Electric Kiln Ceramics

Hal Riegger

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Preface

In the classrooms of most schools below the college level electric kilns for firing ceramics predominate over other types. In the studios of many potters, and in the garages and basements of many hobbyists, it is the electric kiln that is being used. Neither better nor worse than gas-, or fuel-fired kilns, the electric kiln is nevertheless the most practical to install. There is little information available on how to use and care for these kilns other than the brief instructions that come with the purchase of a new one. For these reasons I have chosen to write about firing ceramics in the electric kiln.

Today we are in the midst of a "stoneware cycle"; for the great majority of us potters high-fired, reduced stoneware is the only acceptable kind of pottery. It is odd to note that a considerable number of potters fire this way without either understanding why, or deriving any of the special benefits that result from reduction firing. No electric kiln can produce these particular qualities of reduced stoneware. Pottery fired in electric kilns can have a quality equal to that of stoneware in terms of the hard, dense clay quality we associate with high-fired wares. Interestingly enough, it is actually stronger than pottery fired in the reducing atmosphere of a gas kiln.

Some people have lived long enough to see cycles, or fads, in pottery come and go, and to realize that they are merely current foci of interest. That the widespread use of electric kilns has not affected the current stoneware cycle significantly is rather extraordinary, unless we realize that those who guide many people in ceramics are trained in the same classrooms and university ceramic departments as are the art and production pottery majors. The great majority of these departments consider the art education student as someone

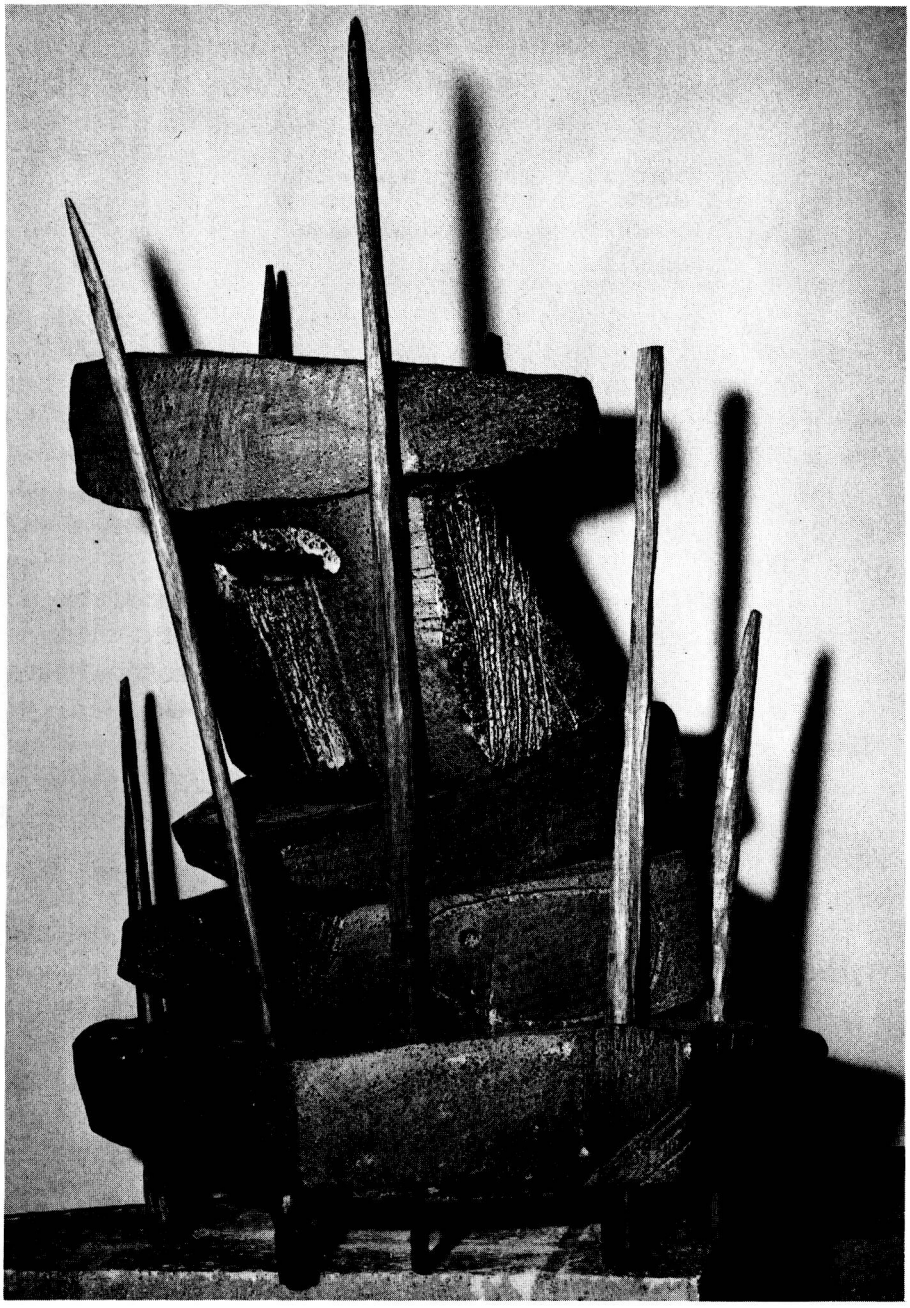
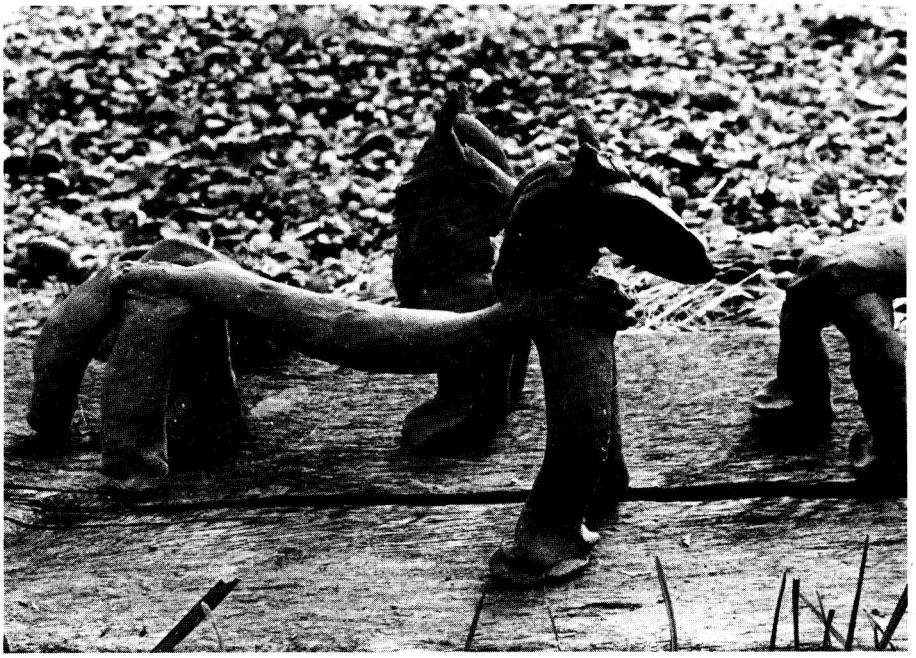


Image with Sticks, 1960. Betty Feves. Fireclay with local basalt grog. Cone 9, electric kiln firing.

who must be tolerated and gotten through the course and out of the way as soon as possible. ("Thank goodness they're here for only one semester.") Rarely is attention given to the fact that many students, including ceramic majors, may work in shops quite different from that of the university or production potter; instruction and training are seldom planned to prepare a considerable number of people for the situation in which they will later find themselves.

Hardly anyone would challenge the validity of the enriching experience of working with clay. When students are involved with firing kilns as well as making clay objects, an appreciation is gained of the intense heat needed to fire clay. By definition a piece of ceramics (a ceramic product) is something made of an earthy, nonmetallic substance which at some stage of its manufacture is subjected to red heat, or greater. This will once and for all answer the question as to whether pottery can be baked in one's kitchen oven. Red heat is above 1200°F.



Horses, 1976. Pamela O'Connor. Earthenware clay, cone 3.

Plate Drowning, 1971. Robert Arneson. Modeled clay with slip and glaze; white earthenware.

This volume is written primarily for teachers who have only electric kilns available to them and for all potters using electric kilns who wish to develop a uniqueness to their pottery.

Perhaps over and above all others, the message of this book is that a more instructive and creative experience can be had with pottery fired in electric kilns than is commonly believed. All that is presented here is done with due consideration of the limitations imposed by city regulations and physical shop environments, and upon teachers by school administrations and maintenance personnel, who seem to restrict ceramic activities more than any of us would like to acknowledge.

Introduction

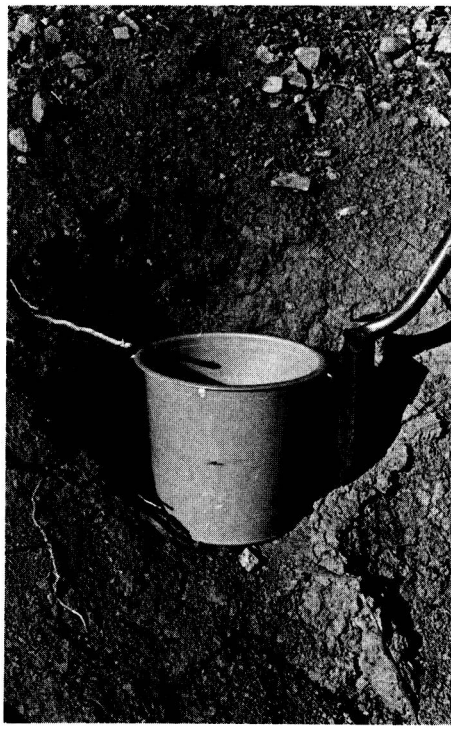
Through the years many theories on teaching have been formulated and advanced; some have remained valid, proven ways while others have turned out to be passing fads. The subject will be interpreted in as many ways as there are people deeply concerned with it.

Yet, it seems to me that teaching has one aim only: to assist the student in learning. And learning derives from experience. You can conduct a class in the belief that it is a teaching/learning situation and at the same time present little more than a "how-to-do-it" session. Surely in art, and with ceramics particularly, this reveals a teacher's concern with a perfect end product and with any students who appear to put him or her in a good light because of visible "accomplishments." This situation is not wholly limited to teachers: in the case of young students, parents hamper art experiences because they want their children to succeed and to excell on the parents' terms.

Doesn't this cheat both the student and the teacher? And isn't this especially true in the creative areas of art such as pottery?

In the lower grade levels of schools, curiosity is a prime motivating factor. Children are inquisitive: They want to know why, how, and for what reason. Children are less concerned with achieving perfection than with the how and why it happened. As adults we could well be more like children, but we are more concerned, most of us, with a good result in a material sense: a good painting, a fine pot, a lovely piece of weaving. However, I don't believe this is "where it's at" for the student. What is important in the long run for him is not a very visible thing, but rather an experience and a discovery that he will carry with him and which may emerge from memory as a valuable aid at some future time.

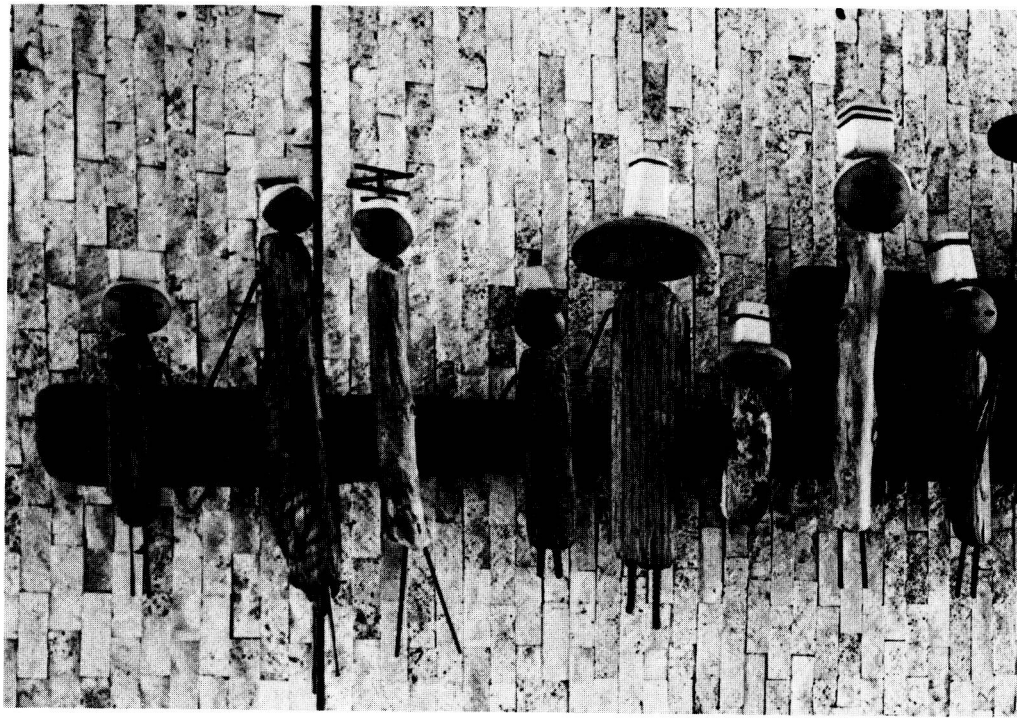
Curiosity: child at a primitive pottery firing for elementary school students.



Ingredients for starting pottery: bucket and shovel at roadside clay bank.

I'm sure my own fourth-grade teacher never realized what it meant to me when one Sunday she took some of us out for a walk: we found some clay, made little pots, painted these with poster paints (I used black and yellow), and then baked them in a kitchen oven (not a kiln). I think this affected my whole life. And the importance to me of that walk was that I found clay, that I made a little pot, and that I baked it in the oven. I also remember that it broke later, but that wasn't very important, except that somehow at that time even, baking didn't seem the right way to finish a pot.

Later on in high school this memory emerged and I spent many hours assembling bricks, hollow tiles, flue tiles, and other fired objects into kilns, firing these assemblies with wood, leaves, kerosene, and anything I could find that would burn. Fortunately I was attending a school that allowed me to do that. I even built two small kilns, one very small, and tried to fire one of them with a gasoline blowtorch. I don't know how successful these efforts were in terms of



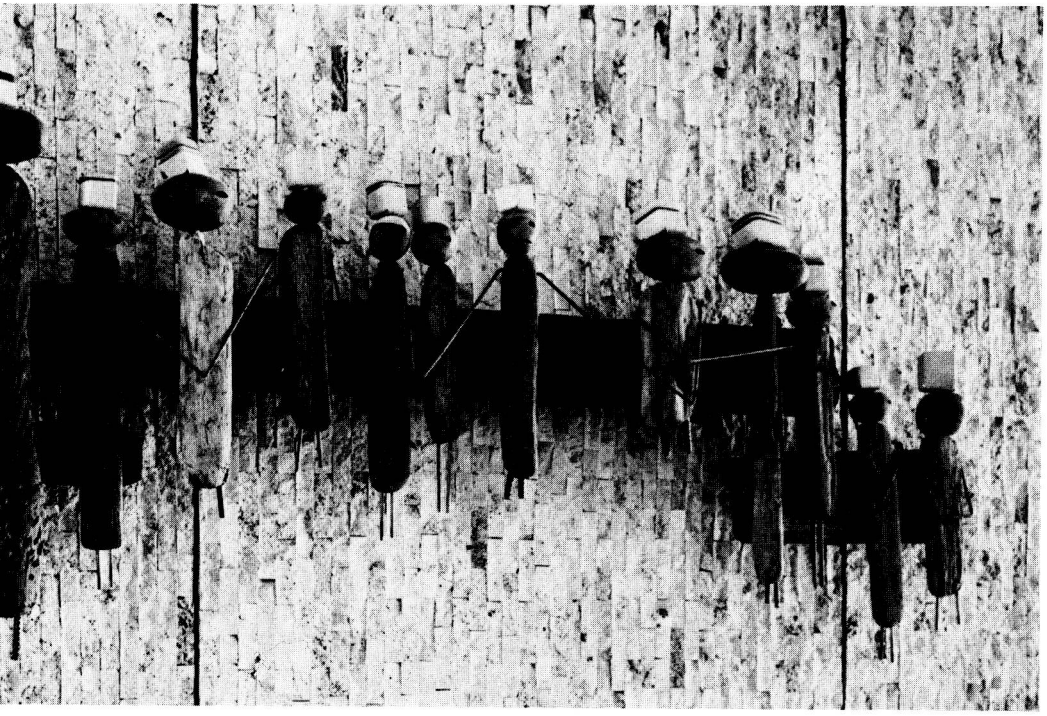
The Nurses, 1962. Hal Riegger. Panel of driftwood, welding rods, enameled iron, and clay heads. Electric kiln firing; heads to cone 4. Approximately 8' long. (Photo, Tampa General Hospital)

ceramics, but I do know that I learned a lot about fire, flame, and draft, and some of the important basics of firing pottery. All this has stood me in faithful stead for many years: I don't think there is a kiln that can stump me when it comes to firing it successfully. I do boast this achievement!

But this is the kind of thing I am writing about.

How can experience of a similar validity find a place in today's classrooms that are far more restricted in what freedom the student has? Is it so much what the administration dictates? Is it the physical environment of the classroom? Is it the class schedule of usually less than one hour? I don't think so. I believe the good teacher, the person with a sense of confidence in what he is teaching who knows from his own experience, can and will find ways to pass on similarly valid experiences to his class.

A philosophy that presents challenges and allows for discovery and subsequent learning for any student is the basis of this book. It is for those who teach ceramics, urging them to allow their students to become more self-directed in a still disciplined milieu. There are many good books on pottery making and therefore I have not included much about the techniques of handling clay. But I have long felt that in teaching ceramics inadequate attention has been given to prepar-



Oubliette, 1976. Gillian Hodge. California fireclay with local clay and earth additives. Cone 4.

ing people for the situation they will find when they assume their roles as potters or as teachers in schools. How often are the latter trained in stoneware-oriented ceramic departments of college art departments with gas kilns, stoneware clays, wheels, etc., only to come to a school pottery shop that has a small electric kiln and a supply of low-fire clay and prepared low-fire glazes. This so stumps a new teacher that often he will avoid the subject entirely. The kiln gets used as a catch-all shelf for other things; the clays dry out; jars of glaze collect dust and lose their labels; and young students miss an important experience.

If I can help overcome the fear and unfamiliarity with kilns that people have about the operation of pottery in schools and elsewhere, I will have achieved my aim with this book. There are certain preconceived ideas to be overcome, not the least of which is that the electric kiln is incapable of producing "real" ceramics. You will have to agree with me that my choice of illustrations of ceramics that some of the fine potters in this country have made, all fired in the same kind of electric kiln you have, contradicts this view.

Here is a bit of wisdom worth assimilating: it isn't what is used—the clay, glaze, kiln, or tools—but how these things are used that count!

The electric kiln is not to be feared; it is to be understood as a tool capable of many things and at the same time with certain limitations, like all kilns. Glazes are basically not a great mystery, though they can be a fascinating study, complex and extensive. They can also be thought of as simple. Viewing them this way is a means to understanding what they fundamentally are: a material melted onto a pot, an essential factor in any person's understanding of what pottery is about.

This book attempts to go no further.

The most meaningful utterance on teaching, to me, comes from *The Prophet* wherein Kahlil Gibran in the chapter "On Teaching" says:

"Then said a teacher, Speak to us of Teaching.

"And he said:

"No man can reveal to you aught but that which already lies half asleep in the dawning of your knowledge.

"The teacher who walks in the shadow of the temple, among his followers, gives not of his wisdom but rather of his faith and his lovingness.

"If he is indeed wise he does not bid you enter the house of his wisdom, but rather leads you to the threshold of your own mind.

"The astronomer may speak to you of his understanding of space, but he cannot give you his understanding.

"The musician may sing to you of the rhythm which is in all space, but he cannot give you the ear which arrests the rhythm nor the voice that echoes it.

"And he who is versed in the science of numbers can tell of the regions of weight and measure, but he cannot conduct you thither.

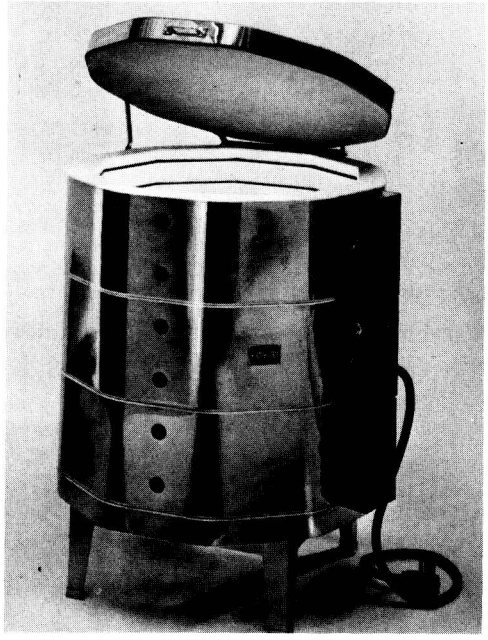
"For the vision of one man lends not its wings to another man.

"And even as each one of you stands alone in God's knowledge, so must each one of you be alone in his knowledge of God and in his understanding of the earth."

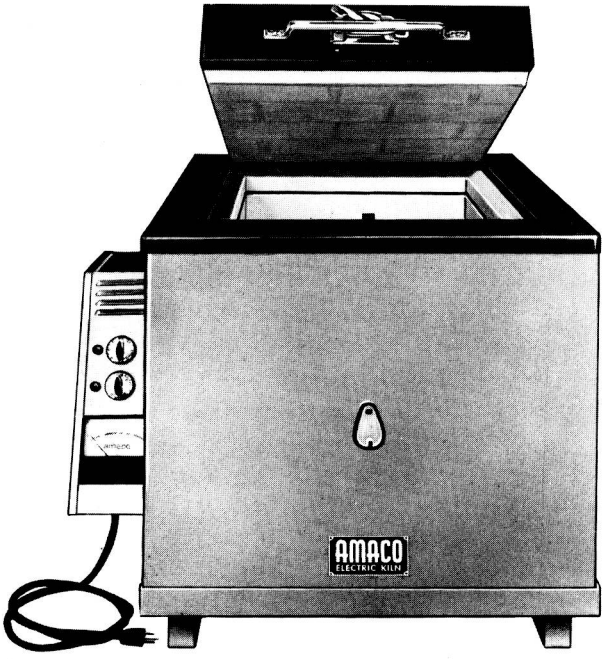
Chapter 1:

The Electric Kiln

Kilns are merely devices for heating clay and/or glaze to temperatures of red heat or greater. They function like kitchen ovens with a few important differences.



Circular, ring-type electric kiln, 230 v. a.c., for cone 6 firing, equipped with automatic cone-type shutoff. (Skutt Mfg. Co.)



Square electric kiln, 117 v. a.c., with two element switches and thermocouple/pyrometer. (Amaco)

Needing to reach temperatures of red heat or greater, pottery kilns must be made of materials that will withstand this heat; a kitchen oven will not. Bricks are used in making kilns while enameled (or other) metal is used in making an oven. Secondly, pottery normally needs only to reach a certain specified temperature whereupon the kiln is turned off and the ware cooled; temperature does not have to be maintained.

Like kitchen ovens, kilns ideally should heat evenly. That is, there should not be cool or hot spots in the kiln chamber. Achieving this condition has been, and still is, a constant challenge in designing and constructing kilns. Electric kilns, by their method of heating, allow for the most practical shape of kiln chamber, the shape most apt to produce even temperature: the cube. It is much easier to design and construct an electric kiln in the form of a cube than it is a kiln designed to be fired by some other means such as gas, oil, or wood.

In theory electric heat, or that which emanates from a hot element, will produce an even heat no matter where the elements are placed, or the shape of the interior. Theoretically such heat is radiated, rather than convected, and radiates in all directions: up, down, and sideways. In practice this is only partly true because most electric kilns are not totally air tight and there is some air movement around the door and peepholes that destroys the radiation theory. However, an electric kiln does a better job of even-heat distribution more easily than any other type of kiln. Perhaps this aspect should be considered when purchasing a kiln.

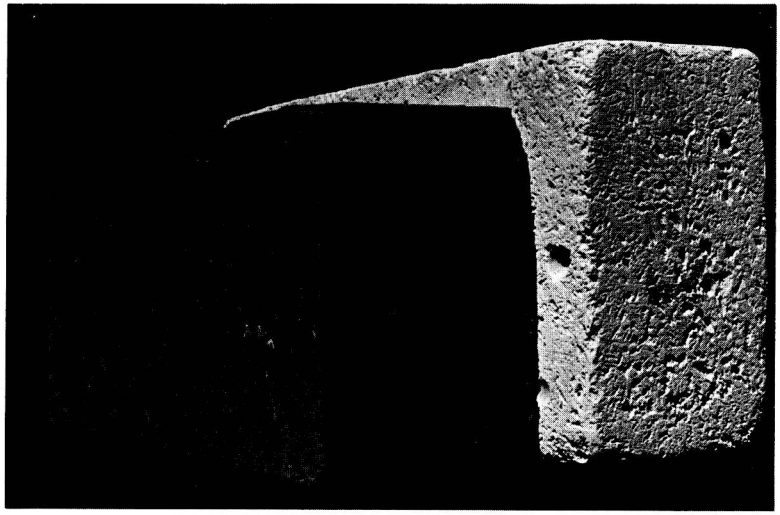
Electric kilns, therefore, are available to us usually in the form of a cube, or nearly that shape. With the exception of enameling kilns, which are flatter than a cube, the great majority of electric kilns have chambers with dimensions that are all about even. The type of kiln that varies from this is the add-on or adjustable kiln made in the form of a series of rings or doughnuts. Such a kiln can be made larger or smaller to meet the demands of a specific firing. Both blank and powered rings are supplied for these kilns.

REFRACTORIES

As mentioned previously, kilns must be capable of attaining higher temperatures than kitchen ovens and these range from a low of about 1200°F. to up to 2500°F. Therefore, it is understandable that kilns must be built of a material capable of withstanding more than the normal maximum firing temperatures as a safety margin.

You are, no doubt, familiar with bricks and know about red, or "common" brick, the ones used in constructing chimneys, brick buildings, sidewalks, and the like. These bricks will stand firing of various temperatures depending upon the clay from which they are made, but in no case will they stand up consistently to the temperatures needed to fire most ceramic ware. This common, or low-grade clay as it is called will rarely stand up to temperatures over 2100°F., which is considered moderately low for many ceramic products.

You may not be quite as familiar with firebrick as you are the common red brick. Firebricks are made from fireclay, considered a better grade of clay that will withstand considerably higher temperatures of up to 2500°F. and above. The maximum temperature firebrick will withstand allows them to be used in making kilns for firing the bulk of ceramic wares. Although the difference between the maximum heat withstood by common brick and firebrick is only 400°F., in ceramics this is considerable.



Common red brick (left) and insulating firebrick.

Both common, and firebrick are hard. The dimensions of the latter are greater and the common firebrick shape is called "standard." Many other shapes are manufactured in firebrick that are not available for common brick.

Electric kilns of the size and type generally seen in the school classroom and home studio are considered portable: they are fabricated and then shipped to the customer. For this reason they are not made of standard firebrick but rather of "insulating firebrick," which weighs but a fraction of the standard firebrick. They are soft and porous and are normally made only to the standard shape of 2½" by 4½" by 9". They have come into widespread use because of their excellent insulating qualities and the ease with which they can be cut with an ordinary saw, or filed with a rasp.

The series of insulating firebrick manufactured by any one of a number of companies have a useful temperature range from 1600°F. up to 3000°F. (See chart below). As the maximum service temperature of the brick increases, its insulating ability decreases while its strength becomes greater. Even a brick made for 3000°F. use will be a far better insulator than a standard heavy firebrick.

The above characteristics of firebrick explain why they have been adopted so completely in the construction of small, lightweight, portable electric kilns.

Your electric kiln has probably been made from these bricks, some slotted to receive the elements, and cemented together with a refractory cement. Some kilns are entirely enclosed in a metal casing while others, notably the ring or doughnut type of adjustable kiln, are held together by bands of metal. Most top- and side-loading kilns of a larger size with hinged doors incorporate metal rods running through the brick to help hold them in place.

In an effort to extend the student's experience with clay, I have sometimes directed them to the idea of using combustible materials mixed into their clay! The idea of adding coffee grounds or sawdust or some such thing to clay only to have it burn out in the kiln may sound odd. Yet an entire industry is based on essentially this idea. As I understand it, the Armstrong Co. uses fine cork granules mixed into refractory clay to make insulating firebrick. Other manufacturers use chemicals and certain processes to create a porous brick. The seemingly absurd idea in ceramics can often lead to innovative work and exciting results.