A sculptural problem
by Billy Bowman Sage

A THESIS Submitted to the Graduate Faculty in partial fulfillment of the requirements for the degree of Master Of Applied Art
Montana State University

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A study of sculpture and the knowledge gained from the execution of sculptures In various media provide a background for solving the problems associated with the exploration of a pure sculptural problem.

The experiences gained in executing sculptures in Stone, plaster, Wire, steel and clay are related and illustrations of the sculptures produced are included.

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Approved:

Cyril H Conrad
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Chairman, Examining Committee

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Acknowledgements

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Abstract

A study of sculpture and the knowledge gained from the execution of sculptures in various media provide a background for solving the problems associated with the exploration of a pure sculptural problem.

The experiences gained in executing sculptures in stone, plaster, wire, steel and clay are related and illustrations of the sculptures produced are included.

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Sculpture

Sculpture is one of man's earliest creative accomplishments. Figures, usually female representations, are found in strata dating to middle Aurignacian times of about 70,000 B.C. Through the ages man has continued to express himself by the modeling, carving, or building of forms in three dimensions. Some eras have produced prodigious quantities of sculpture while other periods have seen very little. Nevertheless all cultures seem to have produced some type of sculptural expression.

Motives for sculpture have probably changed numberless times during its long existence. The first sculptures were, according to some anthropologists, made for magic or fertility reasons. Since that time various uses can be given--decoration of utilitarian objects, enrichment of architecture and as ritual objects. Probably the greatest reason is none of these but that which guides many contemporary sculptors and some of their predecessors--the creation of a work of art which has its own reason for being as an expression of the artist. Whether this is accomplished by forms which are beautiful to the eye or not makes little difference if the piece has a life of its own and can stand alone without using imitation of nature as a crutch. This is not meant to exclude realistic sculpture from the acceptable but such would be the case were not the artist to give it more than

a clever surface modeling and likeness. He must strive to put into any sculpture something of the aliveness of the portrayed object; to give it a meaning in itself apart from representational accuracy.

Materials used in sculpture now are more varied than at any other time. The artist of prehistory had stone, bone, wood, and clay. Metals for casting and the casting processes were discovered later and today we have the use of even more materials with more types of metals, plastics, and concrete. Nonetheless sculptors of stone, wood, and clay work in much the same manner as those of earlier eras, carving wood and stone with hammer and chisel, modeling clay with hands and sticks. The use of pneumatic tools and hardened steel bits may speed up the process for today's artist but sculpture of the carving type remains essentially the same. Welding with torches and gases is one of the few techniques which the ancients did not know. Because it is relatively new and virtually an unexplored field, more and more creative sculptors are turning to it to find new means of expression and to produce new works in a new vein.

Media and Experience

Before work was begun on the problem of a sculptural form for a particular setting; stone, wire, plaster, clay, and steel sculptures were executed to become familiar with the characteristics and manner of working each material. A material such as limestone which is of a great weight in a small mass and may be very hard, cannot be worked, and should not be worked as the softer alabaster or as clay. Plaster cannot be formed in the same fashion as steel or wire. It was found that each material must be handled with consideration for its special characteristics and that one material could not be easily imitated by another and still retain its own identity. Carving of stone retained the massive quality of the block while modeling in clay gave quite different effects. Work in sheet steel cut, shaped by hammering and then welded together could not imitate wood, stone, or clay by the very fact that the processes employed were different. These experiences lead to the belief that a sculptor must try to be true to his media, working each with a sympathy for its unique characteristics.

Works in three types of stone were executed. One of these was "Madonna and Child" (Figure 1, page 8) carved from a fairly soft, pink-veined Wyoming alabaster. Another was a non-objective, "Space Modulator" (Figure 2, page 8) done in hard building limestone. The third was "Torso"

Figure 1
Madonna and Child

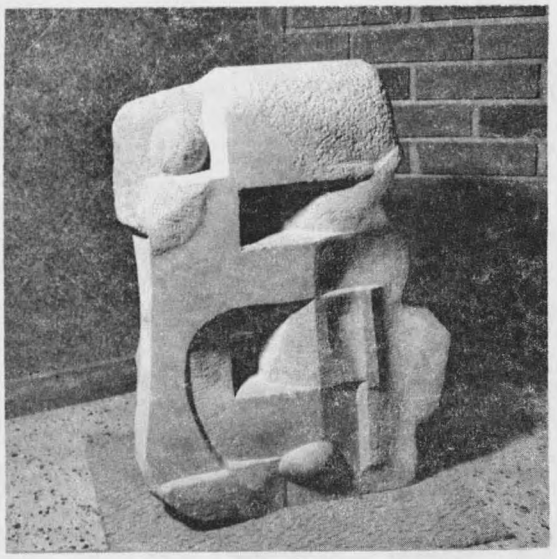

Figure 2
Space Modulator

Figure 3
Torso

Figure 4
Madonna

(Figure 3, page 8) done in soapstone. All were carved directly in the stone with references made only occasionally to sketches. This method allowed the stone to retain its identity as stone. The softer stones were more amenable to the soft flowing curves and planes and rounded masses which the subjects needed. The harder stone offered much more resistance to cutting and had to be worked on a more massive scale retaining the blocky forms and textures and eliminating delicate detail.

A plaster, "Madonna" (Figure 4, page 8), was done with the direct application of plaster over a wire and screen foundation. This was found to be an excellent way to build up a sculpture of fair size with moderate weight. Wet plaster worked in this manner to some extent exhibits the plastic quality of clay yet can be carved when it has hardened. Another feature which it has is that it can be easily colored with various pigments to give any desired effect, and it may be textured in a variety of ways.

A "Spatial Deliniator" (Figure 5, page 10) of brass rod such as the one executed might be called a three dimensional line drawing in space and could only be done in a material which has great tensile strength. Attempts at such a composition in stone or wood would be impossible.

The various ceramic sculptures take advantage of the plasticity and easy manipulability of a clay body. The

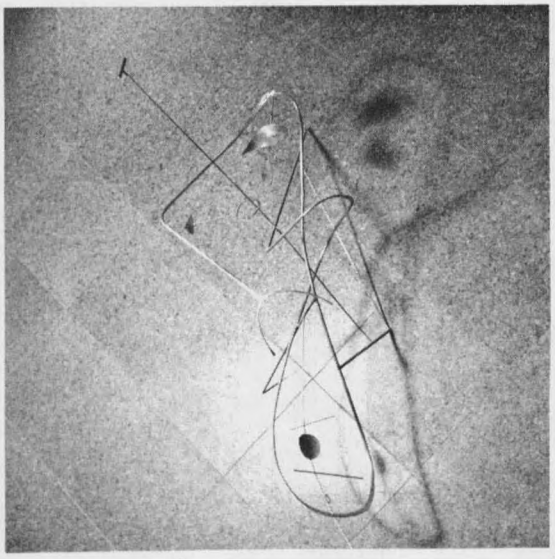

Figure 5
Spacial Deliniator

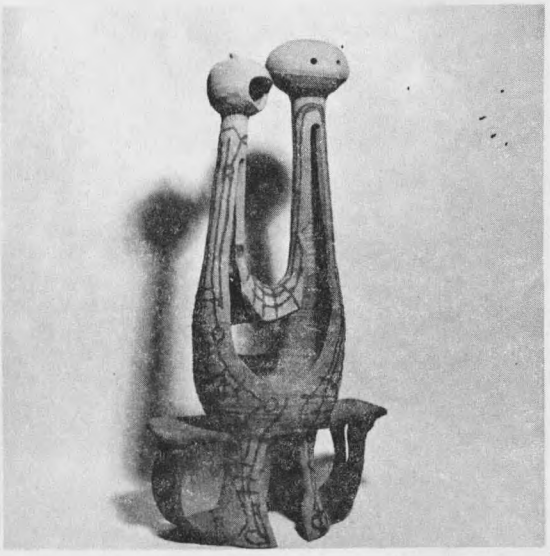

Figure 6
Garden Figures

Figure 7
Fish

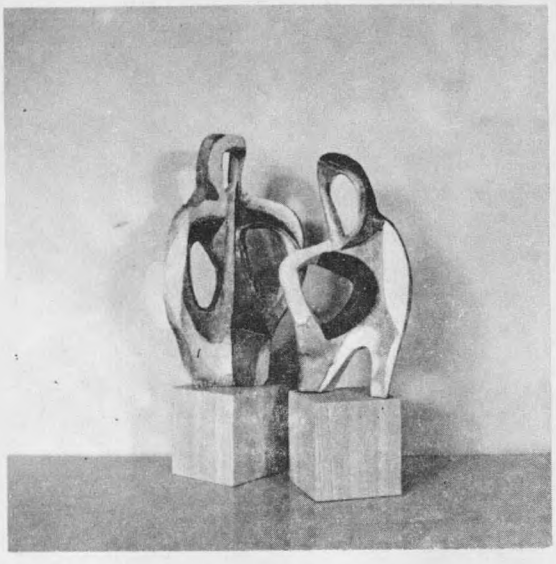

Figure 8
Figures

"Garden Figures" (Figure 6, page 10) comprise several pieces which were thrown on a potter's wheel and joined while wet. The parts retain the characteristic finger marks of the potter. "Fish" (Figure 7, page 10) and "Figures" (Figure 8, page 10) also show the pliability of soft ceramic materials and use glazes for color or accent.

The two works in steel, "Children Screen" (Figure 9, page 16) and "Stringed Figure" (Figure 10, page 16), are exercises in using welded steel in planes only, and in executing a sculpture employing full forms of shaped and welded steel. In "Children Screen", the steel was cut, shaped by hammering, and the pieces welded together to form the silhouette of four figures. The shaping or bending of the pieces was done to give additional planes for added surface play of light. It was brazed with brass rod to add color and interest. "Stringed Figure", in the use of its full bodied forms, acquires a more organic shape as if it were growing out from within while the use of the strings laced into it creates interesting areas of enclosed space which add to the completeness of the whole.

Each of these sculptural works in the various media added to the conviction, reinforced by tradition, that a sculptor must be sympathetic to his material; he must not force it beyond its capacity and he must utilize each for its own particular qualities and select for each work that

which will best express his ideas. Beyond this the sculptor must fuse his idea into the work so that it will not have to be explained or titled to be appreciated for what it is--a sculpture, an entity in itself.

Selection of a Site

Prior to the selection of a setting for a sculptural study, several areas on the Montana State College campus were considered for their suitability to such an undertaking. The area between the driveway and the walk in front of Hapner Hall was considered, as was a small grass plot between the library and the west entrance of the Student Union Building. The interior court of Hannon Hall was also under consideration as a possible site. Each of these presented drawbacks. The first two locations would be too readily accessible to children who might attempt to climb the sculpture and be injured in a fall while the interior court of Hannon Hall was deemed too restricted from public view.

The site selected was the area adjacent to the main entrance of the Mathematics-Physics Building. It offered several distinct advantages. The design of the building was such that it seemed to invite a sculptural form in the area indicated; this area needed enhancement; it afforded some protection from the elements and from climbing children; and it contained light fixtures which could be used or altered for more efficient use at night.

The Mathematics-Physics Building is built of structural steel members and cinder block. The outer surfaces are faced with red brick and a creamy yellow ceramic tile. Window and door frames are of an aluminum alloy.

The setting for the sculpture is a niche five feet deep and twenty-eight feet wide, extending from the entrance-way to within two feet one inch of the northwest corner. Several structural pillars (two feet one inch by two feet one inch) divide the length into two eleven foot eleven inch spans. These pillars are each one foot eleven inches from the wall. The height of the niche is ten feet eight and one-half inches, from red quarry tile floor to the ceiling, which overhangs the area three feet two inches. It is on this twenty-eight foot by ten foot eight and one-half inch wall, behind the pillars, that the sculpture will be placed. All the foregoing figures were obtained by measurement and by consulting the architect's blueprints.

The Proposed Sculpture, Model and Construction

Study and sketches led to the incorporation in the sculptural form of intersecting horizontals and verticals derived from the structural system of the building itself. In the sculpture these were contrasted with shapes and planes designed to break up what might become monotonous repetition into interesting patterns of light and dark, void and solid. This was to create a three dimensional form organization which would be harmonious with the structure to which it was to be attached yet would preserve its own identity as a visual expression of the artist's ideas and emotions in relation to the site.

Structural strength, relative lightness, and ease of attachment would be necessary to carry out the idea. Because it has all these characteristics and because it is strongly associated with contemporary architecture, welded sheet steel was selected as the material to be used.

A model of the site was built of wood to a scale of one and one-half inches to one foot. This model was painted to resemble the building using oil paints mixed with sand to simulate the texture of concrete and brick work.

From the idea sketches one was selected (Figure 11, page 16) and improved upon to better fit the setting and the building as a whole. This sketch, drawn to the scale of the building model, was then used as a pattern for soldering together a wire armature on which plasticine was modeled to

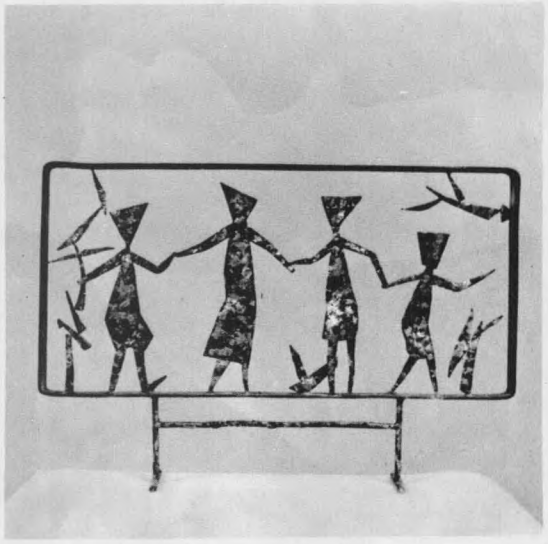

Figure 9
Children Screen

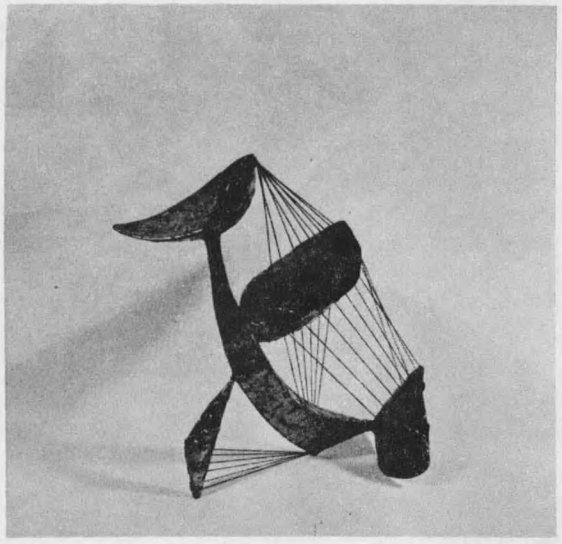

Figure 10
Stringed Figure

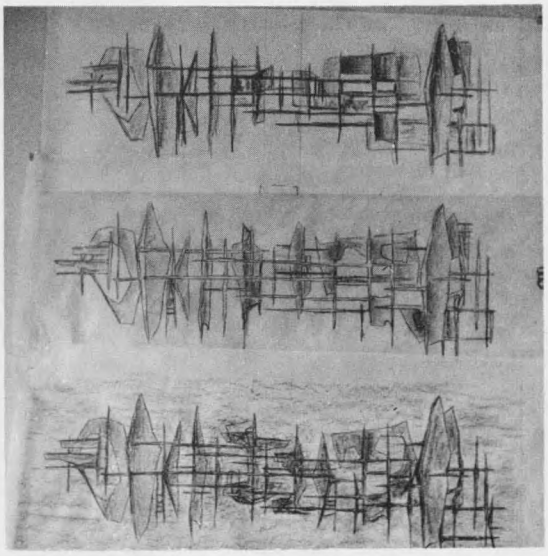

Figure 11
Sketches

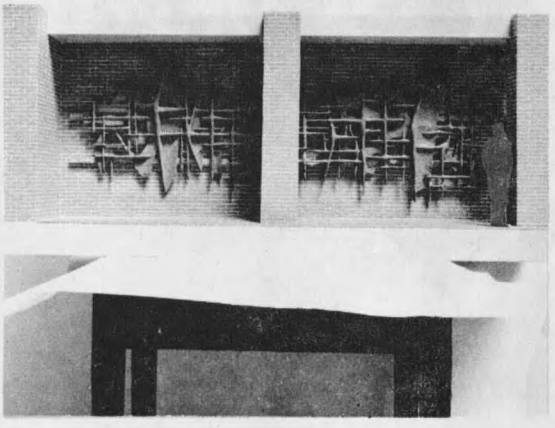

Figure 12
Rough Model

give a three-dimensional presentation of the idea suggested by the drawings.

The plasticine model, after insertion into the model of the niche (Figure 12, page 16), was then reworked and adjusted to improve its qualities of proportion, balance, and harmony with the site.

In order to better illustrate the sculptural aspect of the work and to find and solve any problems of construction, it was decided to create a section of the total work in its true scale from the material selected for execution. This would also give the observer a better appreciation of the quality to be obtained by the use of welded steel than could be comprehended from the small model executed in plasticine. The section for enlargement was selected on the basis of whether it would make a good sculptural form, in and of itself, and would illustrate the problems to be encountered in fabricating vertical and horizontal members as well as planes.

The full scale section was made by referring to the drawings and the plasticine model. It measured eight feet six inches by two feet six inches, and was constructed from cold-rolled sheet steel of sixteen gauge. Figure 13 on page 18 and slide number 1 show the section in place at the site. The steel was cut with a welding torch to the required shapes and further shaped by hammering. After hammering, the pieces

Figure 13
Completed Section at the Site

were welded together along the seams to form the various members and these were then joined to the plane surfaces to complete the sculptural form.

From this fabrication several facts were learned about the limitations of the material in being hammered to shape without the use of heat. Narrow pieces could not be easily hammered into compound curves; long pieces hammered to form a curved corner on one edge curled along the length; plane surfaces buckled as they were heated. These factors were taken into consideration in reworking the model so that it might be as accurate as possible for visual presentation.

The plasticine model was painted with an air brush and tempera paints to simulate the steel to be used and fastened into the building model. Figure 14 on page 20 and slide number 2 show the completed model on its stand. The model and the full scale section are pictured together in slide number 3 and figure 15 on page 21. Figure 16 on page 22 is a composite of photographs of the model and building illustrating how the sculpture would appear upon completion.

Accuracy in the model was also desired so that it could be used to estimate the amount of material required for the total project. Measurement of the section of the model used in the full scale blow-up revealed that the amount of steel, welding rod, and weight could be estimated within an error limit of 1/30th of the whole. Calculations from

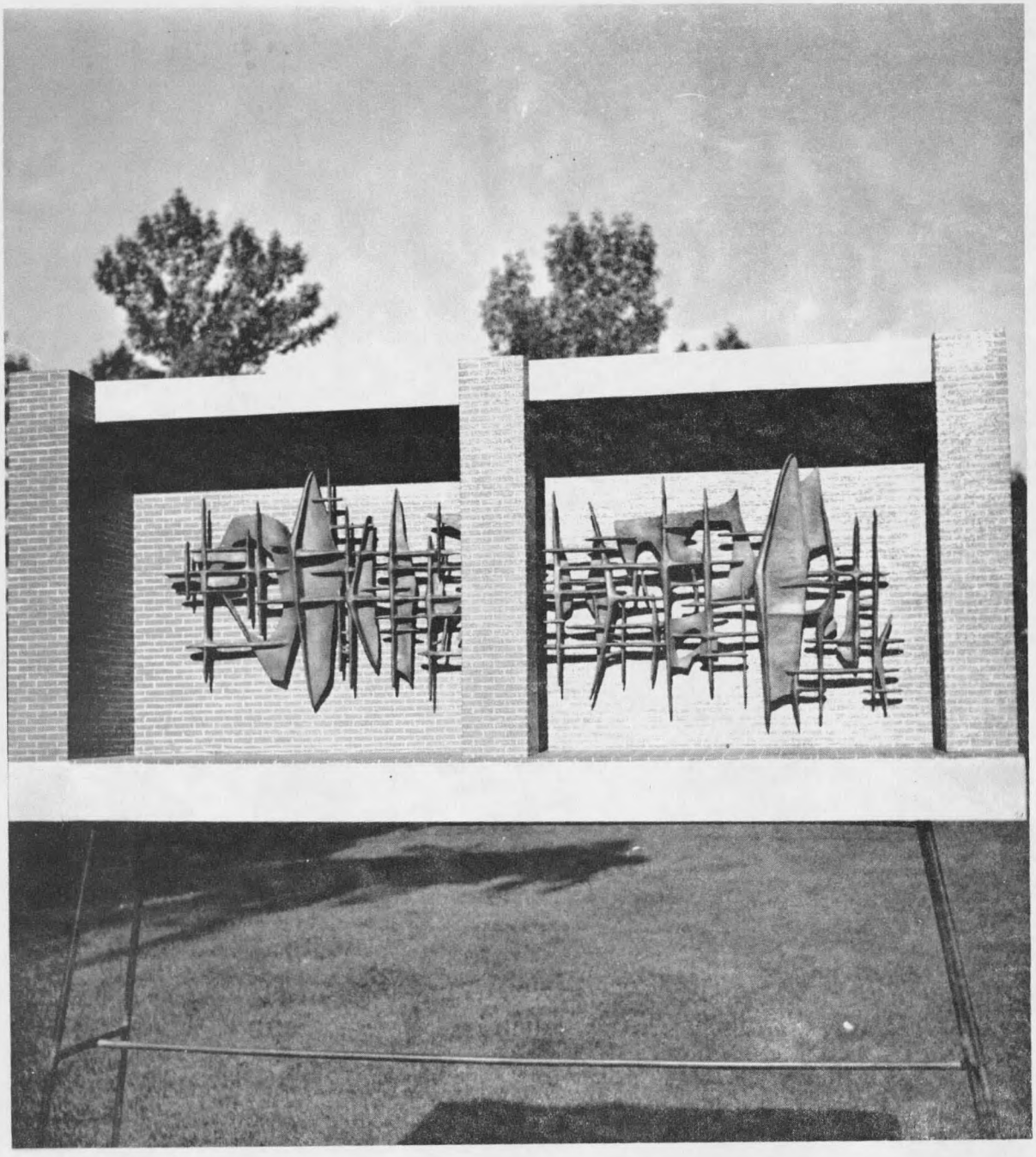

Figure 14
Completed Model

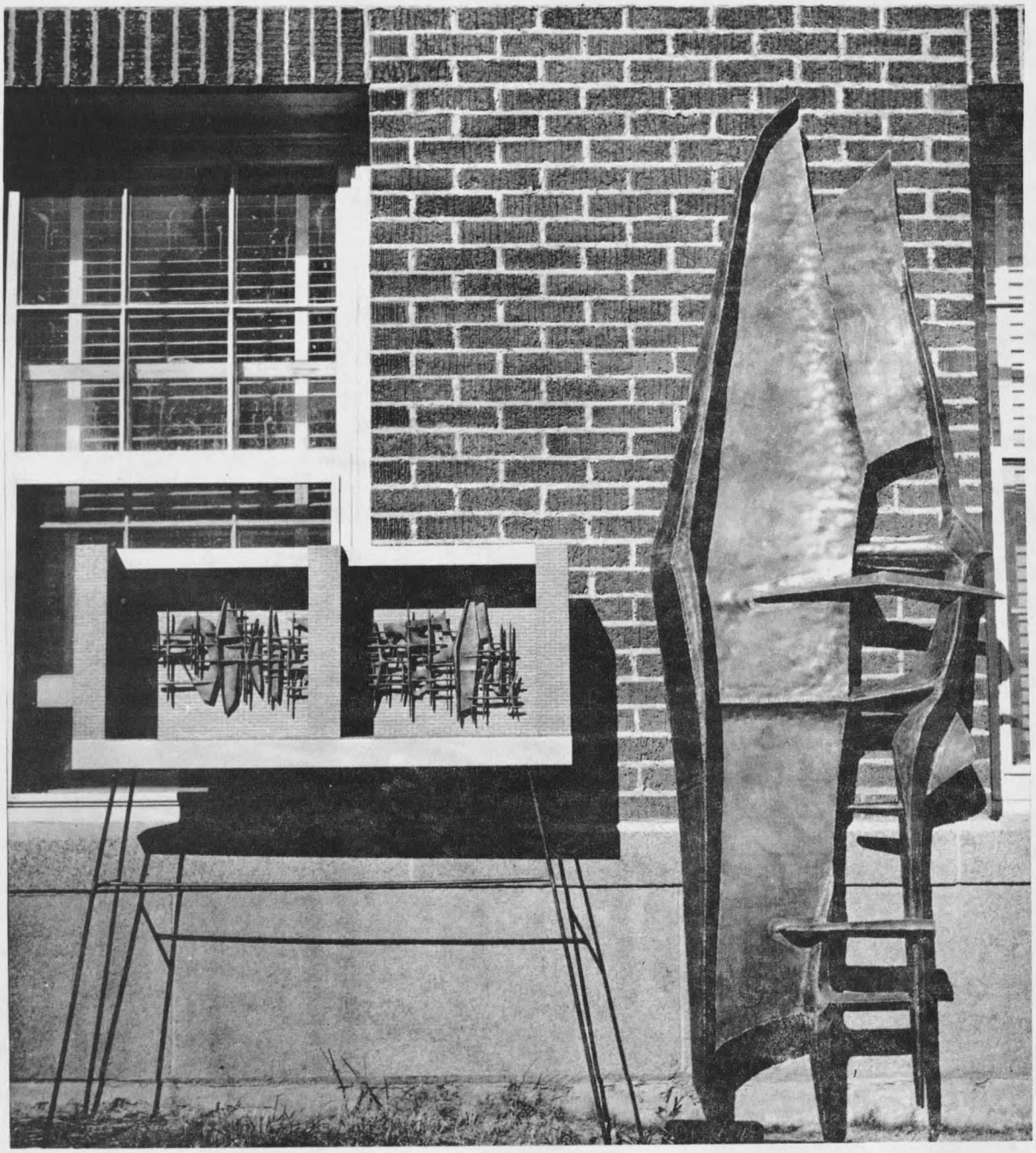

Figure 15
Model and Section

Figure 16
Composite of Model and Building

measurements of the model gave a weight of sixty pounds for the section executed. This section was then weighed and found to weigh sixty-two pounds. Accordingly, in figuring the materials required, this margin of 1/30 was added to the estimated final weight, amount of sheet steel, amount of rod, and amount of gases used. Another 1/30th was then added to offset any loss due to human error in the execution or any changes deemed necessary to the final work.

From measurements of the model it was estimated that seven and one-third sheets of 3' x 8' x 16 gauge cold-rolled sheet steel at $8.13 per sheet would be required. This would come to $59.62. Sixteen pounds of 3/32" and two pounds of 1/8" mild steel welding rod would be necessary at forty cents per pound for a total of $7.20. The project would require an estimated 142.78 cubic feet of oxygen and 102.55 cubic feet of acetylene at a cost of $7.64.

The completed sculpture would weigh approximately 456 pounds. To support this weight at an average distance of four inches from the wall would require the use of masonry fasteners utilizing expansion shields and machine bolts. There are two types of fasteners deemed suitable on the market. One of these is a steel cylinder with teeth on one end and split sides. This is called a self-drill type because the teeth drill the hole in the masonry when a hammer is used. After the hole is drilled it is cleaned, a plug

inserted in the toothed end, and the entire cylinder driven into the hole. The splits on the sides allow the fastener to expand when the plug is forced into it by contact with the hole bottom. A machine bolt of the proper size is then screwed into the fastener. The other type of fastener is composed of a lead casing inside of which fits a tapered steel, threaded plug. It is secured by drilling a hole in the masonry with a star or masonry drill and then driving the assembled parts into the hole causing the lead shield to expand when forced up the taper of the threaded interior part. A machine bolt may then be screwed into the threads. Whichever type was selected for use would then have the sculpture welded to the projecting ends of the machine bolts.

The lead fasteners would probably be more suitable to use in brick, having less tendency to crack it. If the hole were drilled entirely through the brick to the cinder block which it faces, the lead cylinder would then be expanded at the rear edge of the brick and there would be little danger of cracking a brick because of its perforations. Admitting the possibility of several fractured bricks, a dozen one-half inch machine bolt lead fasteners would be entirely satisfactory and leave a very wide safety margin in supporting less than 500 pounds. This would amount to a cost of $7.70.

The total cost of the materials for the complete sculpture would be $90.29.

The project to be done in its entirety would be built in sections just as was done with the one section which was fabricated in its full scale. Upon completion of these sections their placement on the wall would be noted and the expansion fasteners put in place. Each section would then be welded to the projecting bolts and to the sections on either side.

Preservation of the metal could be accomplished by the painting or spraying of the surface with several coats of any of a number of commercial vinyl-type plastic preparations.

Conclusion

The sculpture and the problems presented by the setting, materials, and the idea were basically those encountered by sculptors. Since this was a problem in pure sculptural design, the solution was not affected by such factors as communication with a client, finances, and contractual time limits. Had these been present the sculpture and solutions might have been different.

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SLIDE #3

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SLIDE #1

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