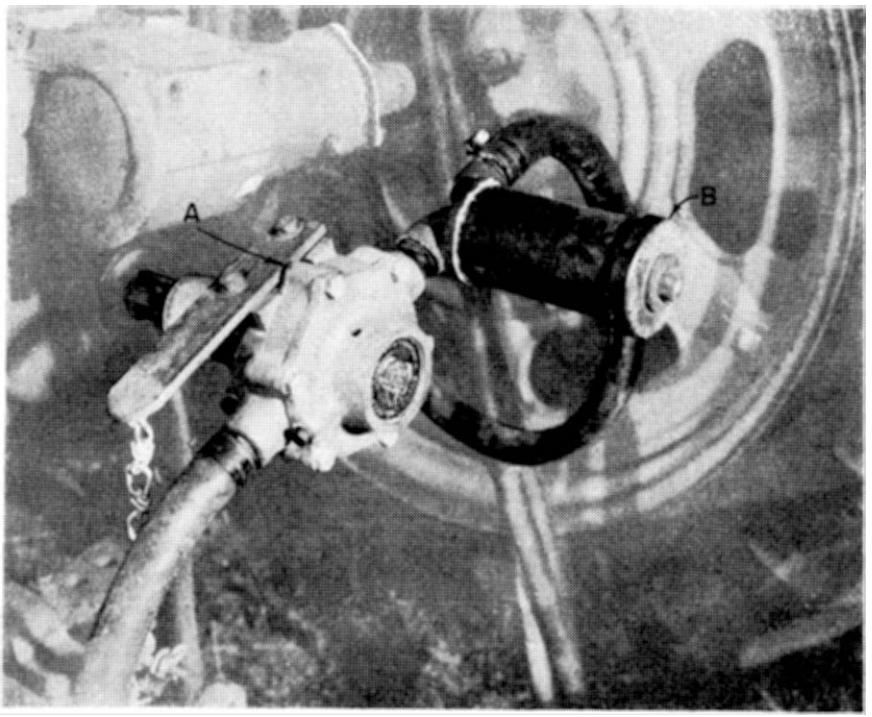


Fig. 4.—The pump (A) mounts directly on the power takeoff of the tractor. The line strainer (B) removes foreign matter which might otherwise clog the nozzles.

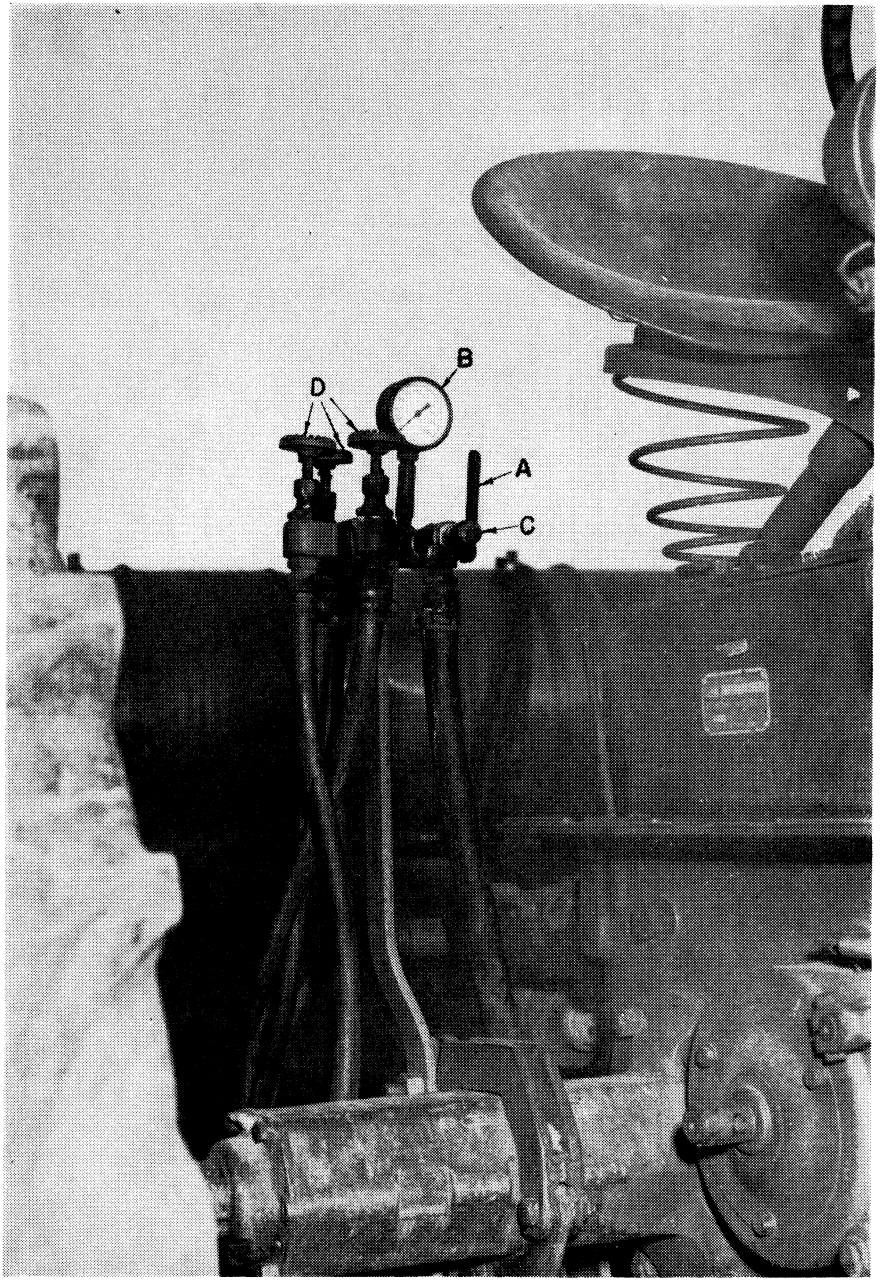


Fig. 5.—The control manifold is conveniently located and gives the operator complete control of the sprayer. The one unit includes a cutoff valve (A), pressure gauge (B), pressure regulator (C), and separate individual cutoff valves (D) for each section of the boom.

is within easy reach of the driver, and he can see it without turning in the tractor seat. The manifold contains within one brass casting a master cutoff valve ("A," Fig. 5), a pressure gauge ("B," Fig. 5), a pressure regulator ("C," Fig. 5), three individual boom cutoff valves ("D," Fig. 5), three ½-inch hose connections for boom lines, and a hose connection for a by-pass line.

The by-passed liquid returns to the tank and serves to agitate the liquid in the tank to keep the toxicant mixed with water. The individual boom lines are connected to the three sections of boom, each spraying two rows. From the ½-inch hose connecting the manifold with the boom, the liquid passes into horizontal stainless steel tubing in the boom. Stainless steel was chosen for the experimental models because it is practically immune to corrosion by the spray materials used at present.

Eyelet connectors spaced at 20-inch intervals along the stainless steel tubing let the liquid pass out of the top of the tubing into ¼-inch hose terminating in nozzles. The liquid is drawn from the top of the tubing so that any particles in the liquid would settle in the bottom of the tubing and be flushed out when the machine was cleaned at the end of the work period. Cleaning is facilitated by plugs screwed into the end of the stainless steel tubing opposite the end through which the liquid enters.

The nozzles used with the experimental models were fan spray type, selected because they were rated as good,* are easy to disassemble, and can be purchased in a wide variety of sizes. The nozzles are arranged so that a single nozzle is positioned directly over the row and a double adjustable nozzle is dropped between each row. This arrangement permits the use of up to three nozzles per row for row-crop spraying, and up to three nozzles per 40 inches of boom length for broadcast spraying. The boom covers a swath of six rows or 20 feet with each pass of the sprayer.

By disconnecting one of the boom lines from the manifold and attaching in its place a section of garden hose fitted with a hand gun, the sprayer can be used for any spraying operation requiring a hand gun.

Boom

Booms were singled out as a particularly weak part of the structure of sprayers on the market during 1948 and 1949.** A majority of the field sprayers put on the market in past years have been equipped with booms which consisted of a 1-inch pipe, hinged in two places to divide the boom into three equal lengths. The booms were bolted to the

* Hudspeth, E. B.: *Comparison of Low Volume Spray Nozzles for Weed Control.* Thesis, Michigan State College, 1949; p. 37.

**"Weed Spraying Profitable." *Farm Equipment Retailing,* March, 1950.

frame in the center, and supported on the ends by guys of chain, wire, or rod.

A long section of pipe, not rigidly supported, will whip and pitch when subjected to irregular vibrations such as are transmitted to a sprayer boom from a tractor in motion on irregular ground. Whipping of the boom causes the spray material to be deposited in irregular patches. To avoid this, some manufacturers have resorted to trussed structures of steel supporting rubber or brass tubing in which the liquid lines carry no mechanical load.

Some sort of hinge for folding the boom is necessary to permit the sprayer to be moved through gates, down roadways, and among farm buildings. The hinge usually doubles for a safety device to prevent damage when the boom strikes an obstruction.

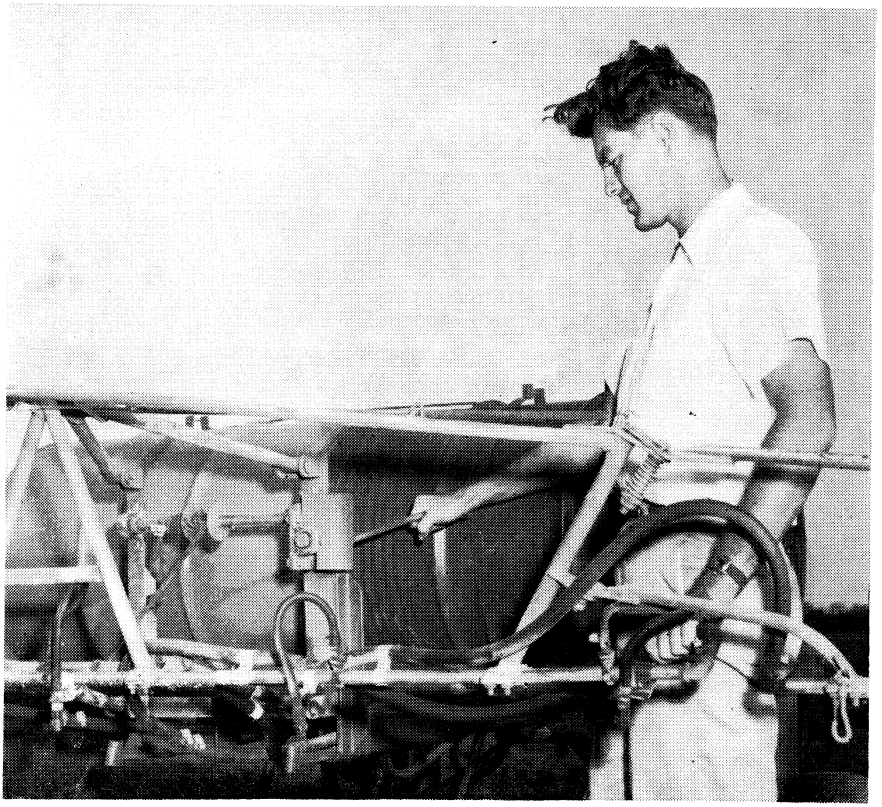


Fig. 6.—Height of the spray boom is easily and quickly adjusted by turning a hand crank. No wrench is needed.

Fig. 7.—The spray boom is wide enough to cover a 20-foot swath in broadcast spraying, or six rows when working on row crops. Up to three nozzles per row are available to give thorough coverage.

A frequent source of trouble is difficulty in adjusting the boom height to suit different crop sizes. One manufacturer provides a hydraulic lift to raise the booms of one model, but on the majority of sprayers it is necessary to use a wrench to adjust the boom height.

The boom on the Oklahoma A. & M. all-purpose farm sprayer is attached to the chassis by slotted holes in the boom base. These slots are so arranged that the weight of the boom holds it securely in place. Wing nuts are added as a precaution to prevent the boom from being unseated by jolting over rough ground. Parallel links are hinged to the base, and support the boom on their outer ends. The parallel links are capable of movement of 45 degrees above and below the horizontal. The movement of the linkage is controlled by a hand actuated cable lift (Fig. 6). The boom can be raised to its greatest height from its lowest position by turning a hand crank.

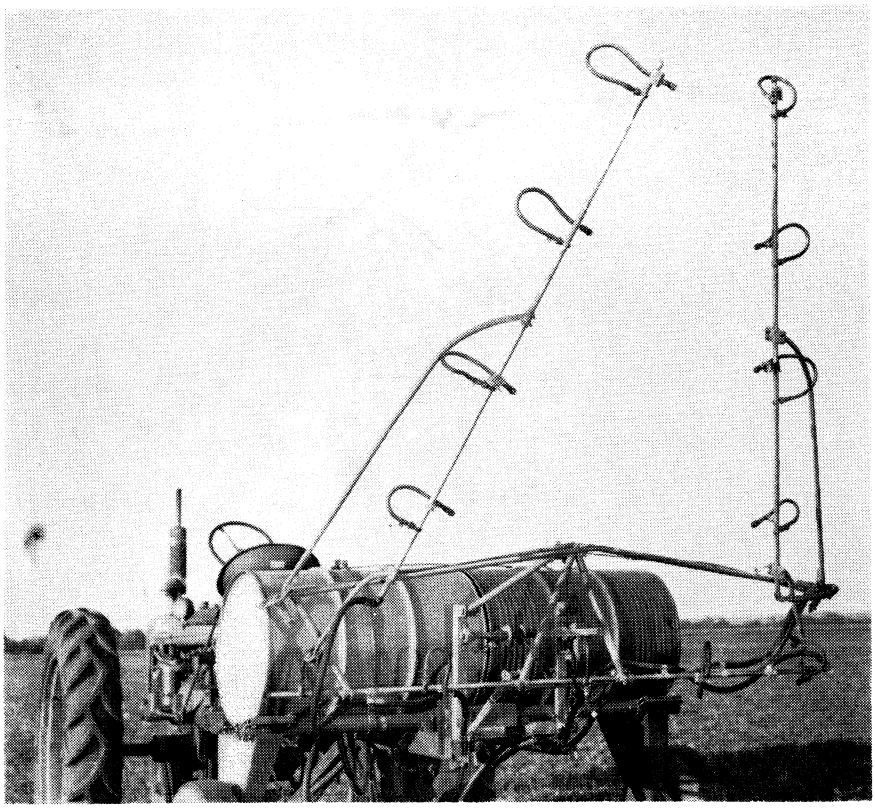


Fig. 8.—The boom folds back and up for traveling. The folding hinge in the boom also acts as a safety feature to prevent damage when the boom strikes an obstruction. When lowered for spraying, the hinged sections of the boom are held in place by gravity, so only a light spring catch is necessary; therefore the boom can be folded or extended without difficulty.

The boom covers six rows of row crops or 20 feet of swath in broadcast spraying (Fig. 7). The liquid line of the boom is constructed of three sections of ¾-inch stainless steel tubing. The center section is 86 inches long and the two outer sections are 78 inches. The two outer sections are suspended by tubular guys extending from the top center of the boom structure to a point mid-way the length of the outer boom sections.

The inner ends of the outer boom sections are supported by a hinge joint. The folding line of the hinge is inclined outward an angle of 60 degrees and extends through the upper guy tubing. The hinges permit the outer ends of the boom to fold back without damage and provide a means of folding the booms for travel (Fig. 8). The angle of the hinge causes the outer boom to swing up as it is folded back; therefore when the boom is returned to its extended position the force gravity assists in bringing it down to the correct position and holding it in place. Thus, a light spring catch is all that is needed to hold the folding boom in an extended position.

Power Source

In the experimental models, the pump was driven from the tractor power takeoff in both the trailer-mounted and tractor-mounted models. However, the trailer design provides space for mounting a one-cylinder gasoline engine if desired.