

NOTE ON CONSTRUCTION OF EFFICIENT AND SAFE CRUCIBLE TRAYS AND TONGS FOR MUFFLE FURNACES

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Cereal Chem. 55(4): 521-523

Ash content of wheat, wheat flour, and other cereal grains and flours often is determined on 25 to 50 samples at a time, depending on the laboratory. Crucibles containing samples, however, often are placed into and removed from the ash muffle one or two at a time. Such a procedure is time consuming and inefficient, and with most tongs is uncomfortably hot and hazardous for the operator.

We have developed a stainless steel tray (Fig. 1) that holds ten crucibles, and special tongs (Fig. 2) that firmly, safely grip the tray with its crucibles for insertion into and removal from the muffle. The tongs convert a 50-lb hand grip to about 150 lb. When ashing is completed, each tray is removed from the furnace to a 1/16 × 12 × 24-in. asbestos sheet on the transite top of a portable table. The crucibles then are immediately transferred in pairs to a desiccator until cool enough to weigh.

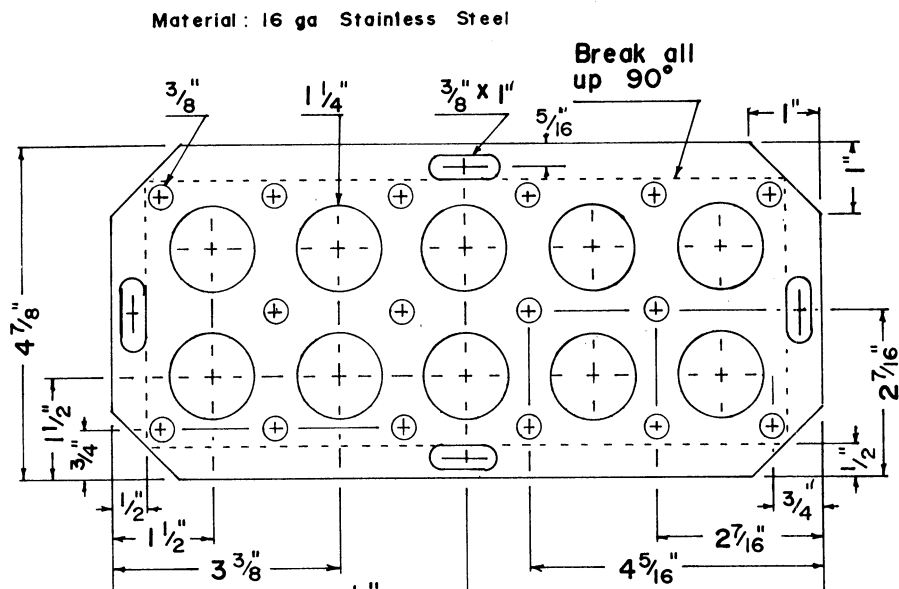


Fig. 1. Stainless steel crucible tray for increasing efficiency of making tests in muffle furnaces. Outer 1/2 in. on all sides of tray is bent 90 degrees along dashed lines. Lower jaw of tongs is inserted into one of four slots so that jaws can grip surface of tray.

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The 1.25-in. crucible holes with beveled top edges are for Coors 22.5–25-ml round bottom porcelain crucibles that are glazed inside and outside except on the bottom. If crucibles differ appreciably from the above, the diameter of the holes should be adjusted accordingly. If the holes are too large or are not beveled or both, contraction of the stainless steel when cooling likely will pinch and break the nesting crucibles.

We use two muffles, each with inside dimensions of $6 \times 12 \times 18$ in. Each accommodates three trays side by side with a total of 30 crucibles. The 36-in. tongs allow placement of the first tray of crucibles at the back of the muffle, and still allow the hand that is holding the tongs to be a safe, cool 19 in. from the opening of the muffle. The other supporting hand would momentarily be about 14 in. from the muffle opening. With conventional tongs, wearing a glove is usually necessary, because the hand is often uncomfortably close to the muffle opening. The spacing and diameter of crucible holes could be used in making similar trays to fit muffle furnaces that differ from ours.

Some other laboratories use some type of a tray system. Gordon L. Rubenthaler, of the Western Wheat Quality Laboratory, Pullman, WA, uses two

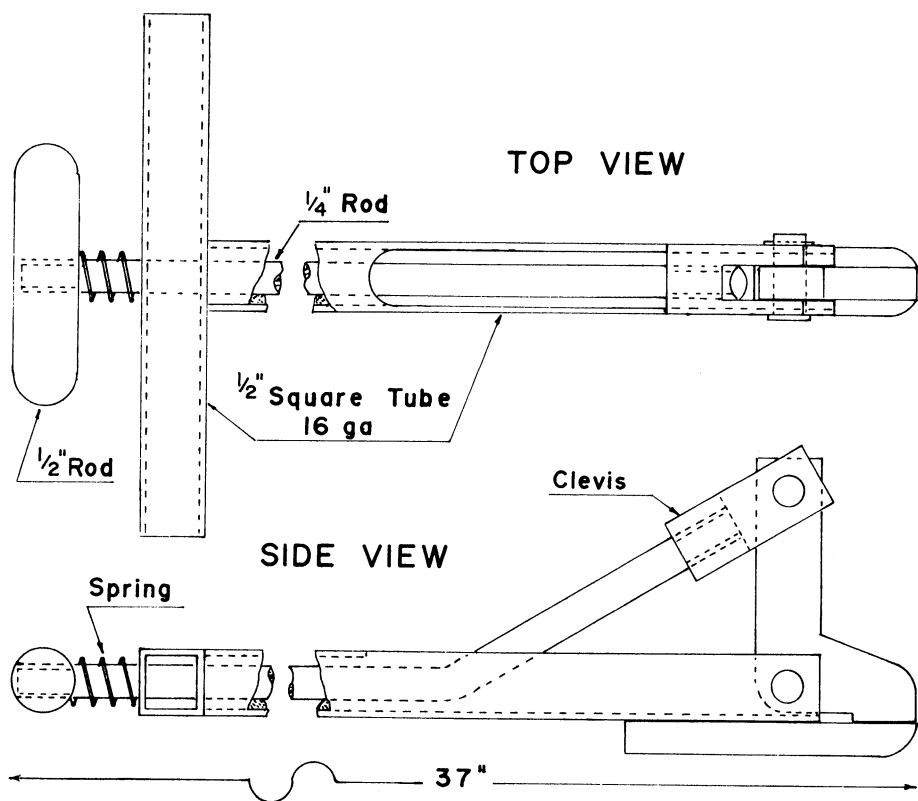


Fig. 2. Special tongs that firmly, safely grip tray with its crucibles for insertion into or removal from muffle furnace. Lower jaw is welded to square tubing.

stainless steel trays, one above the other to double capacity, in a smaller ($5 \times 8 \times 14$ -in.) muffle than ours. Their trays do not have holes to nest the crucibles; they use low-form nickel crucibles tapered from 3.5 to 5.0×1.3 -cm deep, because they are less prone than porcelain ones to tip and slide on the trays. Their stainless steel bottom tray is solid and is turned down $3/8$ in. at 90 degrees on each side. Their top tray contains ten $3/4$ -in. vent holes and is turned down 2 in. on each side. Those trays usually warp materially in the heated muffle furnace. Our trays with the large nesting holes (Fig. 1) prevent the crucibles from tipping and sliding, and do not warp in the hot muffle.

The tray diagramed in Fig. 1 has been made into a top tray by turning down the ends about $2-1/8$ in. for nickel crucibles or about $2-1/2$ in. for porcelain crucibles. For relatively large muffle furnaces such as ours, the $2-1/2$ in. turndown is preferred and is more versatile. In addition, the finished surface of the top tray is lengthened to 10 in. so that it straddles the bottom tray with about $1/4$ -in. clearance at each end. The distances between all holes, the width, and the $1/2$ -in. turndown along the 10 -in. sides are the same as those in Fig. 1. If the tray in Fig. 1, or a modified size of it, were to be inserted lengthwise into a muffle, the sides instead of the ends of the top tray would be turned down $2-1/8$ to $2-1/2$ in., and the width instead of the length would be increased $1/2$ in. so that it would straddle the bottom tray.

[Received September 22, 1977. Accepted December 22, 1977]