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An effective yet simple welder for plastic film has been developed at Lawrence Radiation Laboratory. Because the heating element used is comprised of a single length of nichrome ribbon, no warmup is required and the weld cools very quickly; a typical complete operation requires less than a minute. A convenient spade-type handle is provided so that the welder can be operated with one hand. It is readily portable, inexpensive, and quick and easy in operation, all features which encourage the use of positively sealed bags when removing contaminated objects from glove boxes and other enclosures.

INTRODUCTION

The use of plastic film sleeves or bags for removing contaminated objects from radioactive enclosures is well established as an effective method for preventing the spread of contamination outside the enclosure.(1, 2, 3, 4).

At Lawrence Radiation Laboratory the typical glove box is equipped with a ring around one door opening for use in attaching a polyethylene bag. The bag is placed over the ring and held in place by a rubber O ring. The ring has two raised beads to facilitate the replacement of a used bag by a new one in much the same manner as box gloves are usually changed.

When a contaminated object is to be removed from the box, it is placed in the bag, the bag is sealed shut with a wide heat weld, and the bagged object is severed from the box by cutting through the weld with scissors. The possibility of a "spill" during the severing operation is eliminated, since any contamination on the inside surface of the bag is firmly

embedded in the plastic during the sealing process.

Such a system provides excellent control and has been successfully used at many installations. Our experience has been that spills do not occur when the sealed-bag system is used. The important point is to ensure that this technique is always used when contaminated objects are removed from working enclosures.

The key to ensuring the use of sealed bags is to make their use convenient. With this in mind, we have developed a welder which overcomes many of the disadvantages of other available equipment. This welder has the following important features:

1. It is portable.
2. No warmup is needed.
3. The entire welding process takes less than one minute.
4. It is inexpensive.
5. It is reliable and requires no careful adjustments or tuning.
6. The weld it makes is 3/8 in. wide, for easy cutting within its width.
7. It seals a polyethylene bag 24 inches in circumference, of material up to 10 mils thick, with excellent results.

DESCRIPTION

The welder consists basically of a 5-inch length of 3/8-inch-wide by 0.001-inch-thick nichrome ribbon, covered with 0.003-inch Teflon-coated glass cloth backed by a silicone rubber insulating pad. The bag is clamped in close contact with the Teflon-covered nichrome ribbon, and a current of about 12 amperes is passed through it for a few seconds. After a few more seconds cooling time the weld is completed and may be unclamped and cut.

Teflon and silicone rubber are used not only because they withstand the heat, but also because melted plastics do not adhere to them. The resilience of the silicone rubber ensures good contact between plastic and the Teflon-covered nichrome ribbon. A further requisite in the design of the welder is to have the proper amount of heat insulation on either side of the heater. It must be sufficient to allow the heating elements to melt the

plastic, but not so much that the time required for cooling the completed weld becomes excessive. Figures 1 and 2 indicate how the welder is constructed.

The power supply (Figure 3) for this particular sealer is a 10-volt filament transformer rated at 5 amperes (Stancor P-4096). A small powerstat is used in the primary circuit for adjusting the heater current. Only small variations in voltage are necessary to accommodate different material thicknesses. An automatic timer, push-button, and pilot light complete the power supply, which is housed in a cabinet 7×8×8 inches. In typical operation, with 117 volts on the transformer primary, the secondary current is 12.5 amperes and the voltage 8.2 volts. Sealing time is 6 seconds. Conditions are not critical, however, since good seals are obtained between 5 and 8 seconds. These conditions are proper for a 24-inch-circumference bag of 2-mil polyethylene. For heavier material, it is desirable to decrease the current by about 10% and lengthen the sealing time.

Figures 1, 4, and 5 show the welding unit. The welding clamp has a pistol grip for convenient one-hand operation. As the fingers are closed, links are drawn back, forcing the jaws of the clamp together. The links are drawn a little beyond center, so that the clamp is locked shut and finger pressure may be removed. A thumb lever is provided for unlocking the clamp after completion of the weld.

One of the jaws is mounted by a pin which allows it to pivot slightly, thus equalizing the pressure applied across the entire width of the bag. The other jaw is provided with an adjusting screw to control the amount of pressure applied by the clamp. It is important to have good contact over the entire width of the clamp to obtain good uniform welds.

The bags normally used at Lawrence Radiation Laboratory are 24 inches in circumference, or 12 inches wide when flat. Even though the heating element is only 5 inches long, these may be welded in one operation by roughly gathering the bag into folds so that all the material may be clamped and welded at once. Wire guides are provided which help to keep the material within the clamp. If larger bags are to be welded, the guides may be flipped down out of the way and the bag welded in two or more successive operations. Figure 4 shows guides in place and in Figure 5 they have been flipped down out of the way.

The design of the clamp is such that the handle may be easily extended to any length desired for remote handling, as might be required in the presence of penetrating radiation. In this case it is also desirable to modify the sealer so that besides welding the bag shut, it cuts it off in the same operation. All that is required is to fasten a length of 20 gauge wire along the center of the resilient pad opposite the heater, and cover it with a piece of 1-mil teflon tape. The pressure of the wire on the melted

plastic material is sufficient to squeeze it out, separating the two sides of the weld.

In normal glove-box operations, however, where speed is not unusually important, it is safer, and surer, to make the welding and the cutting two separate operations. Cutting can then be done after first making sure that the weld is satisfactory.

Another feature of the clamp which is useful at times is that the clamping bars may be pivoted through 90 deg for welding along the edge of a large piece. This type of welding is sometimes required for making up large sleeves or bags. Figure 5 illustrates this feature.

About 30 of these welders have been in use for more than 3 years without any serious failures. This system provides dependable, positive, and convenient prevention of contamination in the handling of radioisotopes.

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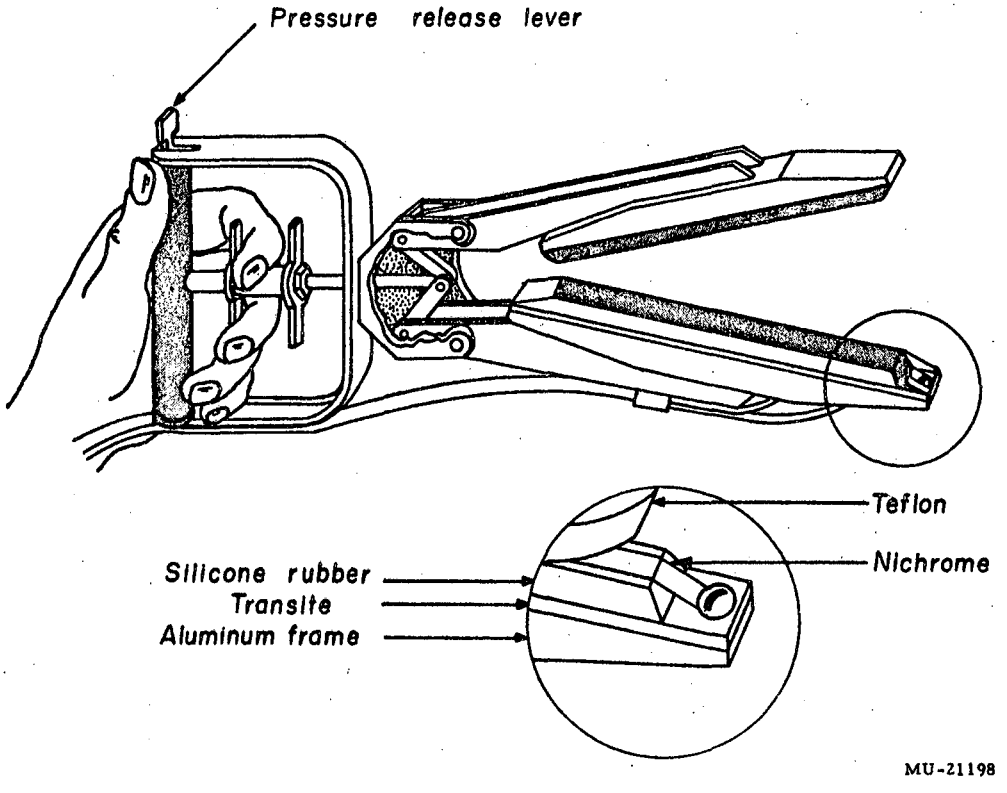
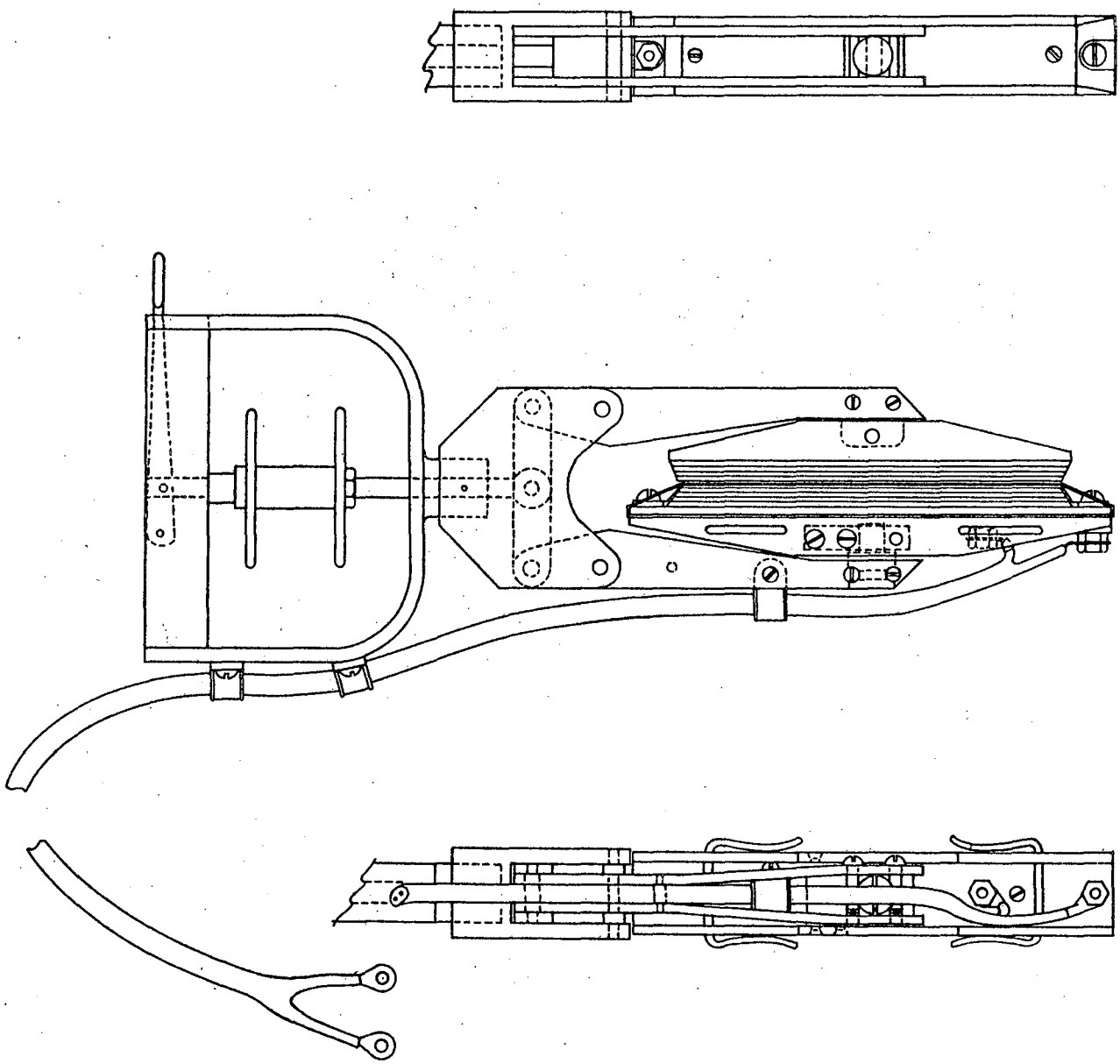
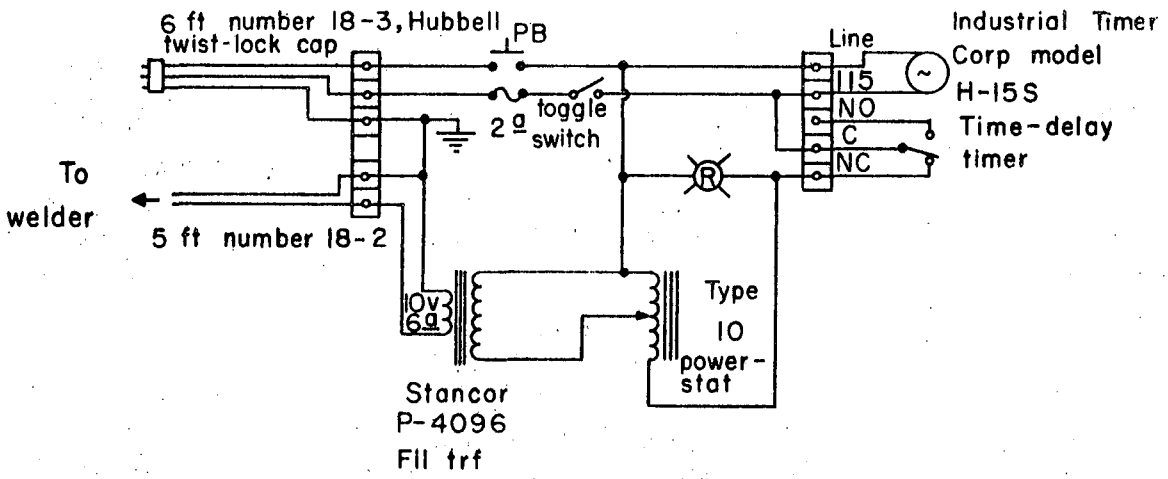

Pressure release lever
Teflon
Nichrome
Silicone rubber
Transite
Aluminum frame
MU-21198

Fig. 1.



MUB-441

Fig. 2.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PB
toggle switch
2 a
To welder
5 ft number 18-2
10v 6a
Stancor P-4096 FII trf
Type 10 power-stat
R
Line
115
NO
C
NC
Industrial Timer Corp model H-15S Time-delay timer
MU-21199

Fig. 3.

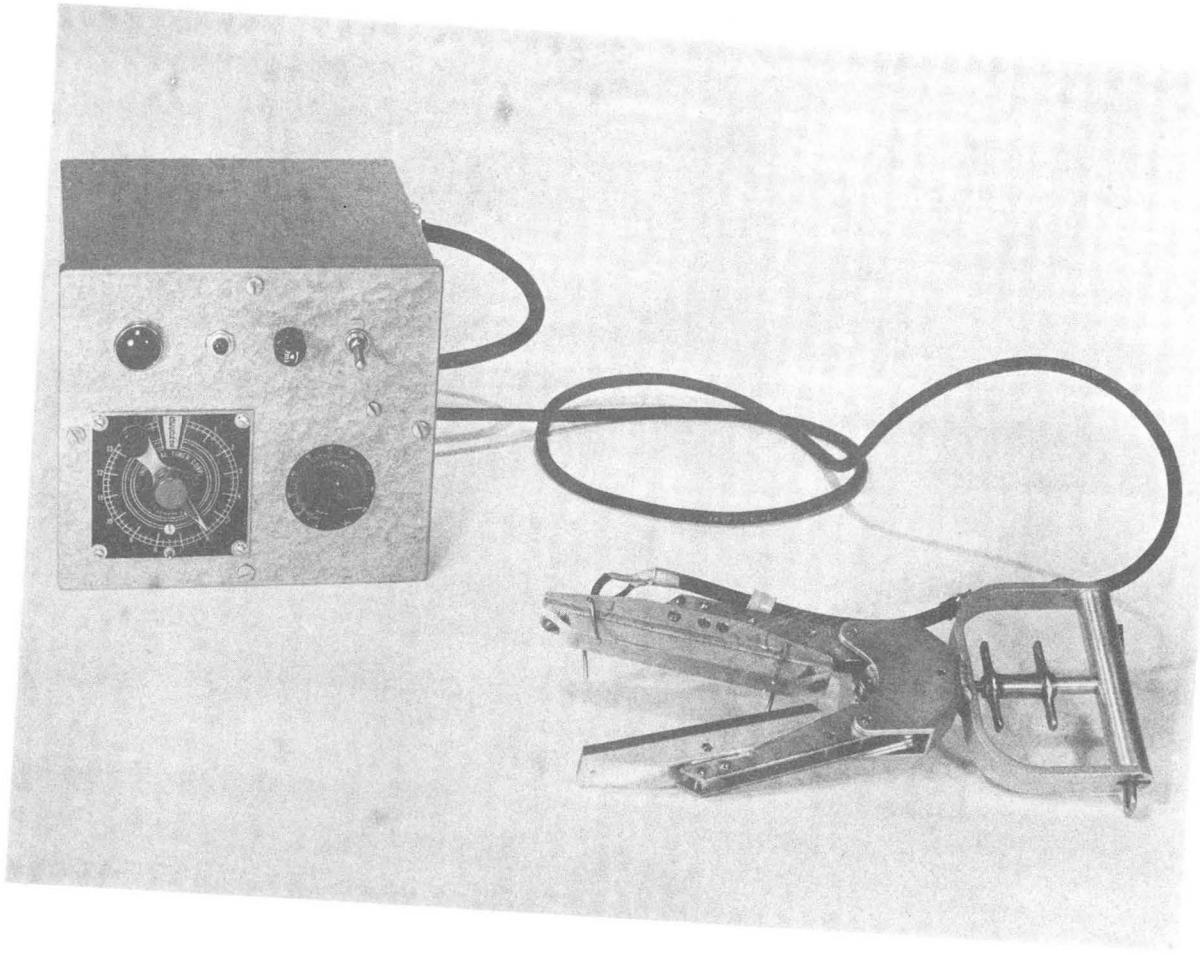

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Fig. 4

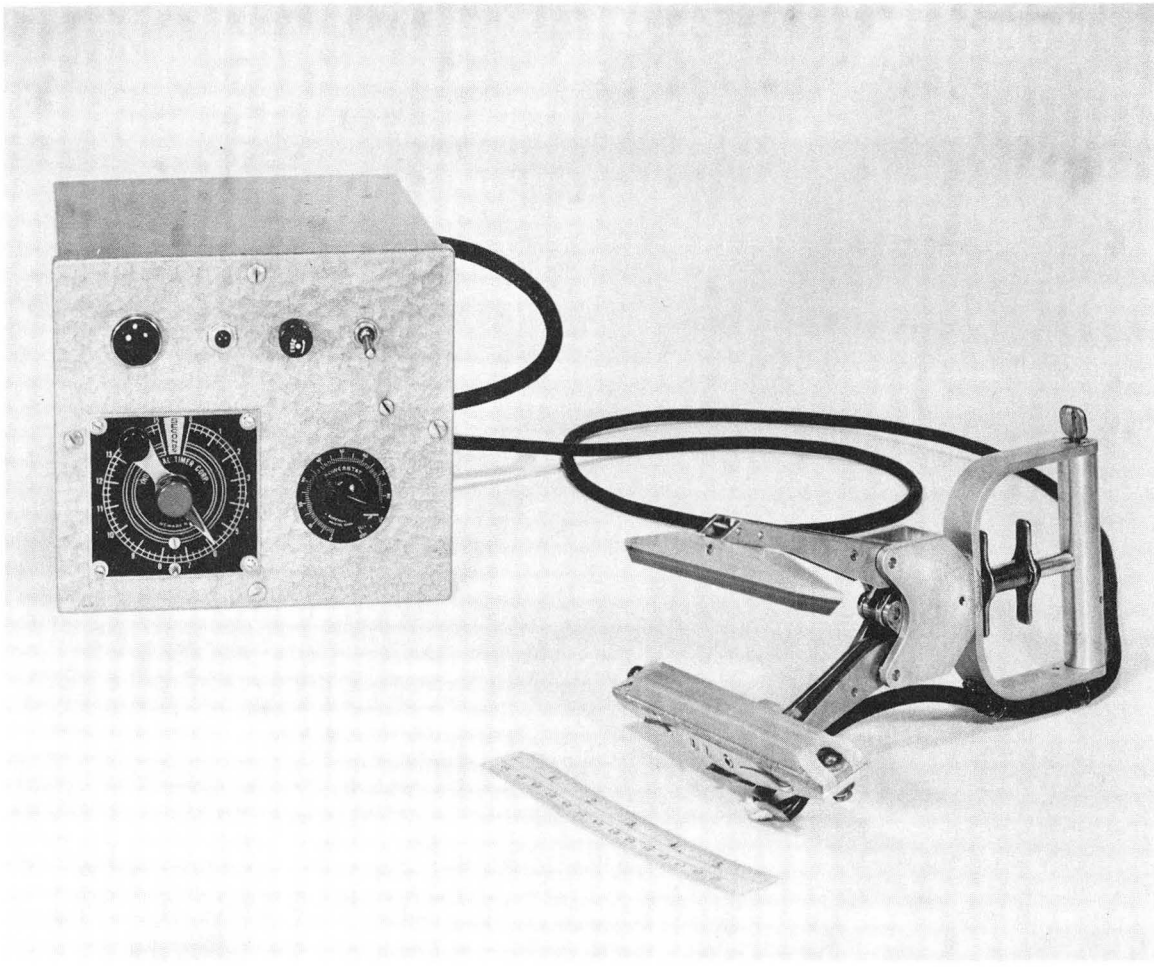

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Fig. 5