DEVICE FOR VACUUM AND INERT-GAS SEALING OF TIN CANS

RESEARCH by Barton (1, 2), Brison (3), Glass et al. (4), Goodsell et al. (5), Harrison (6), Harrison and McLeish (7), and Lewis (8) has shown that some kinds of seeds will retain a high viability much longer when sealed under either a partial vacuum or an atmosphere of nitrogen or carbon dioxide than when stored in either cloth or paper containers. A device to accomplish this sealing will therefore be a useful tool for agronomists, especially plant breeders, as it will provide a very inexpensive means for packaging small quantities of valuable breeding stocks for long-time storage.

A simple, inexpensive device for vacuum and inert-gas sealing of tin cans was recently developed at the National Seed Storage Laboratory, Fort Collins, Colorado. The complete sealer, shown in Figure 1, consists of a vacuum chamber, soldering gun, 3-way valve, vacuum gauge, several lengths of air hose, hose clamps, a brass tee fitting, and a source for both vacuum and inert gas.

The vacuum chamber, which was constructed locally, was made from a rigid plastic cylinder, 4½ inches in length. The cylinder had a 3-inch outside diameter and a 1½-inch wall thickness. A ½-inch cut was made around the inner wall extending ¾ inch in from each end of the cylinder. This increased the inside diameter to 2¾ inches on both ends of the cylinder. A base 2½ inches in diameter was cut from a ¾-inch plastic sheet and fitted into the bottom of the cylinder. A shallow depression for proper positioning of the cans was made on the inner surface of the base.

A top for the vacuum chamber was turned from ½-inch aluminum. The aluminum top was provided with a shoulder 3 inches in diameter so that the main part of the top, which was 2½ inches in diameter, would fit into the cylinder while the shoulder rested on top. Two holes, spaced to accommodate the two electrodes of the soldering gun, were drilled in the aluminum top. Each hole was fitted with an “O” ring and an aluminum collar. Several grooves were turned in the upper surface of the top and around each collar to facilitate dissipation of heat from the electrodes of the soldering gun. The edges of the top and bottom of the vacuum chamber were coated with high-vacuum grease to prevent leakage.

A hole was drilled in the side of the vacuum chamber and fitted with a brass hose connection. A length of air hose connected the vacuum chamber to the tee fitting to which the vacuum gauge was attached. A second length of hose joined the tee to the 3-way valve. Two additional lengths of hose were attached to the 3-way valve; one was connected to the inert-gas supply tank and the other to the vacuum line leading to a dual-piston Worthington vacuum pump, size 2½ X 2½ X 1½ inches. All hose connections were secured with clamps. The whole assembly was mounted permanently on a board and clamped to a table top while the sealer was in use.

Operation of the sealer was very easy. A can was filled with seeds and the lid affixed by a regular motor-driven tin-can sealer. A small drop of solder was affixed in the center of the lid and a pin-sized hole was punched through both the solder and the lid. The can was placed in the vacuum chamber and a vacuum drawn. A residual pressure of 2 inches of mercury was obtained. At the altitude of Fort Collins, Colorado, the atmospheric pressure is approximately 25 inches of mercury.

While the can was under the desired vacuum, the soldering gun was activated and the pin-sized hole was soldered shut.

When an inert-gas atmosphere was desired inside the can, the same procedure as for a vacuum was followed except that when the chamber was evacuated, the 3-way valve was turned to permit entry of the gas into the chamber. The inert-gas was withdrawn by evacuating a second time. Again the desired gas was permitted to enter the vacuum chamber. Then the hole in the lid was soldered shut while there was a slight gas pressure in the chamber.

When too much heat was applied to the solder, the solder flowed through the hole rather than sealing it. However, with a little experience the correct amount of heat was applied to seal the hole without losing the solder. Best results were obtained by activating the soldering gun a few seconds before placing the tip in contact with the solder. Satisfactory results were also obtained by placing the tip in contact with the solder before activating the gun.

The number of cans processed per hour with this sealer depended upon the efficiency of the operator and the type of sealing done (vacuum or inert-gas). Vacuum sealing proceeded more rapidly than did inert-gas sealing because there were fewer steps in this procedure. Differences were found in sealing rates when using the various inert-gases.

The size of the vacuum chamber can be varied to fit individual needs. In addition, other uses can be made of this chamber. By removing the soldering gun and plugging the holes which receive the gun, the vacuum chamber made an excellent device for evacuating plant tissues during killing and fixing.—LOUIS N. BASS and EDWIN JAMES, Plant Physiologist and Director, respectively, National Seed Storage Laboratory, New Crops Research Branch, CRD, ARS, USDA, Fort Collins, Colo.

LITERATURE CITED