HOW TO MAKE MOBILES

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Photographs of the author's mobiles
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I. WHAT IS A MOBILE?

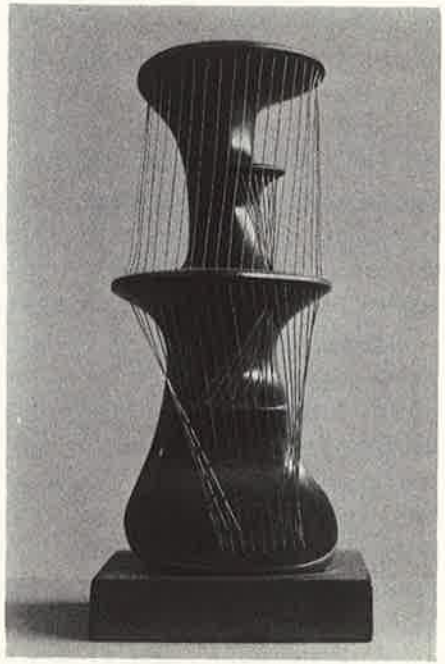
PLEASURE IN MOVEMENT is as great in our daily lives as is our delight in color or sound. The soaring, swooping flight of a bird, a leaf falling, a flag fluttering, water flowing—all are movements which give us a great deal of pleasure or excitement or peace, according to our moods. A mobile is created for the sake of movement and it is the particular way in which it moves that captures our attention and intrigues us.

Mobiles have very little tradition or history behind them. They are a new art form. The first mobile in the style with which most of us are familiar was created in the early 1930's by Alexander Calder. It was he who gave this art its whole general direction and specific style. As an art form, mobiles are related to sculpture, painting, drawing, and design. Because they are three-dimensional, art critics often refer to them as mobile sculpture. This term is intended to explain that mobiles are a form of sculpture which moves. I think, however, that this emphasis on the sculptural qualities of mobiles is misleading. It ignores the very close relationship of mobiles to drawing and painting. The many pieces are like silhouettes or outlines. When painted they have much the same quality as shapes cut out of an abstract painting.

Traditional sculpture is defined as a continuous three-dimensional mass surrounded by space and light. It is a solid form which occupies an unchanging volume of space. The modern sculpture by Henry Moore is much closer to the particular sculptural quality of a mobile. It remains a solid form but incorporates some space and light as part of its design. The plastic constructions of Gabo are still a form of sculpture but their transparency destroys more of the feeling of impenetrable solidity. Thus, light, space, and form become almost equal. These constructions are suspended in the air and, as they turn, present many combinations

Traditional sculpture. Greek.

(Metropolitan Museum of Art)

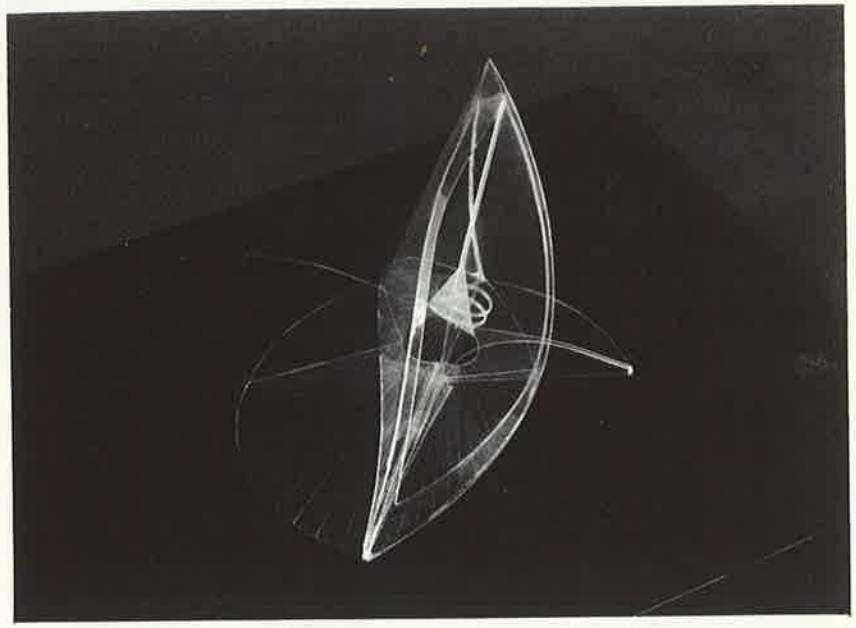


Modern sculpture. "The Bride," by Henry Moore.

(Collection Museum of Modern Art)

of form simultaneously. We can see the outside and the inside at the same time.

The mobile by Calder is getting down to essentials. It exists in three dimensions, but it does not completely exclude space and light from within itself, nor does it completely enclose any given space. It consists of a series of two-dimensional shapes combined

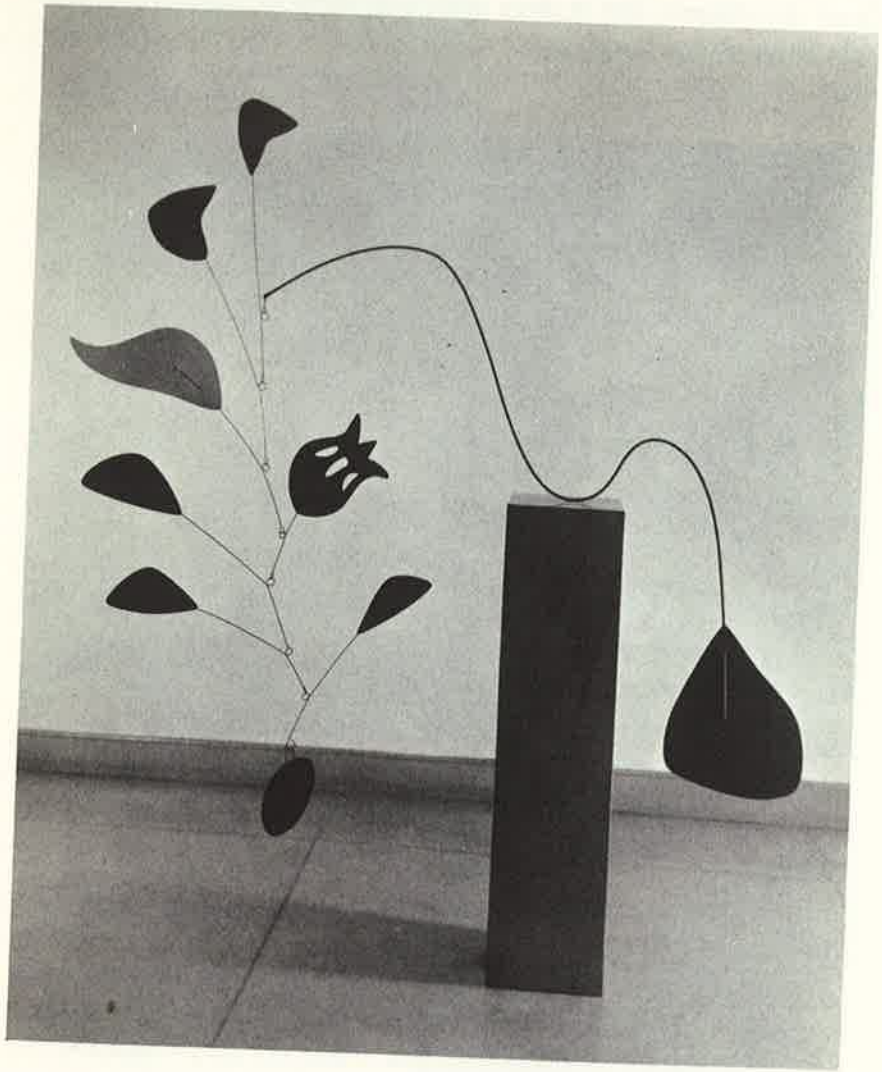


(Collection Museum of Modern Art)

Plastic construction. "Spiral Theme," by Naum Gabo.

to form an abstract composition. The shapes are separated, each one surrounded by its own light and space, each to some extent independent of the other, and all related through balance, form, and color. The connecting wires form a thin network, and are a subordinate part of the composition. They are very much like the lines in a drawing.

The space in which a mobile moves is as important as the mobile itself. A mobile should not merely hang in the air and move like a weathervane or windmill; these are passive, static objects which are made to move in a limited way by the force of the wind. They do not interact with the space in which they move. The best mo-



(Buchholz Gallery)

Mobile. "Pomegranate," by Alexander Calder.

biles have a life of their own and appear to be moving according to a plan; the forms are purposeful and often point to one another or indicate directions in which the observer should look. All these elements of motion can be controlled by the maker, giving each mobile a special character; making it move dreamily, solemnly, or wittily. Think, for instance, of the differences in mood created by a giddy, exuberant, splashing fountain and a lazily meandering stream. Such differences of mood can be translated into the movement of a mobile.

WHERE TO HANG MOBILES

As part of the decoration of a room, a mobile should be hung wherever there is enough room to permit it to move freely and not look closed in. However, the center of a room is not the best place. To be seen and fully appreciated, a mobile is best hung at eye level or a little higher. At this level it would, of course, be in the way. Generally speaking, mobiles should be hung toward the side or corner of a room.

Mobiles are particularly effective hung from the ceiling and in good design relationship to a painting, piece of sculpture, or perhaps a large-leaved plant, which is frequently a major decorative element in a modern room. They can hang free with nothing under them, or they can hang over a grand piano or a series of cabinets set out at right angles to the wall, serving as a space divider between living areas. This is a very popular use. Other locations often utilized for mobiles are to one side of a wide doorway or arch or an opening between two rooms, in a bay window, or in a main entrance hall or foyer, where they can be hung centrally, leaving enough headroom.

For those in business, there are many uses for mobiles of every imaginable sort. They serve as eye catchers in store windows or show rooms and add an interesting up-to-date touch as a point of interest in lobbies, waiting rooms, conference rooms, and other places where people meet. In the display world, all kinds of small merchandise, such as jewelry or trinkets, small carved figures or toys, colored papers in fantastic shapes, small boxes or many types of decorative accessories, can be displayed and balanced on wires in the form of a mobile. At Christmas, both at home and in stores or offices, colored ornaments can be suspended on moving arms to add glitter to this festive occasion.

2. BALANCE

A GREAT MANY people who might otherwise attempt to make a mobile have been put off by the terrifying word "balance." I am asked more consistently about balance than about any of the other factors that are just as fundamental and important a part of mobile making. A very special person who combined a thorough knowledge of mathematics, physics, and metallurgy with the mechanical ability of a blacksmith could possibly produce the most profound, mechanically "balanced" mobile, but not necessarily the most intriguing, colorful, charming, or playful one. A mobile is not some sort of ingenious scale; it is not a machine for defying gravity or solving problems in physics. There are many kinds of balance besides the purely mechanical. Forms, or shapes, can produce one kind of balance, spatial relationships another, while color and variations of materials or textures will help create subtler balances than those of either weight or size.

To understand better the construction of a mobile, try this experiment: Take a piece of cardboard cut to any simple shape, tie a thread to a straight pin, stick the pin into the edge of the cardboard at any point, and suspend it where it will move freely. (You can thumbtack the end of the string to the ceiling or to the arch of a doorway.) A free object such as this immediately takes on a life of its own and we enjoy watching it simply because it moves. Now take another piece of a contrasting shape and suspend it in the same way near the first. The two pieces will move independently and in a different manner, at differing rates of speed. Move the two pieces toward and away from each other and notice how the space in between becomes involved in their movements and forms.

Now take these two cardboard shapes down, find a piece of wire stiff enough to hold the cardboard without bending, and tie the

pieces of cardboard to each end. Tie a string around the wire and adjust it by sliding the string toward one end or the other until the wire is horizontal, the two pieces of cardboard balancing one another. Hang the whole construction up again by this string. We now have all the essential elements of a mobile—motion, balance and form (see figure 1). The same experiment could be conducted using spherical forms, such as Christmas tree balls, or with cut-out stars tied to the wire and balanced as shown in figure 2.

KINDS OF BALANCE

The balance in the experiment just conducted was based on the wire being horizontal. But this is not always necessary. Move the balancing string to one side so that one end of the wire is higher than the other. The objects will still be balanced, as shown in figure 3. One piece is above and the other below an imaginary horizontal line, creating an asymmetrical balance. Now move the pieces back and forth along the wire until you are pleased with the effects created by the space between the two pieces. This is balance through spatial relationships. You are not only moving the pieces nearer to or farther from one another, you are increasing, decreasing, and changing the shape of the space between the pieces, creating various combinations of these two elements of space and form. As we shall see in the mobiles illustrated later, many more than two objects can be added to make a balanced pattern of forms.

Another important element we must consider is color. This not only makes a mobile more attractive but it is a very subtle means of achieving balance. If both pieces of cardboard in your two-piece mobile are the same neutral color, paint one of the sides of one piece a bright red. Notice how this side becomes a focal point and how the other sides seem to revolve about it as the mobile turns. A kind of three-to-one "balance" through color is the result. To vary the color balance, the opposite side of the other piece of cardboard might be painted green, black, or another contrasting color.

In a mobile, the elements of space, form, and color are combined mechanically to produce a balanced abstract composition. All these factors, which are present in our two-piece mobile, will become more complex, more interesting, and more satisfying as we construct larger and more ingenious mobiles.

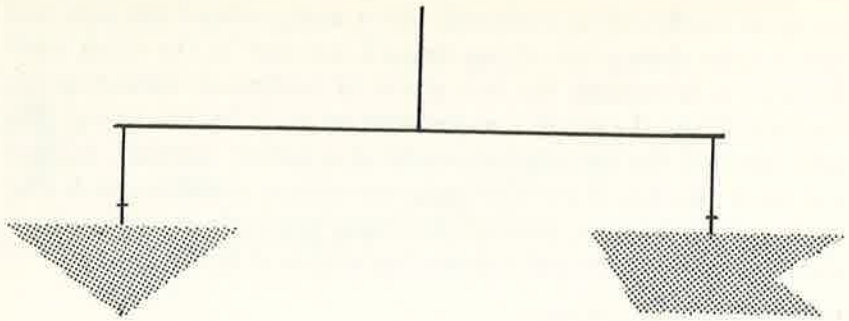


Fig. 1. Two cardboard shapes balanced at either end of a wire. The string toward center, which holds the mobile, is adjusted to right or left until the two units are in straight balance. In this experiment, a pin with thread attached is stuck into the top edge of each cardboard shape. The other end of the thread is tied to the wire.

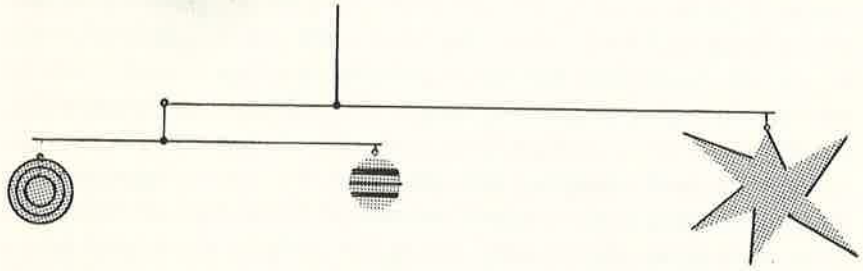


Fig. 2. Two Christmas tree balls and a paper star balanced horizontally as in figure 1. The two small spherical shapes are balanced asymmetrically by the large paper star.

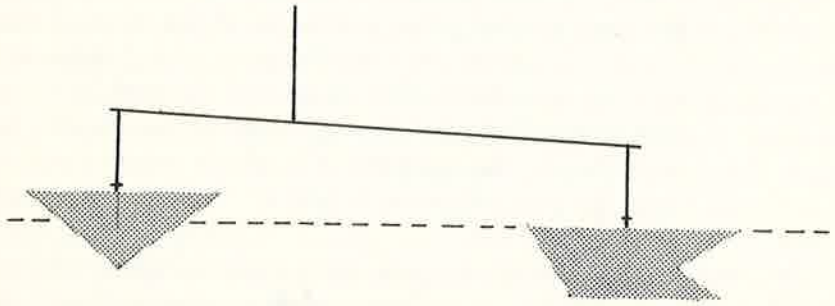


Fig. 3. Two cardboard shapes balanced asymmetrically. The angle of the wire is established by moving the string which suspends it to the left (or right).

3. MATERIALS AND TOOLS

THE MATERIALS and tools needed for mobile making are simple and inexpensive. To begin with, you will probably have half the necessary things somewhere about the house, and even later on you will find the chief ingredients of a complex mobile are your own ingenuity, imagination, and skill. The basic materials you will need to assemble are the following:

Cardboard. Get illustration or poster board in two or more thicknesses. Avoid a very thin board which is liable to warp easily, or too thick a board which will be difficult to cut with a clean edge. Cardboard comes in white or gray on both sides, or white with gray backing on the other side. Sometimes it comes in colors, otherwise it can be painted black or any color you wish.

Sheet metal. The two thicknesses of tin sheet used in the examples in this book are .006 "Tagger's tin" and .012 I.C. There are four progressively heavier weights as follows—.015X, .018XX, .019XXX, and .022XXXX. These are measurements in thousandths of inches. The .006 and .012 are as easy to cut as cardboard if you use metal shears. The tin is available at most good hardware stores.

Wire. No. 12, 14, 16, and 18 gauge galvanized iron wire is about the cheapest, most easily obtainable wire, and it is easy to handle. It can be obtained at most hardware stores in 1-pound or 5-pound coils at approximately 35 cents to 40 cents per pound. Aluminum, copper, brass, and steel wires are not only expensive but difficult to handle. They are usually too hard, too soft, or too brittle to use just as they are manufactured.

Thread. Nylon thread or thin nylon fishing line is strong, lightweight, and attractive.

The above list is basic and covers requirements for the step-by-step examples of mobiles given in this book. For those who wish

to experiment further, here are some other suggested materials.

Wood. Balsa comes in thin sheets (like those used for airplane models) or in blocks which can be carved, filed, and shaped. Wood veneers are manufactured in thin strips. They are very flexible and can be bent to form a great variety of three-dimensional shapes. They can be cut with a coping saw and glued with Duco cement.

Plaster of Paris. Plaster can be poured into molds or cardboard boxes or containers having simple geometric forms, such as cylinders, cones, cubes, or rectangles. A cardboard milk container, for instance, can be cut down in height and used as a rectangular mold. The plaster forms can be further shaped by carving or filing.

Plastic. Sheets of from 10 to 20 gauge are like paper and can be cut with scissors when warm (room temperature). Sheets 20 by 50 inches can be bought for around $1.25 to $2.00, depending on the thickness and quality.

Plastic pieces can be glued to one another with acetone, Duco cement, or nail-polish remover. Bits of metal or wood can be glued to plastic with Duco cement. Plastic sheets are available in clear finish or color.

Liquid plastic is also available for pouring into molds, and small, colored objects can be embedded in the center.

There is also a type of quick-drying clear liquid plastic into which small wire forms, such as a wire with the end bent into a circle or oval, can be dipped. Plastic will fill in this outline with a thin film which will dry, giving a light yet solid form to be used as a shape in a mobile.

Glass. Sheets of colored glass or stained glass are made in a complete range of beautiful colors. They are sold in sheets from 18 by 24 inches to 4 by 8 feet and range in cost from approximately 40 cents to $4.00 per square foot, depending on color, type of glass, and whether or not it is domestic or imported glass. Unlike window glass or plate glass, sheets of colored glass may vary greatly in thickness and contain many irregularities (which refract light), making it more difficult to cut. Only the simplest shapes should be attempted by the amateur, since even an expert is quite limited by the physical properties of the glass. One of the best methods of attaching a piece is by wrapping it with fine wire (26 gauge galvanized iron wire or any other flexible wire of approximately this gauge), making a loop of the wire or attaching a small

ring to the wire at the top of the piece (as in figure 22) and twisting the wire at the bottom until it is tight against the glass. See figures 22 through 26.

Paint. Poster paint (water mixed) is good for cardboard mobiles. This is available at art supply stores. Flat oil paint is used for metal or other materials. The latter can also be used over cardboard if preferred. Oil paint can be procured in small half-pint cans in a variety of colors. Since little color is required for a single mobile, buy small quantities at a time.

Turpentine is used for thinning oil paint and for cleaning brushes. *Rags* are always useful for wiping brushes and wiping and polishing metal surfaces.

Miscellaneous material. Actually there is practically no limit to the kind of material that can be used to make mobiles, provided it is not too heavy and will hold its shape. Thus you can make Christmas mobiles using colored balls and metallic paper cut into stars and other shapes; we can attach small objects made of pottery, aluminum, thin copper, or any other light metal, according to the type of mobile you plan to make; its purpose and the materials that are at hand or easiest to obtain.

Odd-shaped parts of old kitchen utensils or bits of scrap wood, cork, spools, washers, metal rings, shapes cut from old cans, and many other things can be used in a composition. They can be cleaned and polished up to an attractive natural finish or painted black or any planned color.

In addition to your materials, here is a basic list of tools you will need:

Pliers. Long-nosed pliers (3 or 4 inches) with wire cutter at the side.

Metal shears. Straight (tinsmith's) or with curved blades especially made for cutting curves. (You will need these only when working on metal mobiles.)

Scissors. Kitchen, garden, or any heavy-duty scissors (especially needed for cutting cardboard mobiles).

Mat knife. A Stanley knife or any standard mat knife (to use as well as, or instead of, scissors, for getting a sharp outline on cardboard mobiles).

Brushes. Two or three soft-hair, square-tipped 1-inch brushes will be found best for painting cardboard or metal mobiles.

4. AN EASY MOBILE FOR THE BEGINNER TO MAKE

LET'S START with an easy mobile, using five pieces of cardboard. Our finished result is shown in figure 11.

The materials and tools you will need for this project are:

Wire (16 or 14 gauge galvanized iron).

Cardboard: illustration or poster board or any thin cardboard on hand (enough for a total area of about 35 by 24 inches).

Long-nosed pliers with wire cutter at side.

Scissors or mat knife.

Straight pin tied to a short length of string.

Thread (or string).

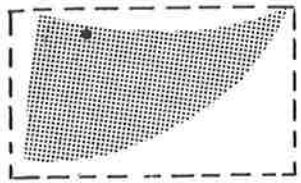
Paint (optional) and brush. (The pieces of the working model illustrated were painted black with poster color.)

MAKING PATTERNS FOR THE SHAPES

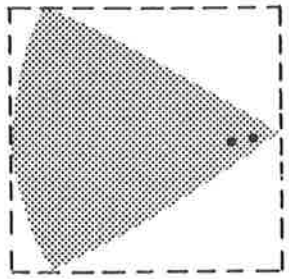
The first thing we must do is to mark up and cut the cardboard into rectangles according to the dimensions given in chart 1. This makes it possible to get each shape cut out without bending or cracking the remaining cardboard. It also controls the maximum size of each piece. A mat knife cuts a clean, sharp edge that is very professional looking, but if you have never used one, scissors will be safer and more natural to your hand. Sooner or later, however, it is a good idea to practice cutting with a sharp knife or razor blade.

Sketch the outline of each piece within the cardboard rectangles. Don't worry about copying the design exactly or getting perfect circles, curves, or straight lines. Warm up a bit by sketching circular shapes on paper (or even in the air) before drawing the actual patterns. I advise doing this because shapes sketched freehand are more spontaneous and have a more lively personal quality than laboriously drawn outlines. A perfect circle is not one of the best shapes to use in a mobile anyway. It is rather dull, and so is

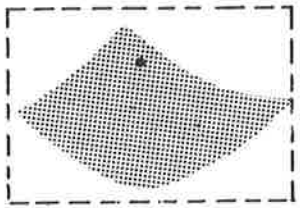
Chart 1



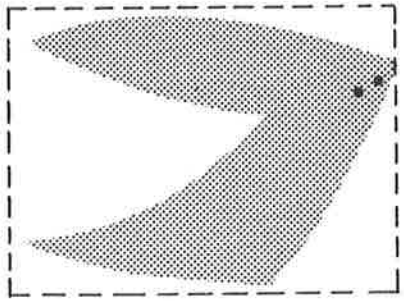
1 6 X 3½



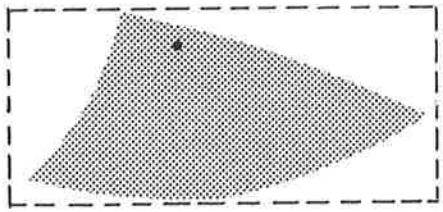
4 5½ X 5½



2 6 X 4



5 8 X 6



3 9 X 4

ARMS

	Length	Gauge
a	12½ inches	16 or 14
b	19¼ "	
c	24¼ "	
d	25¼ "	

an equilateral triangle. The best effects will be achieved with pleasingly irregular shapes, related to one another in form and feeling as suggested in chart 1. The scale in chart 1 is ¼ inch to the inch. You can vary the scale in making your pieces. Arm lengths given allow for the making of attachment loops.

If one shape used in your mobile is mathematically precise, then all should be. This, however, demands meticulous workmanship over all and more exact spatial relationships, without necessarily a better-looking mobile as the end result. In the beginning don't fuss with each piece—dash it off. If you don't like your first sketch, turn the cardboard over and do it again. I often draw several outlines in the same place without lifting the pencil. Then I cut along the edge of the one I like best. Actually, an oval shape is not used in the design of this particular mobile, but you could substitute it for one of the others if you like, within one of the areas given in chart 1. When you have the five shapes sketched to your satisfaction, cut them out with scissors or mat knife.

Now stick a straight pin into the top edge of shapes numbered 1, 2, and 3 at approximately their balance point. These balance points can be seen very clearly in the photograph of the finished mobile (figure 11). When you have established this point, punch a small hole approximately ⅛ inch *below* the pin through the *side* of the cardboard in pieces 1, 2, and 3. (See chart 1.) (To do this place the cardboard flat over a piece of soft wood and pierce the hole with an awl, nail, or other sharp-pointed instrument.) Through the holes we will later attach wire rings.

Pieces 4 and 5 are treated differently, two holes being made, as described shortly.

SHAPING THE WIRE

You will see from figure 11 that the wires from which our cut-out shapes are suspended are curved. This is customary in all mobiles, curved lines being more graceful than straight ones and lending more interest and movement to a design.

Therefore, if you are using wire from a coil, take advantage of the fact that it is already curved. To make the necessary longer arcs, slide the curved wire back and forth between thumb and fingers until the wire is as straight as you want it. Hold the end of the wire firmly in one hand during this operation and keep the

pressure light and even between thumb and fingers of the other hand while pulling the wire toward you.

If you are using odds and ends of wire, try to shape them to smooth arcs by the same method. You cannot get this effect by making a series of little bends one at a time along the length of the wire as the line will then show a lot of ugly bumps.

Shape and measure the wire before cutting off any lengths from the coil. Use a flexible tape measure to follow the curve of the wire. The lengths given in inches in chart 1 allow for attachment and balance loops for our present project, and either 14 or 16 gauge wire is recommended.

ASSEMBLING THE MOBILE

You now have your cardboard shapes cut out (with holes punched in three of them) and the connecting wire arm *a* smoothed into an arc and cut to a length of 12½ inches. Now make six wire rings approximately ¼ inch in diameter. Shape the rings with pliers and, before closing the ends right together as shown in figure 4, insert one ring in each hole in pieces 1, 2, and 3. Keep the other three rings for later attachments. Next make a small, round loop at each end of arm *a* (see figure 4), using the

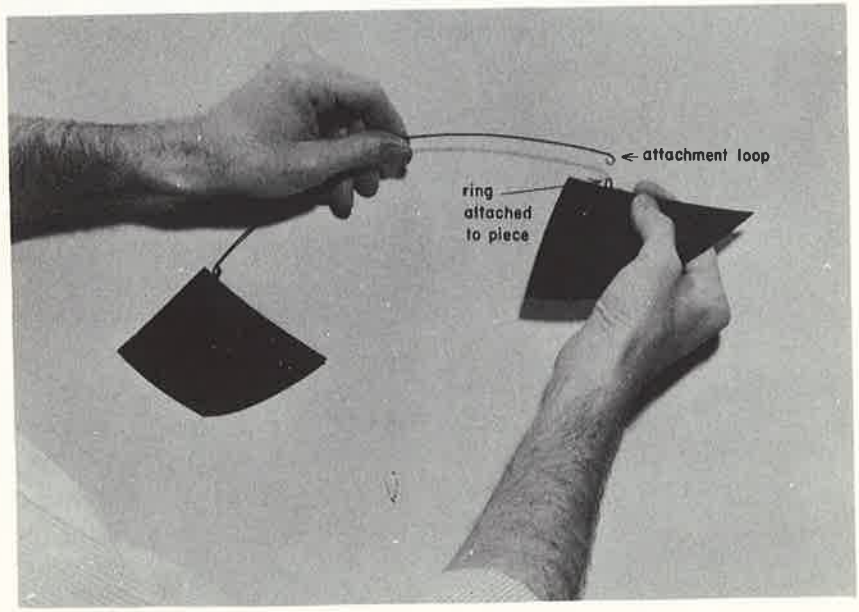


Fig. 4. Attaching piece 1 to the end of arm a.

pliers. Place the ring attached to piece 1 over one of the loops and close up both the ring and the loop so the piece will not fall off the arm, yet will hang freely. These loops at each end of the arm will be called attachment loops. Attach piece 2 to the other end of the arm in the same way.

With pieces 1 and 2 attached at either end of curved arm *a*, the next step is to find the point on the arm at which the two pieces balance, as shown in figure 5. Note that piece 1 is higher than piece 2. Tie a string around arm *a* at approximately its center, then adjust the string until the pieces balance as shown. The string is now at what we call the balance point.

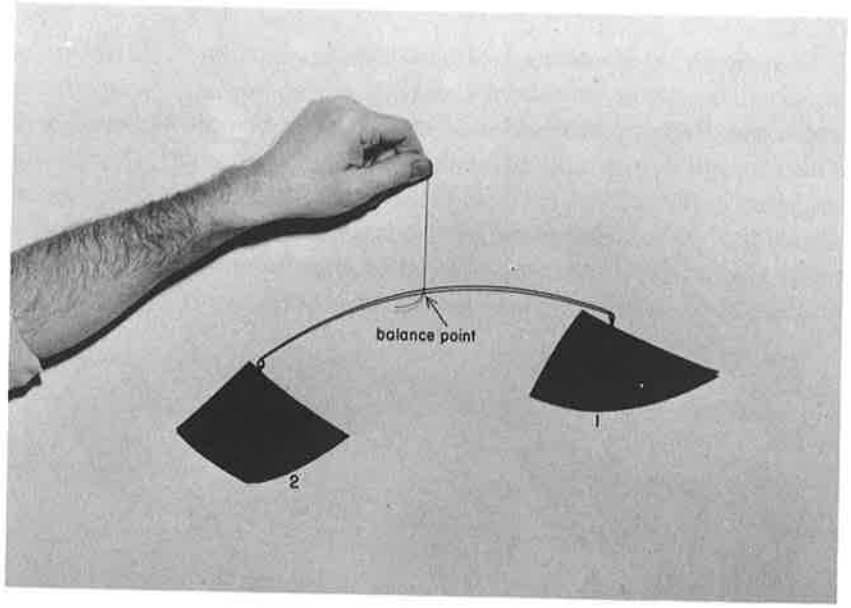


Fig. 5. Finding the balance point on arm a.

Grip the wire at one side of the knot (balance point) with tips of pliers and bend wire back toward you over the top of pliers, as shown in figure 6. Continue bending the wire back until the loop is three-quarters made, then shift the pliers to the top of the loop (see figure 7) and finish by bending the wire in the same direction until it is aligned, forming a smooth arc along its entire length. *The balance loop should always be made above the arm, or arc,* and the attachment loops below it.

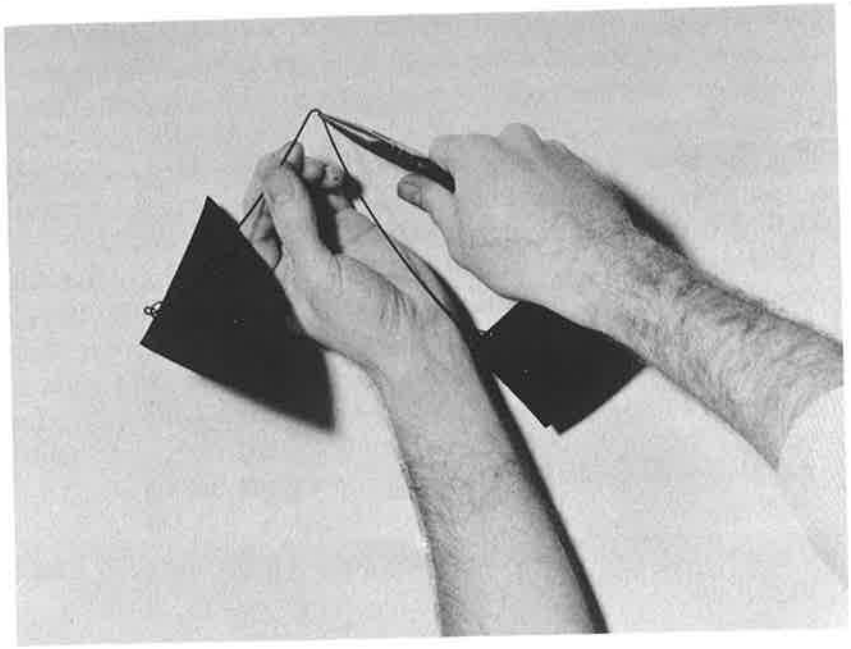


Fig. 6. First step in making balance loop.

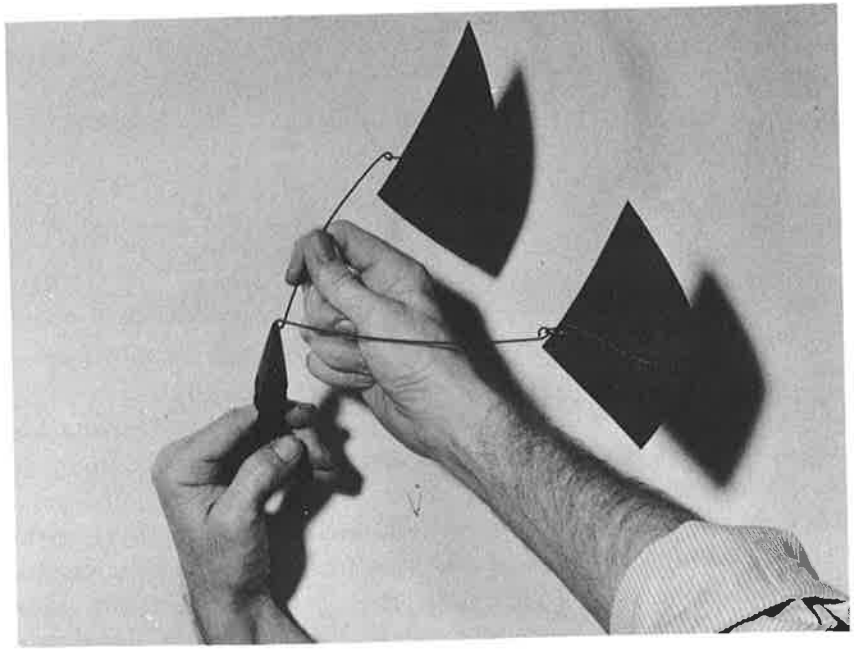


Fig. 7. Second step in making balance loop.

Note also that a balanced loop cannot be made until pieces are attached to both ends of the arm. It is impossible to give exact measurements for the points at which the arms will balance, since readers will be using materials of varying weights. Also, by establishing the balance point *after* the pieces are attached to the arm you can make allowances for variations in shape from the original design, and correspondingly more or less weight.

You have started assembling your mobile with arm *a* for the reason that a mobile must be built from the bottom up. If you think about this for a moment, you will see why. It is impossible to start at the top and continue adding weight, without making adjustments for every piece added. (And, by the same token, for those of us who are not mathematicians or engineers, it is necessary to *design* each new mobile from the bottom up.)

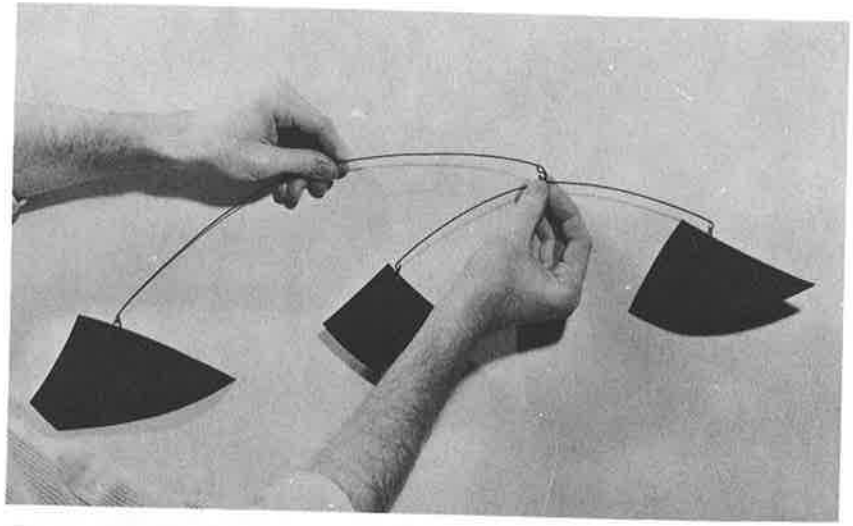


Fig. 8. Attaching arm a to arm b with ring through balance loop of arm a.

The next step in building up your mobile, therefore, is to tackle arm *b*, shown in correct position, second from the bottom, in figure 11. Following the same general procedure as for the first arm, shape, measure, and cut the wire to the correct length given in chart 1, namely 19¼ inches. Make an attachment loop at each end. Next put a ring through the balance loop of arm *a*, at the same time connecting the attachment loop on the end of arm *b* as shown in figure 8. Close the ring so the arm is secure, yet free swinging.

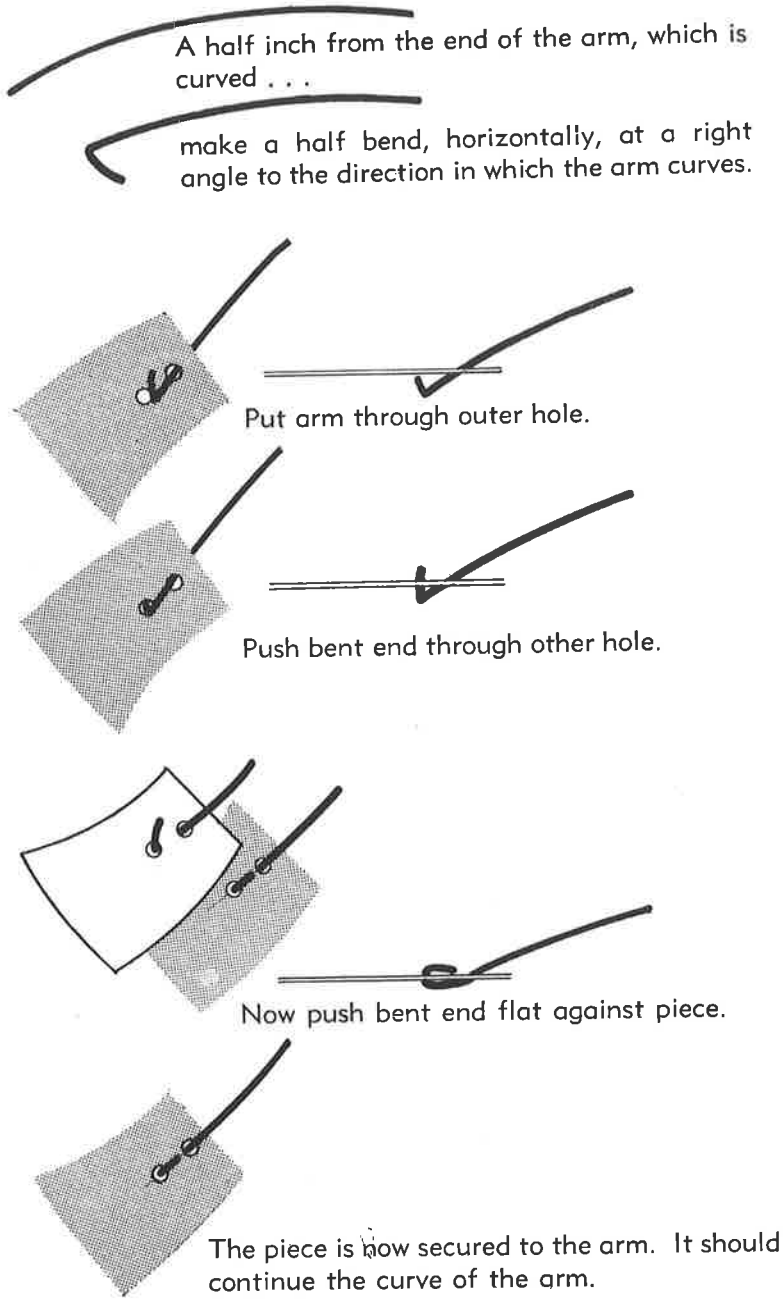


Fig. 9. Steps showing how to attach a piece directly to the end of an arm.

Attach piece 3 to the other end of arm *b* with its ring, as you did with those on arm *a*. Now you must find your new balance point with string as before and make the balance loop on arm *b*. With this done, move into arm *c*.

The third arm (arm *c*) has piece 4 attached to one end. The manner of doing this is different from the previous attachments. The piece is fixed *directly* to arm *c* in the following manner. An inch from one end of arm *c* makes a half bend, horizontally, at right angles to the direction in which the arm curves (see top of figure 9). Punch two holes in piece 4 at the points indicated by the dots in the pattern (see chart 1). These holes should be approximately half an inch apart. Manipulate the bent end of arm *c* through the two holes as illustrated in figures 9 and 10. Secure the piece by bending the wire back on itself flat against the other side of piece 4, as shown in the final illustration of figure 9.

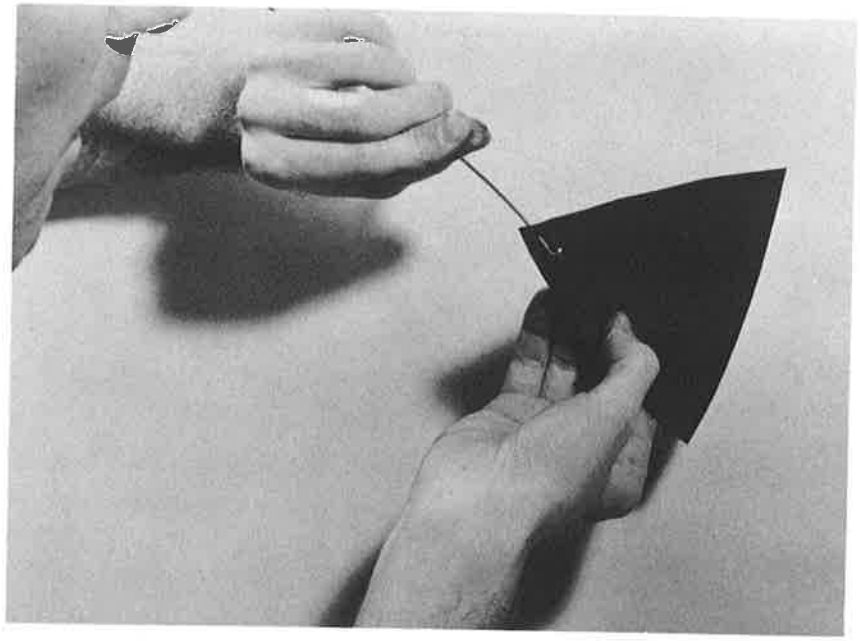


Fig. 10. Attaching piece 4 directly to one end of arm c.

With piece 4 secure on one end of arm *c*, where it will act as a sort of tailpiece catching any stray puff of wind and setting the mobile in motion, now make an attachment loop at the other end of arm *c*. Put ring through balance loop of arm *b*, simultaneously

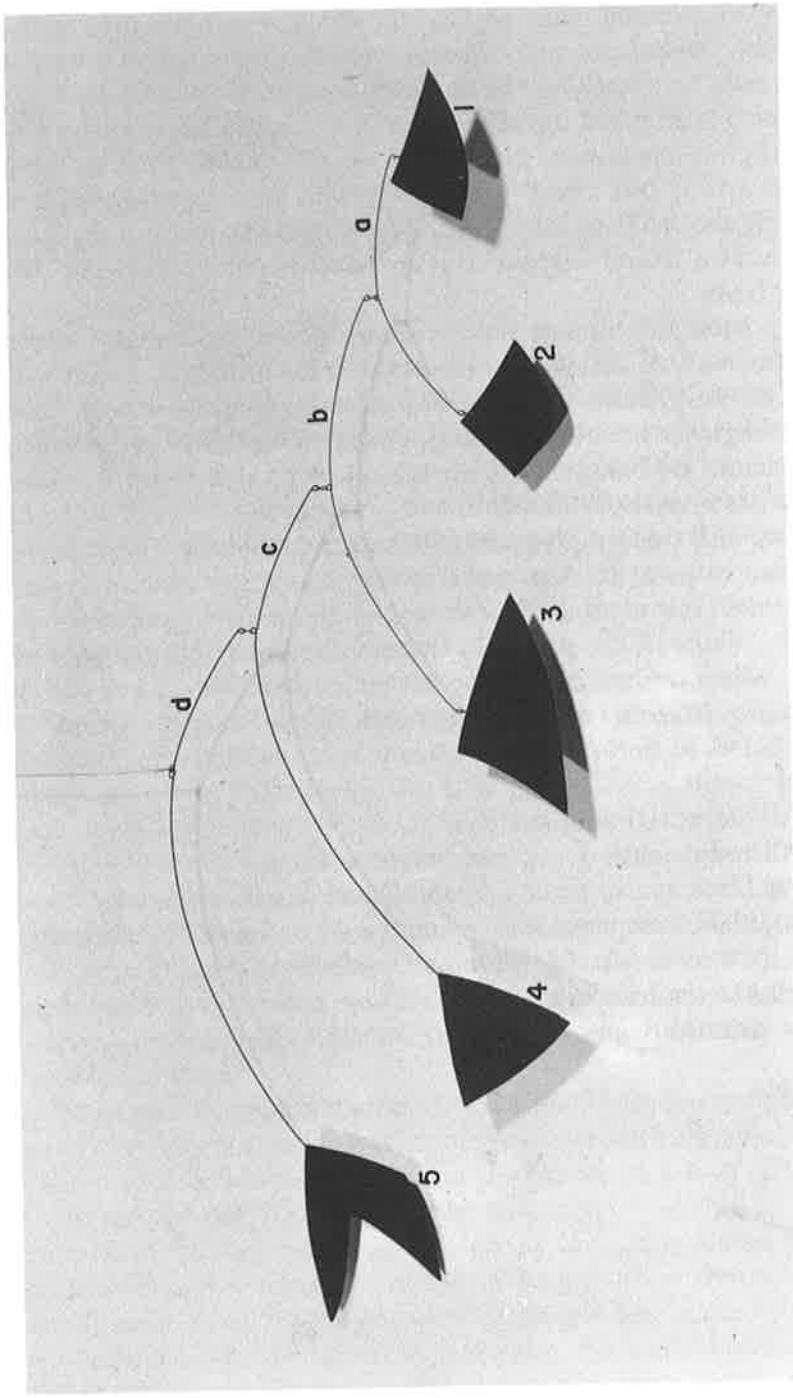


Fig. 11. The completed cardboard mobile of five pieces.

joining attachment loop of arm *c*, which you have just made. Establish the balance point in arm *c* in the usual way and make a loop ready for attaching the final, top arm of the mobile.

Piece 5 is attached directly to arm *d* in exactly the same way as the tailpiece on arm *c*. Now make an attachment loop at other end of arm *d* and attach arm *c* to it with your last ring, placed through the balance loop. The final step is to make a balance loop in arm *d* and suspend the completed mobile where it will swing freely.

Step back and admire your creation before making any minor adjustments that may seem necessary. Set it in motion and it will come to life. Touch one piece and all will move. It will respond to the slightest breath of air and move as effortlessly and silently as a cloud. Its being in the air is quite logical and yet it seems somewhat mysterious, fanciful, and playful.

Now, with the completed mobile hung at a convenient height, is the time to paint it. Use poster color with water and apply the paint over the cardboard with a 1-inch square-tipped *soft-hair* brush. While all the pieces in the mobile illustrated are painted black, which is always a satisfactory color, variations can of course be made. Here are a few suggestions if you want to introduce other colors to tie in with the color scheme of the room in which it is to hang:

All pieces red or olive green.
All red or olive green with white arms.
All black except piece 2 (painted red or white).
All black except piece 2 (painted red) and piece 5 (white).
(Or paint piece 2 white and piece 5 red.)

Additional notes about workable color schemes and the application of paint to the arms are given in chapter 8.

5. VARIATIONS ON A THEME

BEFORE BEGINNING another mobile, let's first discuss the different types of arrangement that are possible, then let's add a few pieces to the first one and try a few variations. Since we can add to our mobile only at the top, we should first decide whether to make the additions go beyond the length of the original or make them considerably shorter. We do not want a rectangular or square mobile, especially with pieces whose shapes are as free as those we have been using. Later in the book there is a picture of a rectangular mobile, but you will find here that all the shapes within it are variations on squares or rectangles.

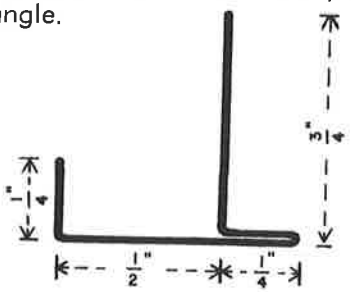
When we plan a mobile, we can design it to move in rectangular, horizontal, or vertical space, and certain shapes will be found more pleasing and appropriate to each of these space arrangements. Free forms (not strictly geometric figures) are more logical and pleasing when the space occupied by the whole mobile is itself a free form. Circles and straight lines, on the other hand, can be arranged vertically or horizontally, and squares and rectangles again can be arranged vertically or rectangularly. The windows in a tall building make a pleasing horizontal and vertical pattern; but, if they were irregularly shaped, they would seem arbitrarily forced into this pattern.

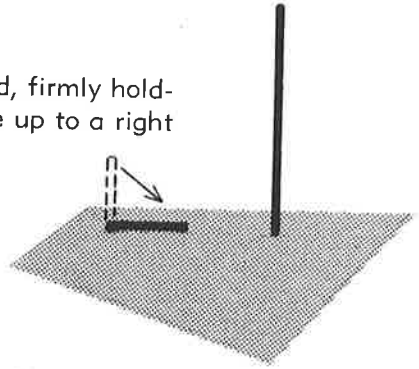
When working with free forms, it is a good rule to arrange them in an asymmetrical combination of horizontal and diagonal directions, very much like the leaves on the branch of a tree. The free forms should not be too violently contrasted. Groups of three, four, or five shapes which are variations of a basic shape can be contrasted with one small circular or long, narrow shape. These small, contrasting shapes are very exciting when made to spring out into the air two or three feet from the main body of the mobile. They are like antennae and give the whole mobile a deli-

Start with a 2-inch length of 18 gauge wire . . .

which you bend tightly in half.

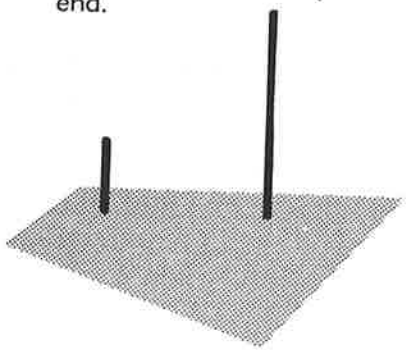
Put pliers ¼ inch from bent end, firmly holding both pieces. Bend one piece up to a right angle.

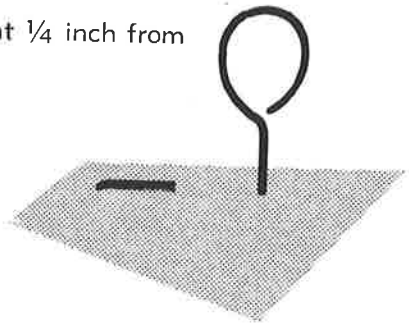




Bend short end over to secure piece.

Bend other piece of wire upright ¼ inch from end.





Make loop in upright wire.

Insert long end through balance hole, other end through second hole.

Fig. 12. Step-by-step method showing how to bend wire into a hook for attaching a piece so that it hangs horizontally.

cate, graceful, sensitive movement. Thus placed, these shapes have a great deal of *esprit;* they enhance the light, airy qualities of the mobile and have an elegant, erratic, playful movement of their own. They exaggerate the whole pattern of movement and make the mobile seem much larger, without making it look any heavier.

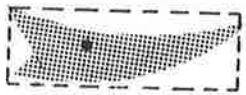
Since a mobile is a construction designed primarily to move overhead in space, the qualities of lightness and illusions of spaciousness which can be achieved through good design are always to be aimed at. The mobile should at all times seem to be floating or moving through the air, never merely hanging in space. Should a mobile ever give the impression that it is ready to fall in the event that another piece were added, or make us afraid to walk under it, then the construction has been made either too heavy looking or static.

We can make certain kinds of changes on a mobile without rebalancing it. For example, all pieces could be hung horizontally. Alternatively, piece 1 and piece 4 could be horizontal, with the others vertical. This also makes a good arrangement. The method of fastening these pieces to hang horizontally is demonstrated in figures 12 and 13 and is described in the text a little later on. Another variation can be made by cutting a circle or free form from any one of the pieces; but, in order to maintain balance, it must be attached again to the piece from which it is cut. This can be done by reinserting the piece into its own space, at a right angle to the piece from which it is cut.

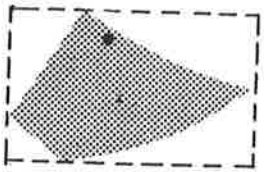
Instead of making any of the above changes, we can add to our mobile by cutting out the five rectangles numbered 6 through 10 in chart 2 according to the dimensions given. After drawing and cutting out the shapes indicated, attach pieces 6 and 7 to the right and left, respectively, of a new arm, *e*. See figure 14. This forms the bottom arm of a whole new unit. Continue to build up this unit, establishing balance points and making loops as you did on the original design. Check with figure 14 and proceed in the following order:

1. With pieces 6 and 7 added, make balance loop on arm *e* and attach to arm *f*.
2. Attach piece 8 to other end of arm *f*.
3. Make balance loop on arm *f* and attach to arm *g*.
4. Attach piece 9 to other end of arm *g*, make balance loop, and attach to arm *h*.

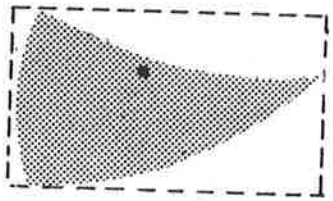
Chart 2



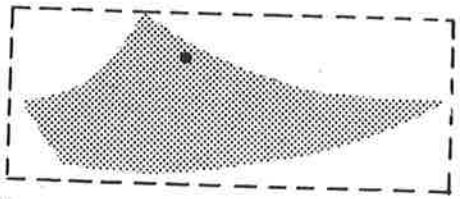
6 4½ X 1½



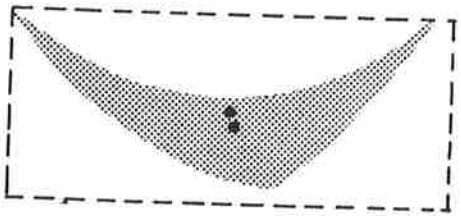
7 5 X 3



8 6½ X 3½



9 9 X 3½



10 9 X 4

ARMS

	Length	Gauge
e	9½ inches	16 or 14
f	15¼ "	12 for arm i
g	22 "	
h	24½ "	
i	28 "	

5. Suspend piece 10 horizontally. (To make hook for holding this piece, follow directions given in figure 12, steps 1 through 4. Find balance point of piece 10 by holding it on tip of pencil or pin and shifting it until it is horizontal. Make a small hole at this point and another small hole ½ inch behind it. Insert hook as shown in steps 5 through 7 of figure 12 and make loop. Put ring through this loop and attach to arm *h*.)

6. Make balance loop on arm *h* and attach to arm *i*.

7. Attach arm *i* to arm *d*.

8. Make balance loop on arm *i* or suspend by tying a string at balance point.

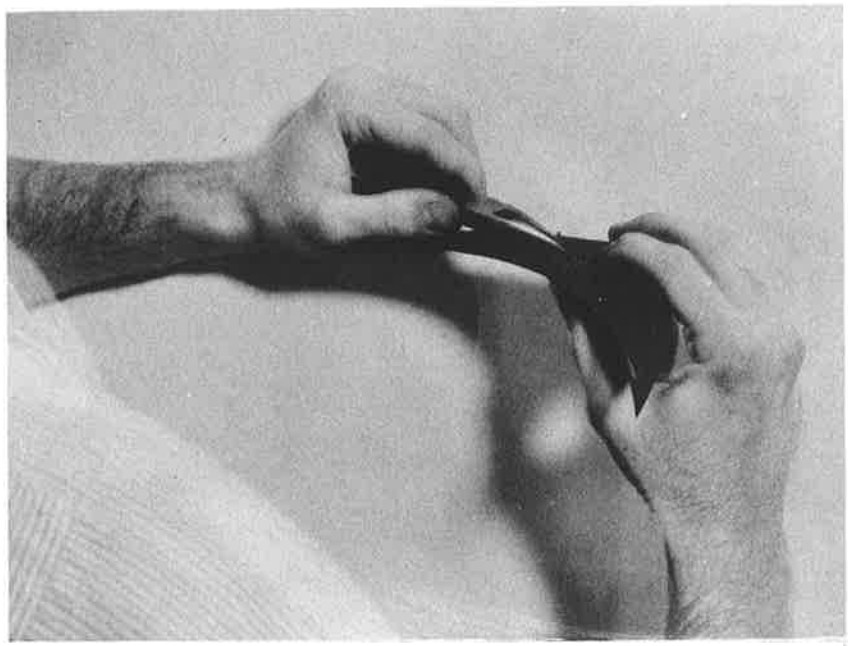


Fig. 13. Bending the wire into a hook on piece 10 so it will hang horizontally. (See finished mobile in figure 14.)

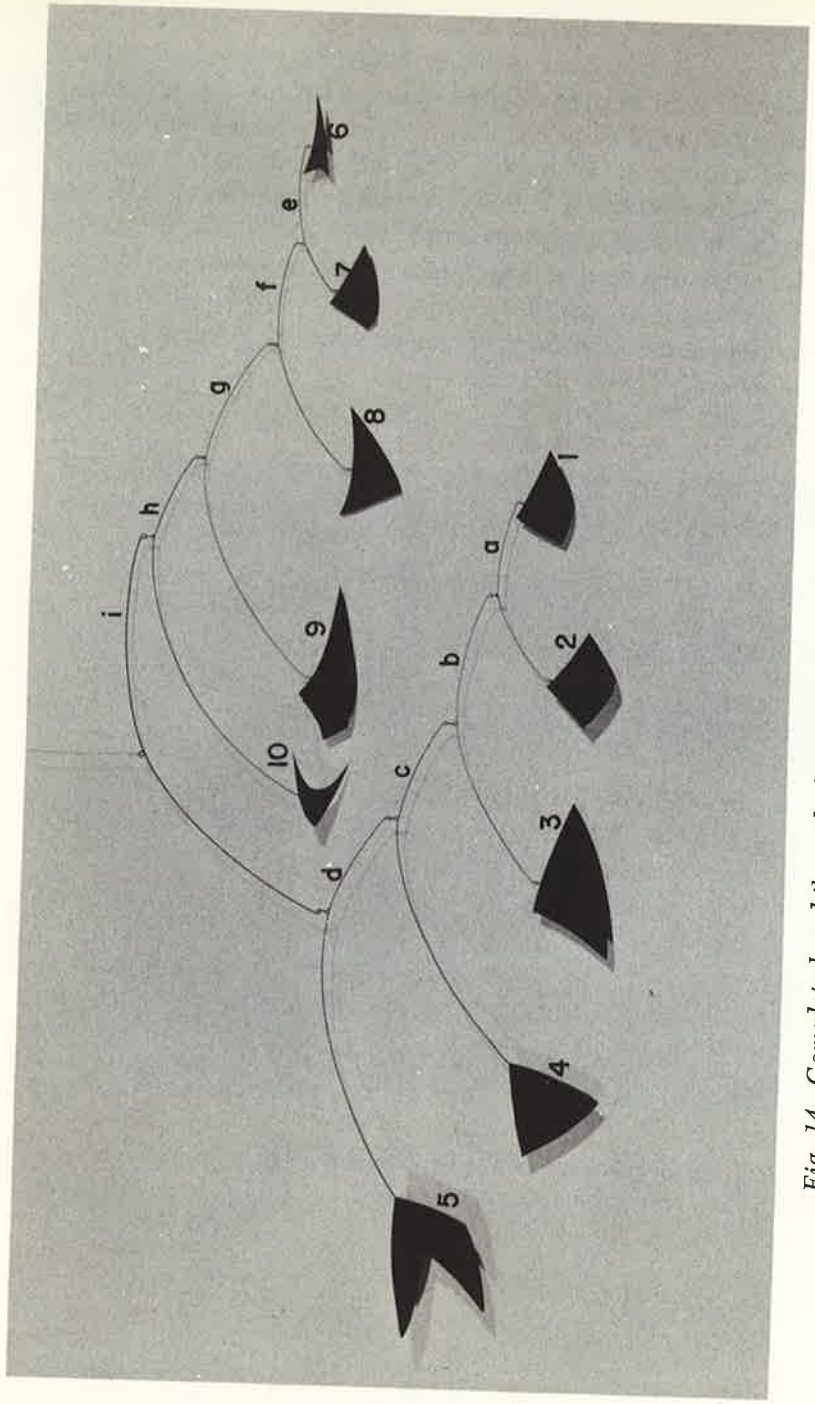


Fig. 14. Completed mobile with the new unit of five pieces added to the basic mobile shown in figure 11.

6. A CARDBOARD MOBILE OF SEVEN PIECES

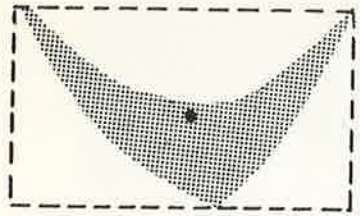
IN THIS EXAMPLE (see figure 15) all the technicalities of construction are exactly the same as those used in making the first mobile and its variations. Check back through the previous pages on any specific operation you may not remember clearly.

For this mobile you will need two gauges of wire: 12 and 16. The heavier, 12 gauge wire is used for arm *f* which is really a bridge between two groups of shapes and must be strong enough to support a heavy weight at each end (see figure 15), the same as in the variation of the first mobile. (If there were a heavy weight at only one end and a light weight at the other, then a lighter wire could be used, since the balance point would be very near the heavy end, giving the arm somewhat the action of a whip.) The lighter, 16 gauge wire is used for all other arms.

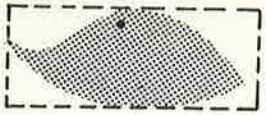
When designing a mobile, you should keep in mind that different gauges of wire can be exploited aesthetically as well as mechanically. The gauge used is, from the first, part of the design. Where one line in a drawing achieves the desired affect, a good artist does not use two. The wire arms of a mobile are rather like the lines of a drawing, and variation of light and heavy adds to the grace and subtlety of the design.

To start making the mobile illustrated in figure 15, cut out the rectangles of cardboard to the dimensions given in chart 3. Find balance points (as described in previous pages) and make a small hole approximately ⅛ inch below this point as indicated by the dots on each shape in chart 3. All pieces are hung vertically, with the exception of piece 7 which is suspended horizontally. Find balance point on piece 7, make hook and insert as demonstrated before in figure 12. Make fourteen rings of 18 gauge wire approximately ¼ inch in diameter for attaching arms and pieces as you did for the first mobile. Shape, measure, and cut wire for arms.

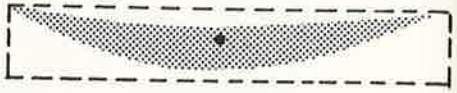
Chart 3



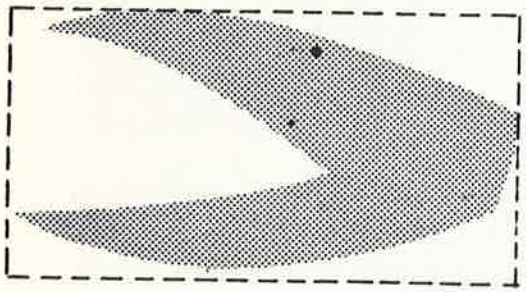
1 7 X 4



5 5 X 2



6 9 X 1½



2 10½ X 5½

ARMS

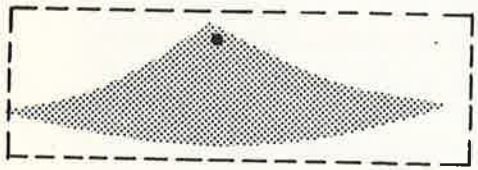
Length

a	18	inches
b	16¾	"
c	24½	"
d	17	"
e	26¼	"
f	31½	"

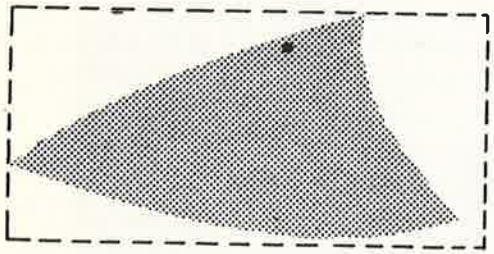
Gauge

16 or 14

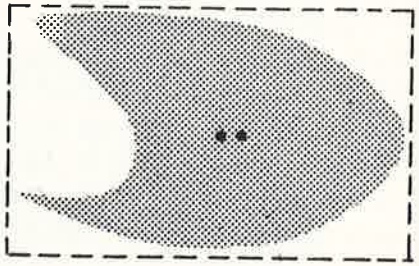
12 for arm f



3 9½ X 3



4 10 X 5



7 8 X 5

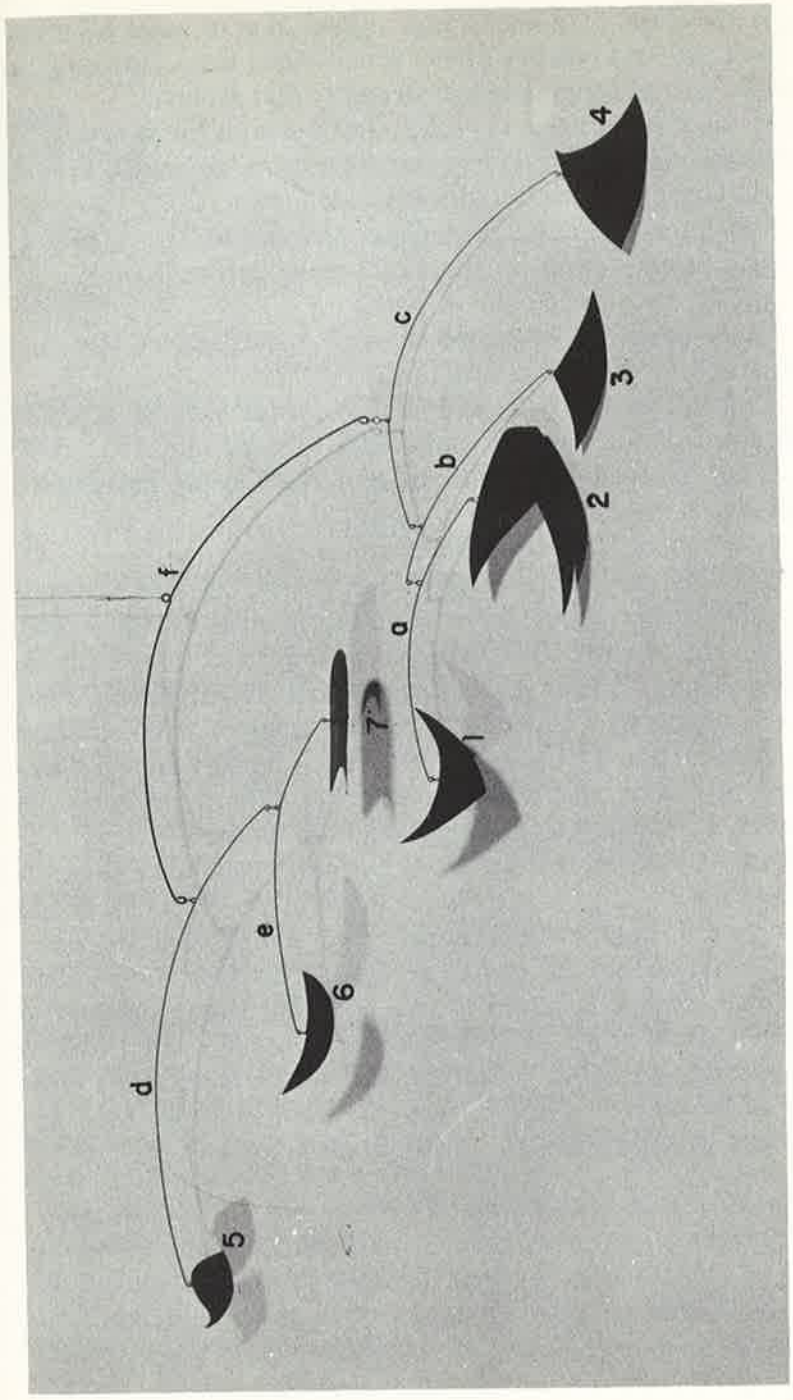


Fig. 15. Cardboard mobile of seven pieces, completed.

Gauges are noted in chart 3. It is a good idea to make all rings, and arms and find balance points at one time, since repeating an operation several times develops dexterity and accuracy.

Make attachment loops at each end of the arms but do not close these completely until the pieces, or other arms, are added in each case. Referring to figure 15, proceed as follows:

1. Attach pieces 1 and 2 to either end of arm *a*.
2. Find balance point on arm *a* and make balance loop.
3. Attach arm *a* to one end of arm *b*.
4. Attach piece 3 to other end of arm *b*, make balance loop, and attach arm *b* to one end of arm *c*.
5. Attach piece 4 to other end of arm *c*, make balance loop, and attach arm *c* to arm *f* with a *chain made of three rings*.
6. Attach pieces 6 and 7 to arm *e* (piece 7 being horizontal), make balance loop, and attach to arm *d*.
7. Attach piece 5 to other end of arm *d*.
8. Make balance loop and attach arm *d* with one ring to arm *f*.

We should always remember that the number of rings used, their shape, and their size determine how far and how easily an arm may swing. Three large, perfectly circular rings will allow more movement than three small circular rings or three elliptical rings, large or small. Long, narrow links, shaped somewhat like paper clips, can be used when one wants to increase the length of a connection without greatly increasing movement.

Control of movement is an important part of mobile design. A mobile in which all parts are free to move in all directions should be designed so that all parts make good composition from any angle. While neither the mobile nor any of its parts is ever completely still, two parts joined by one ring will tend to remain in the same plane. Two parts joined by two rings will tend to remain at right angles to each other, and two parts joined by three rings (as the joint of arm *c* to arm *f* on the mobile we have just been making) will be free to revolve in a complete circle.

7. METAL MOBILES

THIS CHAPTER gives directions for making six metal mobiles, ranging from a simple six-piece one to an eighteen-piece one. The techniques of construction, except for cutting the tin, are the same as those for making the first cardboard mobile.

A SIMPLE SIX-PIECE DESIGN

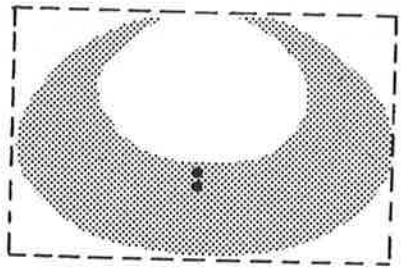
After making this metal mobile, I decided to call it "Persian Tree." The shapes, like leaves and fruit and the crescent moon (suspended horizontally), seem to me to have a slight Oriental quality. See figure 16. (*Note:* some pieces may appear in the photographs to be curved; however, all pieces are flat.)

Of the six pieces used in this design, piece 1 is attached horizontally by the same method as demonstrated in figure 12, while pieces 2, 3, 4, and 6 are attached directly to the arms. Piece 5 is attached vertically with a ring. The design could equally well be made with cardboard shapes.

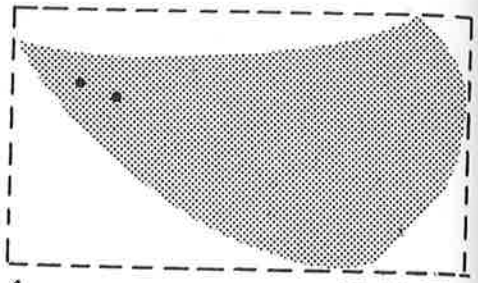
Two weights of sheet metal are used for this model—.006 "Tagger's tin" and .012 I.C. Pieces 1 and 6 are made from the heavier metal, about twice as heavy as the lighter material. Both sheets of metal are thin and flexible and as easy to cut as cardboard provided you use metal shears. Piece 5 may be cut from the same sheet with piece 2 by using a slightly larger rectangle and cutting the convex edge of piece 5 from the concave edge of piece 2. Piece 6 is made from the oval cut from piece 1. See chart 4.

Shapes cut from one another or sharing one edge help to create continuity and unity of form. While I have recommended sketching the shapes on separate rectangles of material, for the ease of the beginner, I often arrive at good shapes by sketching several that have one or two edges in common and cutting them apart. Although I do not think it is creative to rely too heavily on acci-

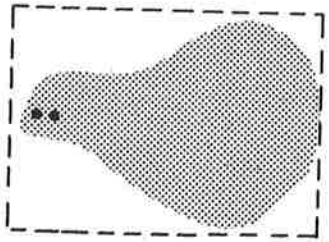
Chart 4



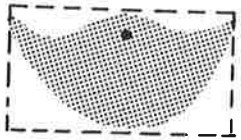
1 8 X 5



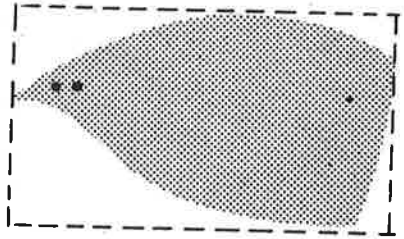
4 10 X 5¼



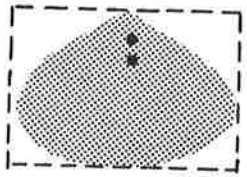
2 6½ X 4½



5 4½ X 2¼



3 8 X 4¼



6 4¼ X 3¼

ARMS

	Length		Gauge
a	13¼	inches	16
b	16	"	16
c	22	"	16
d	20	"	16 (or 18)
e	28½	"	12

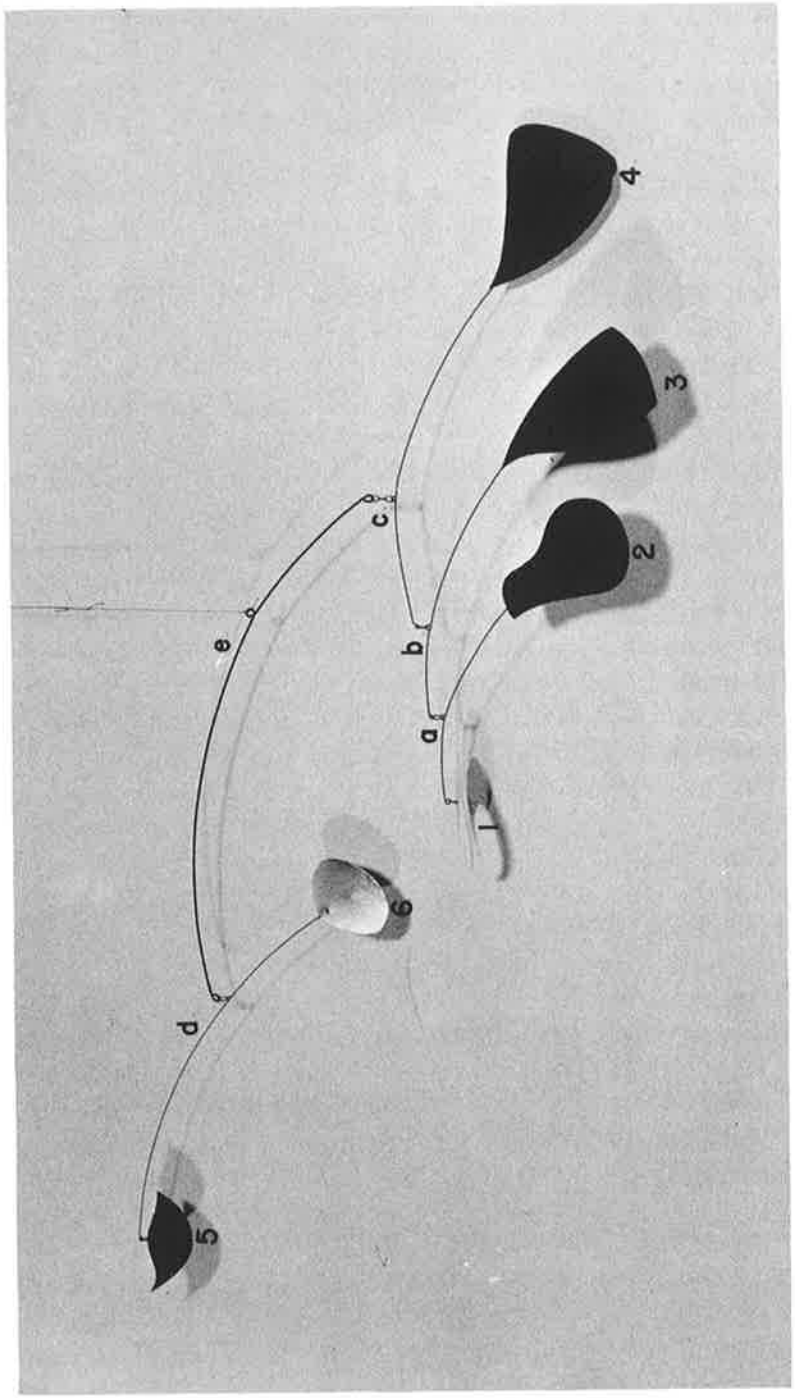


Fig. 16. The completed six-piece metal mobile.

dentals, there are certain cases where an accidental effect should be utilized. The recognition of a good shape is also creative. You will discover this more and more as you continue to make your own designs.

To make the mobile shown in figure 16, cut the six rectangles according to the dimensions given in chart 4. Shape, measure, and cut the five wire arms. See the table in the chart for the gauges of wire.

Referring to previous notes on technique, and using figure 16 as a guide, proceed as follows:

1. Attach piece 2 directly to arm *a*, as shown in figures 9 and 10. (When this piece is properly attached, it is a continuation of the curve of the arm.)
2. Find balance point of piece 1, then make and insert hook as shown in figure 12.
3. Attach piece 1 to arm with a narrow link so that the piece will remain at right angles to the arm. (This shape does not work so well within this arrangement if it is allowed to move too freely.) Since there are only six pieces, the composition must be definite in order to avoid a spotty scattered effect.
4. Make balance loop on arm *a*.
5. Attach piece 3 directly to one end of arm *b*.
6. Attach arm *a* to other end of arm *b* and make balance loop on arm *b*.
7. Attach piece 4 directly to one end of arm *c* and attach arm *b* to other end.
8. Make balance loop on arm *c* and attach to one end of arm *e* with a chain made of three rings.
9. Attach piece 6 directly to one end of arm *d* and piece 5 to the other end with a ring.
10. Make balance loop on arm *d* and attach with one ring to the free end of arm *e*.
11. Make balance loop on arm *e* or suspend with string tied at balance point.

AN ELEVEN-PIECE METAL MOBILE

In a sense this mobile is not a completed design. As you can see in figure 17, the pieces are all variations of a basic triangular shape. The arms are a series of almost horizontal curves, all moving in the same direction. The two groups of shapes move outward

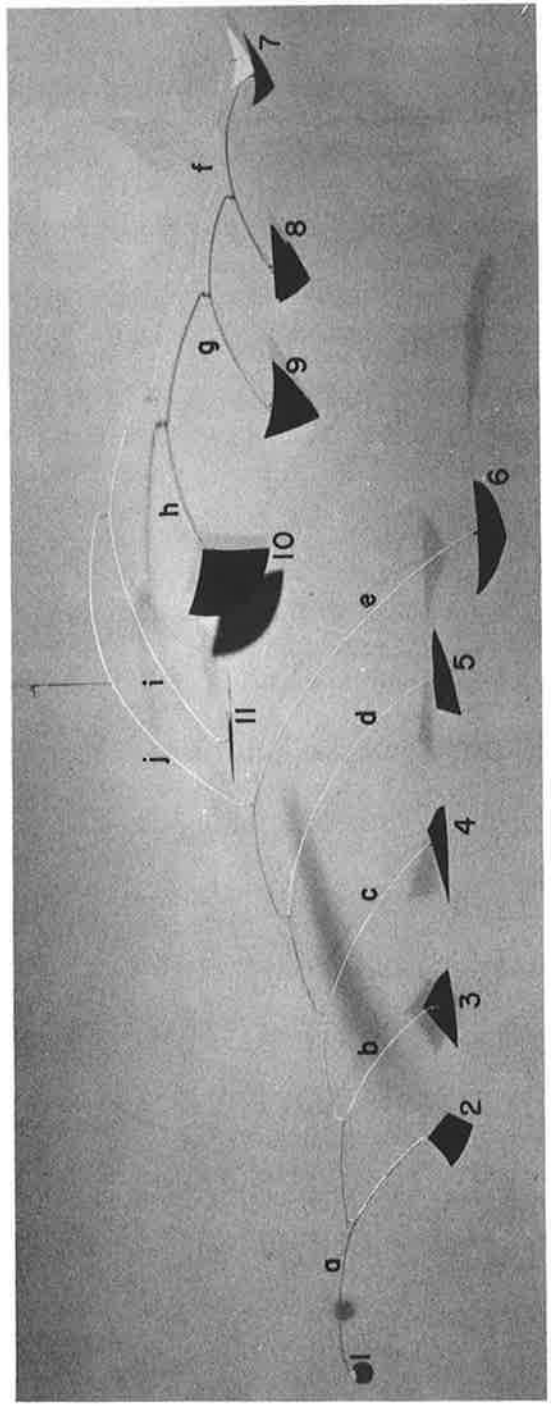


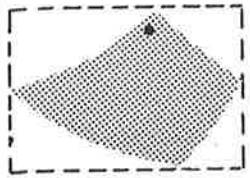
Fig. 17. The completed eleven-piece metal mobile.

in opposite directions. It would be quite possible to repeat this formula (with slight variations) almost endlessly. Making a mobile of variations on a simple geometric form can provide a lot of fun. You can start to work directly with the materials and when you decide to stop you will have a mobile that "just growed," like Topsy.

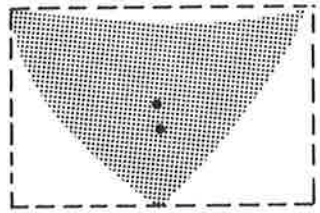
Cut eleven rectangles from a sheet of .006 metal to the dimensions given in chart 5. Pieces 3, 4, 5, 6, and 11 are suspended horizontally. Piece 10 is attached directly. The remaining pieces are suspended vertically from rings. Following figure 17, proceed as follows:

1. Make five hooks for the horizontal pieces.
2. Find balance points and insert hooks as shown in figure 12.
3. Make nineteen rings of 18 gauge wire approximately ¼ inch in diameter.
4. Find balance points for the vertically hung pieces, punch holes, and insert rings.
5. Shape, measure, and cut wire for arms according to chart 5.
6. Attach pieces 1 and 2 to arm *a*.
7. Make balance loop and attach with ring to attachment loop of arm *b*.
8. Attach piece 3 to arm *b*, make balance loop, and attach to arm *c*.
9. Attach piece 4 to arm *c*, make balance loop, and attach to arm *d*.
10. Attach piece 5 to arm *d*, make balance loop, and attach to arm *e*.
11. Attach piece 6 to arm *e*, make balance loop, and attach to arm *j*. Set this group aside.
12. Attach pieces 7 and 8 to arm *f*, make balance loop, and attach to arm *g*.
13. Attach piece 9 to arm *g*, make balance loop.
14. Attach piece 10 directly to arm *h*.
15. Make attachment loop at other end of arm *h* and attach arm *g*.
16. Make balance loop in arm *h* and attach to arm *i*.
17. Attach piece 11 to arm *i*, make balance loop, and attach to arm *j*.
18. Make balance loop in arm *j*, or tie string at balance point and suspend.

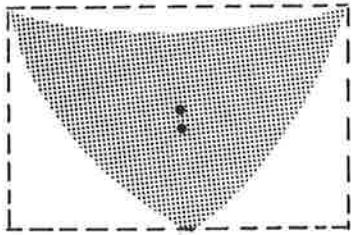
1 1½ X 1¼



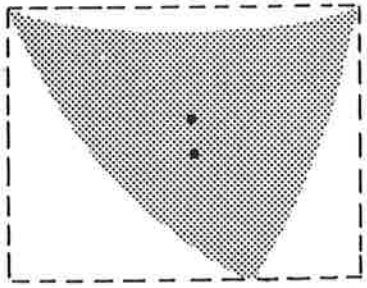
2 4¾ X 3¼



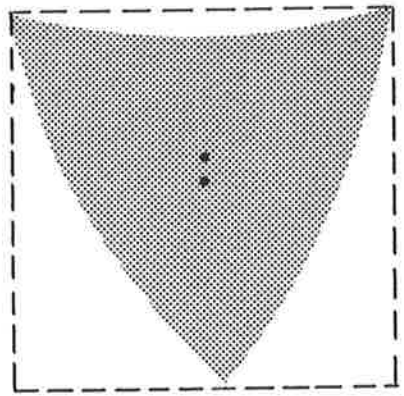
3 6¼ X 4



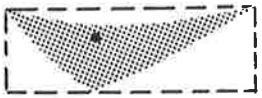
4 7 X 4½



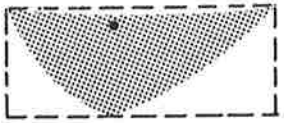
5 7¼ X 5½



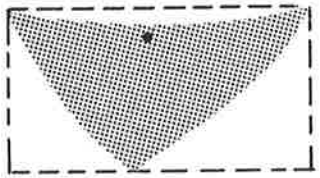
6 8 X 7¾



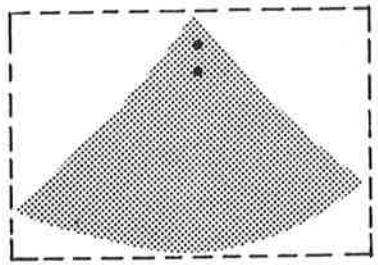
7 5 X 1½



8 5½ X 2¼

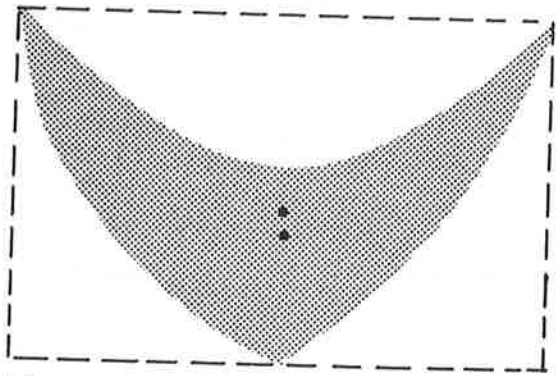


9 6¼ X 3¼



10 7½ X 5

Chart 5 (Continued)



ARMS

	Length		Gauge
a	22½	inches	18
b	18	"	18
c	21½	"	16
d	27½	"	16
e	33½	"	14
f	17	"	18
g	18½	"	18
h	22½	"	16
i	29	"	14
j	28	"	12

A TEN-PIECE DESIGN

Cut all pieces and arms according to the dimensions given in chart 6. Make sixteen rings approximately ¼ inch in diameter of 18 gauge wire. Pieces 3, 4, 5, and 8 are suspended horizontally. Find their balance points, make four hooks in similar fashion to previous examples, and attach to rings. Find balance points for pieces 6, 7, 9 and 10 and attach these also to rings. Proceed in the following manner, referring to figure 18:

1. Attach pieces 1 and 2 directly to each end of arm *a*.
2. Make balance loop on arm *a* and attach to arm *b*.
3. Attach piece 3 to other end of arm *b*.
4. Make balance loop on arm *b* and attach to one end of arm *c*.
5. Attach piece 4 to other end of arm *c*.
6. Make balance loop on arm *c* and attach to arm *d*.
7. Attach piece 5 to other end of arm *d*.
8. Make balance loop and attach arm *d* to arm *e* and put this group aside.
9. Attach pieces 7 and 8 to each end of arm *f*.
10. Make balance loop on arm *f* and attach to arm *g*.
11. Attach piece 9 to other end of arm *g*, make balance loop, and attach to arm *h*.
12. Attach piece 10 to other end of arm *h*, make balance loop, and attach to arm *i*.
13. Attach arm *e* to other end of arm *i*.
14. Either make balance loop on arm *i* or attach with string at balance point and hang up the completed mobile.

ELEVEN-PIECE DESIGN NO. 2

Cut all pieces and arms according to the directions given in chart 7. Pieces 2 and 10 are suspended horizontally. Find their balance points, make hooks as with earlier examples, and attach. Find balance points for the remaining nine pieces which are suspended vertically. You will need twenty-one rings, approximately ¼ inch in diameter, of 18 gauge wire. Shape, measure, and cut wire for arms according to chart 7. Referring to figure 19, proceed as follows:

1. Attach pieces 1 and 2 to each end of arm *a* (piece 2 is horizontal), and make balance loop.
2. Attach piece 3 directly to arm *b* and attach arm *a* to other end.

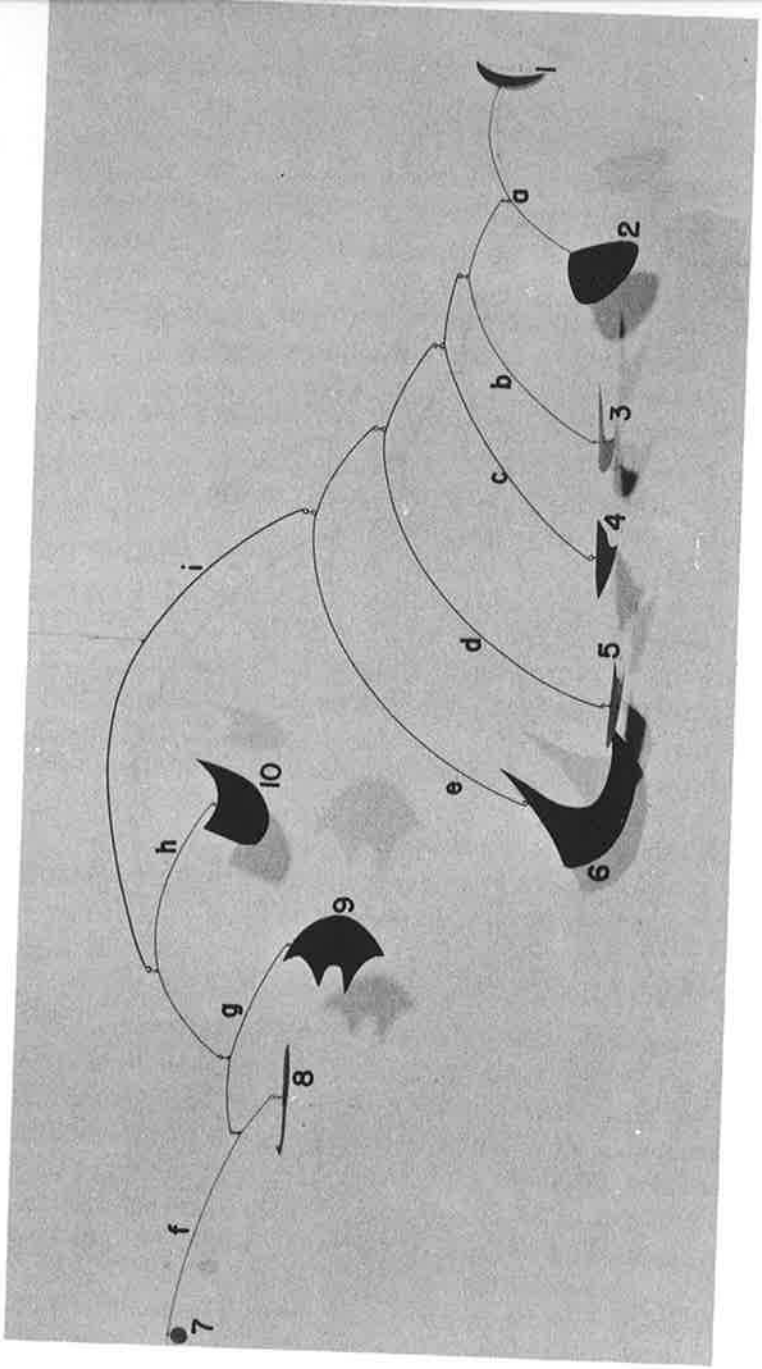
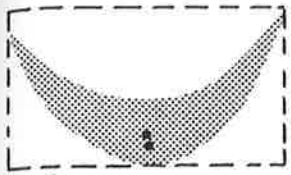
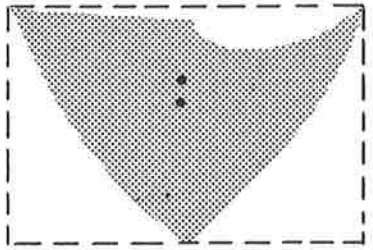


Fig. 18. The completed ten-piece metal mobile.

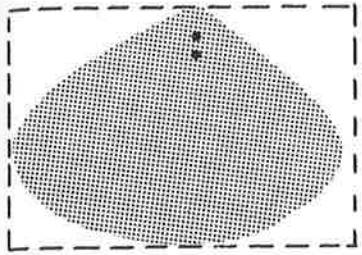
Chart 6



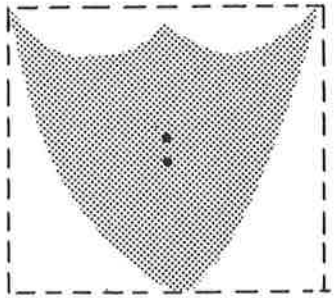
1 5¾ X 3¼



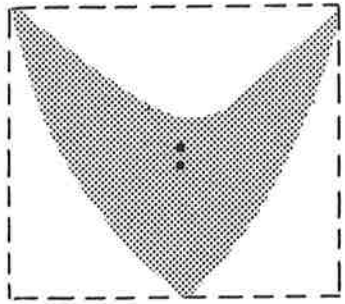
4 7¼ X 4¾



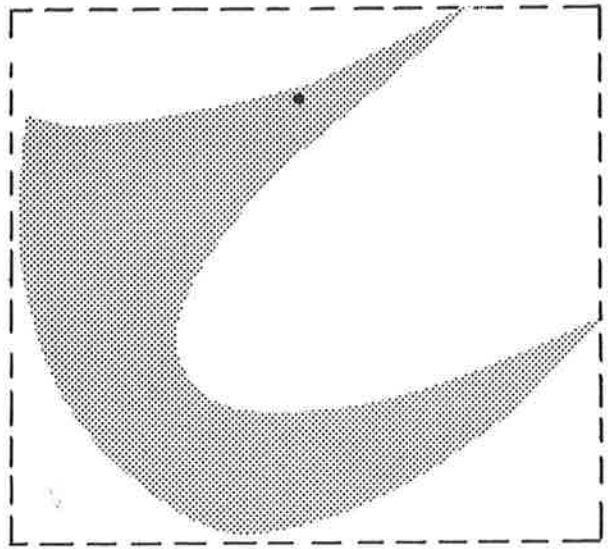
2 7¼ X 4¾



5 6½ X 6

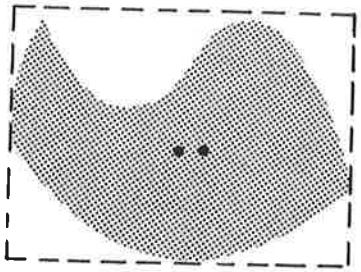


3 7 X 6

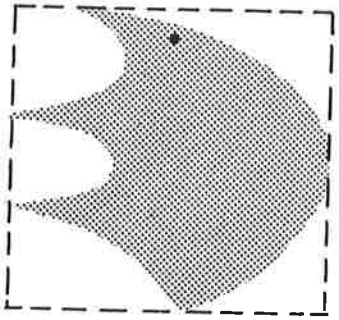


6 12½ X 11

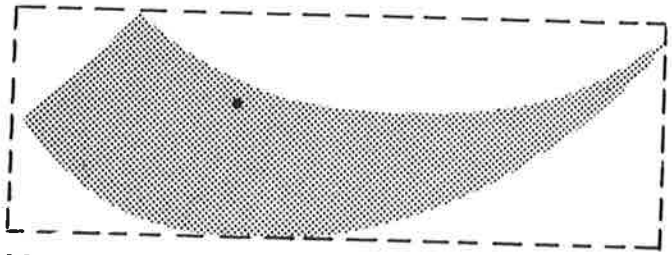
7 1¼ X 1¼



8 7 X 5



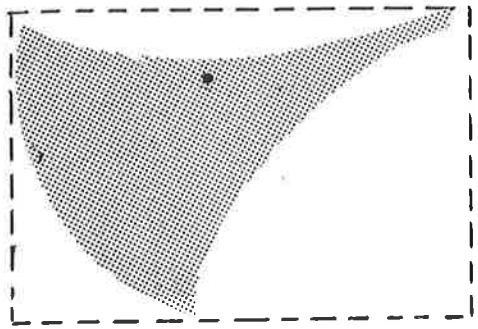
9 6½ X 6¼



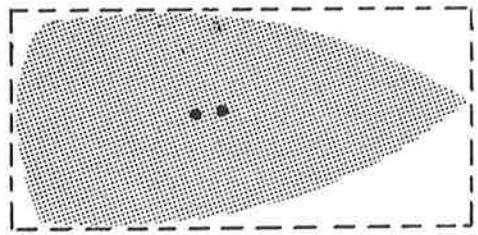
10 10¾ X 4½

ARMS

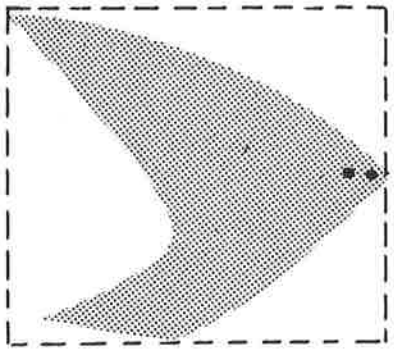
	Length		Gauge
a	25	inches	16
b	23	"	16
c	25½	"	14
d	34½	"	14
e	36½	"	14
f	20	"	18
g	14½	"	16
h	22½	"	16
i	39	"	12



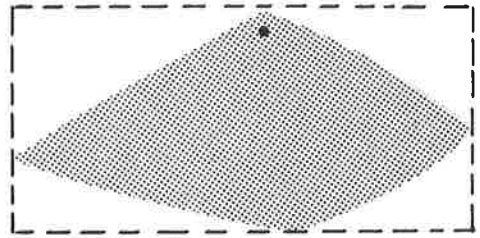
1 9¼ X 6¼



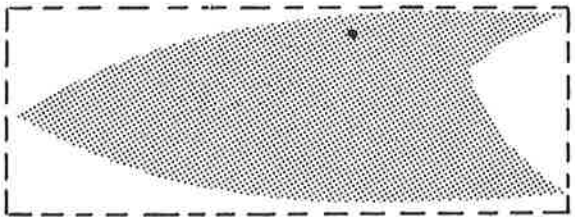
2 9½ X 4½



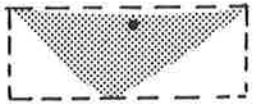
3 8 X 7



4 9½ X 4½

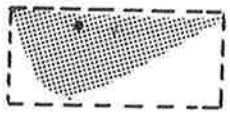


5 11¾ X 5¼

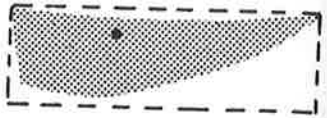


6 5 X 1¾

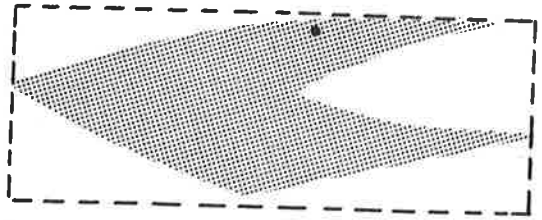
Chart 7 (Continued)



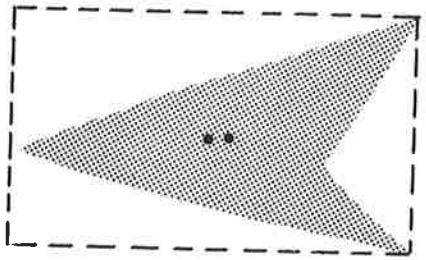
7 4½ X 2



8 6½ X 2



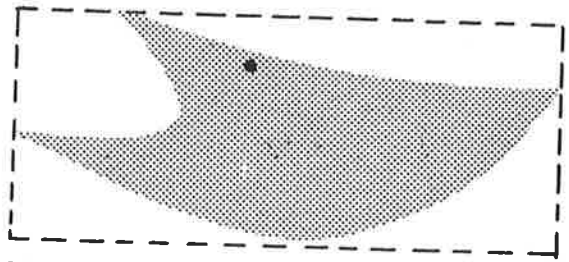
9 11 X 4



10 8½ X 5

ARMS

	Length		Gauge
a	14½	inches	16
b	19	"	16
c	25	"	16
d	34½	"	14
e	8	"	18
f	14	"	18
g	23½	"	16
h	31	"	16
i	37	"	14
j	39	"	12



11 11½ X 4¾

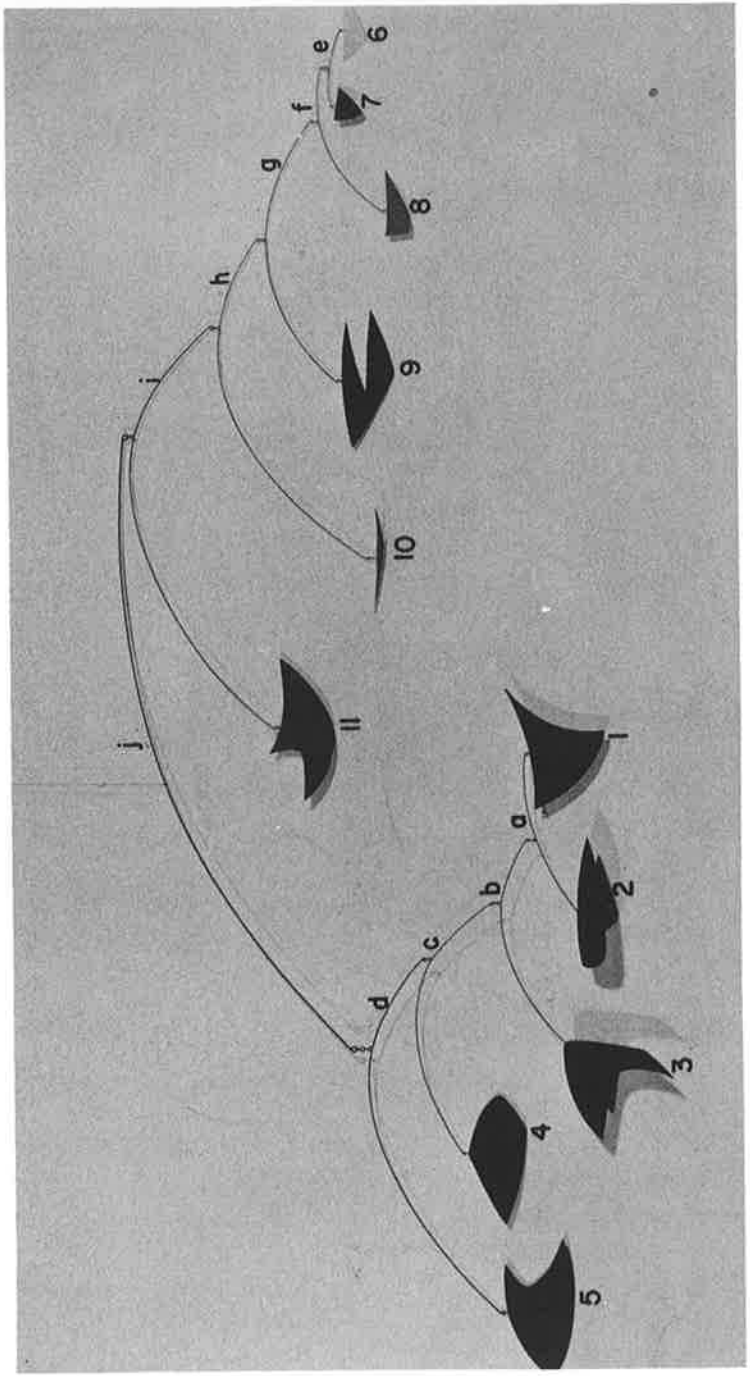


Fig. 19. The completed eleven-piece metal mobile (design No. 2).

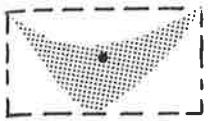
3. Make balance loop in arm *b* and attach to arm *c*.
4. Attach piece 4 to other end of arm *c*, make balance loop, and attach to arm *d*.
5. Attach piece 5 to other end of arm *d* and make balance loop.
6. Make a chain of three rings and attach to balance loop of arm *d*. Set this group aside.
7. Attach pieces 6 and 7 to each end of arm *e*.
8. Make balance loop in arm *e* and attach to one end of arm *f*.
9. Attach piece 8 to other end of arm *f*, make balance loop, and attach to arm *g*.
10. Attach piece 9 to other end of arm *g*, make balance loop, and attach to arm *h*.
11. Attach piece 10 horizontally on other end of arm *h*, make balance loop, and attach to arm *i*.
12. Piece 11 is attached to other end of arm *i*.
13. Make balance loop and attach arm *i* to arm *j*.
14. Attach arm *d* to other end of arm *j*.
15. Make balance loop in arm *j* or tie string at balance point to suspend.

ELEVEN-PIECE DESIGN NO. 3

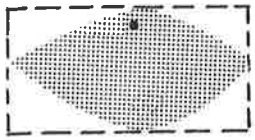
Cut all pieces according to the dimensions given in chart 8. Pieces 7 and 11 are attached horizontally. Find their balance points, make two hooks according to previous directions, and attach. Find balance points for the remaining nine pieces and make twenty rings of 18 gauge wire approximately ¼ inch in diameter. Follow the arrangement in figure 20 as you proceed with your assembly:

1. Attach pieces 1 and 2 to arm *a*.
2. Make balance loop in arm *a* and attach to arm *b*.
3. Attach piece 3 to other end of arm *b*, make balance loop in arm *b*, and attach to arm *c*.
4. Attach piece 4 to other end of arm *c*, make balance loop in arm *c*, and attach to arm *f*. Put this group aside.
5. Attach pieces 5 and 6 to each end of arm *d*, make balance loop in arm *d*, and attach to arm *e*.
6. Attach piece 7 horizontally to other end of arm *e*, make balance loop in arm *e*, and attach to arm *f*. Put this group aside.
7. Attach pieces 8 and 9 to arm *g*, make balance loop in arm *g*, and attach to arm *h*.

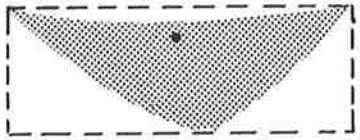
Chart 8



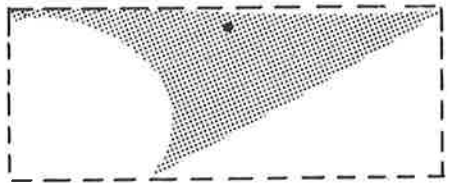
1 4 X 2



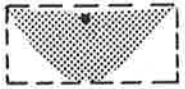
2 5 X 2½



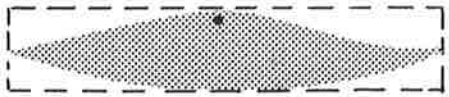
3 7 X 2½



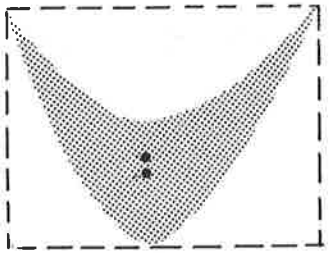
4 9 X 3½



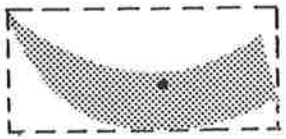
5 3½ X 1½



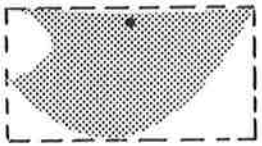
6 9 X 1½



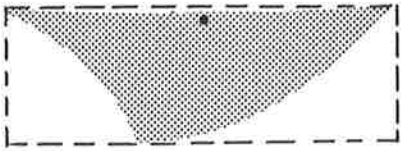
7 6½ X 5



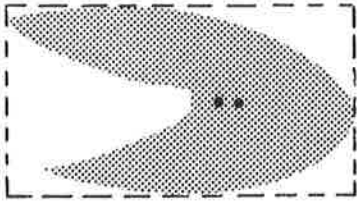
8 5 X 2½



9 5 X 2¾



10 8 X 2¾



11 7 X 4

ARMS

	Length		Gauge
a	9	inches	18
b	16½	"	18
c	24	"	18
d	13	"	18
e	21½	"	16
f	20	"	16
g	13½	"	18
h	20	"	18
i	24½	"	16
j	28	"	12

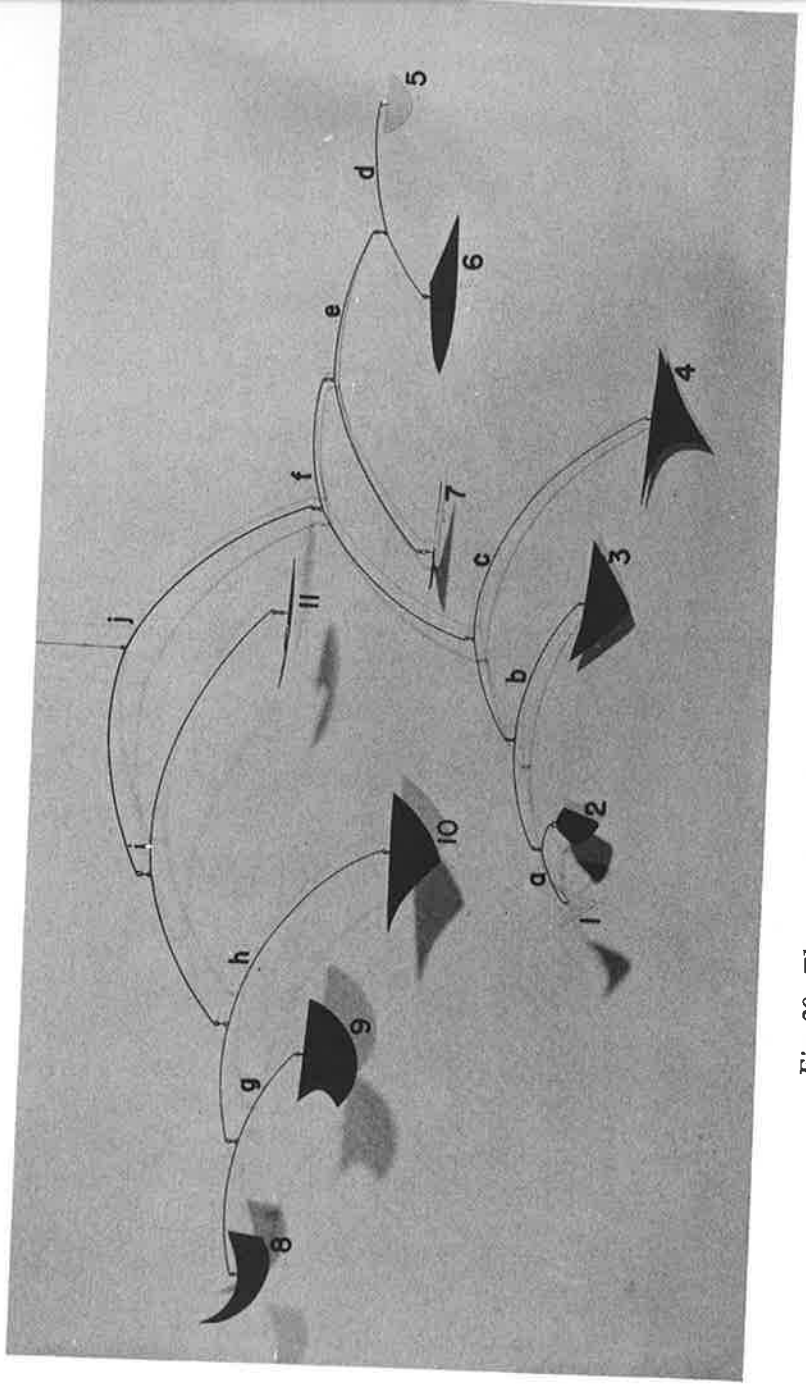


Fig. 20. The completed eleven-piece metal mobile (design No. 3).

8. Attach piece 10 to other end of arm *h*, make balance loop in arm *h*, and attach to arm *i*.

9. Attach piece 11 horizontally to other end of arm *i*, make balance loop in arm *i*, and attach to arm *j*.

10. Attach arm *f* to other end of arm *j*.

11. Make balance loop in arm *j* or suspend with string tied at balance point.

AN EIGHTEEN-PIECE METAL MOBILE

Cut all pieces and arms according to the dimensions given in chart 9. Make forty-two rings of 18 gauge wire approximately ¼ inch in diameter. Pieces 3, 5, 11, 15, and 18 are suspended horizontally in this design. See figure 21A. Find balance points on these horizontal pieces, make five hooks, and insert as explained in previous instructions. Next, find balance points for all other pieces and insert ring in each in the usual way. Refer to figure 21A, and proceed as follows:

1. Attach pieces 1 and 2 to each end of arm *a*, make balance loop on arm *a*, and attach to arm *b*.

2. Attach piece 3 to arm *b*, make balance loop, and attach to arm *c*.

3. Attach piece 4 to arm *c*, make balance loop, and attach to arm *d*.

4. Attach piece 5 to arm *d*, make balance loop, and attach with chain of three rings to arm *j*. Set this group aside.

5. Attach pieces 6 and 7 to each end of arm *e*, make balance loop, and attach to arm *f*.

6. Attach piece 8 to arm *f*, make balance loop, and attach to arm *g*.

7. Attach piece 9 to arm *g*, make balance loop, and attach to arm *h*.

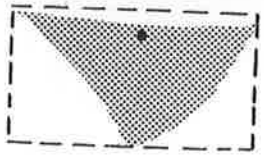
8. Attach piece 10 to arm *h*, make balance loop, and attach to arm *i*.

9. Attach piece 11 to arm *i*, make balance loop, and attach to other end of arm *j* with chain of three rings. Set this group aside.

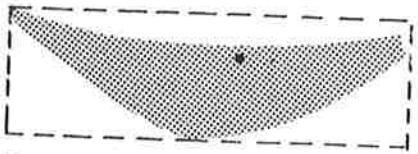
10. Attach pieces 12 and 13 to arm *k*, make balance loop, and attach to arm *l*.

11. Attach piece 14 to arm *l*, make balance loop, and attach to arm *m*.

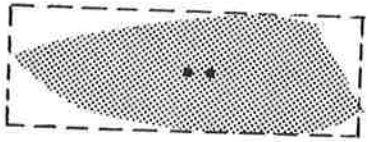
Chart 9



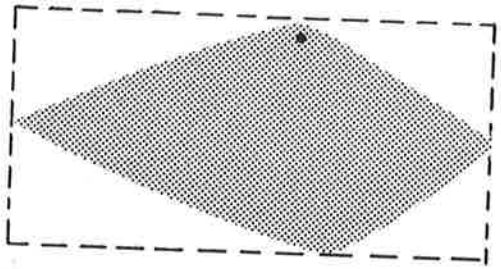
1 5 X 2¾



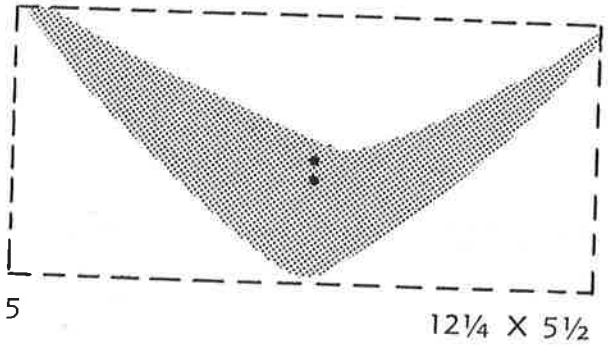
2 8¼ X 2½



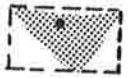
3 7¼ X 2½



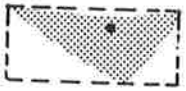
4 10 X 4¾



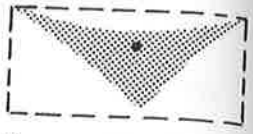
5 12¼ X 5½



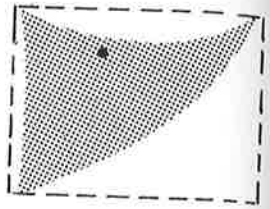
6 2¼ X 1¼



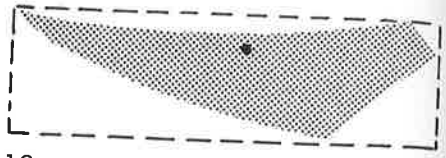
7 3½ X 1½



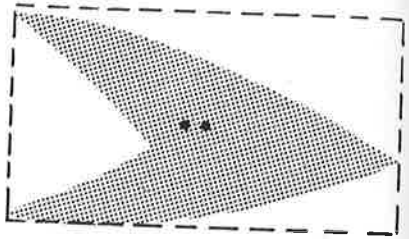
8 4¾ X 2¼



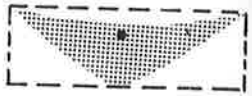
9 5 X 3¾



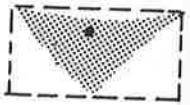
10 8¾ X 2½



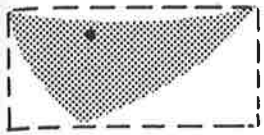
11 8 X 4½



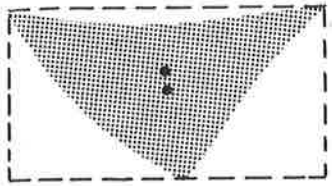
12 4¾ X 1½



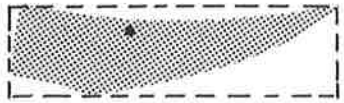
13 3½ X 1¾



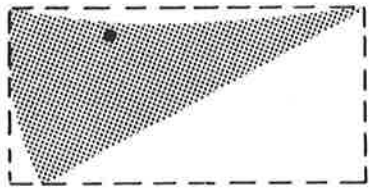
14 5 X 3¾



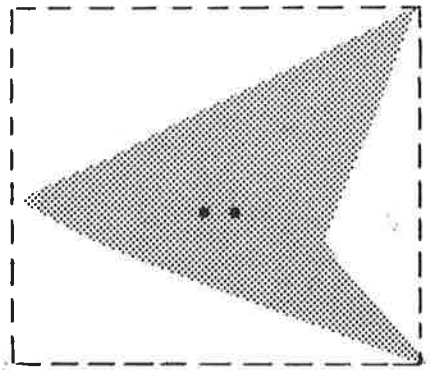
15 6½ X 3½



16 6¾ X 11¾



17 7¼ X 3½



18 8½ X 7½

ARMS

	Length		Gauge
a	13	inches	18
b	16½	"	18
c	22	"	16
d	25	"	16
e	6	"	18
f	8	"	18
g	13½	"	18
h	15¾	"	18
i	21½	"	16
j	27½	"	14
k	7½	"	18
l	12	"	18
m	16	"	18
n	20½	"	18
o	23½	"	16
p	30	"	16
q	44	"	12

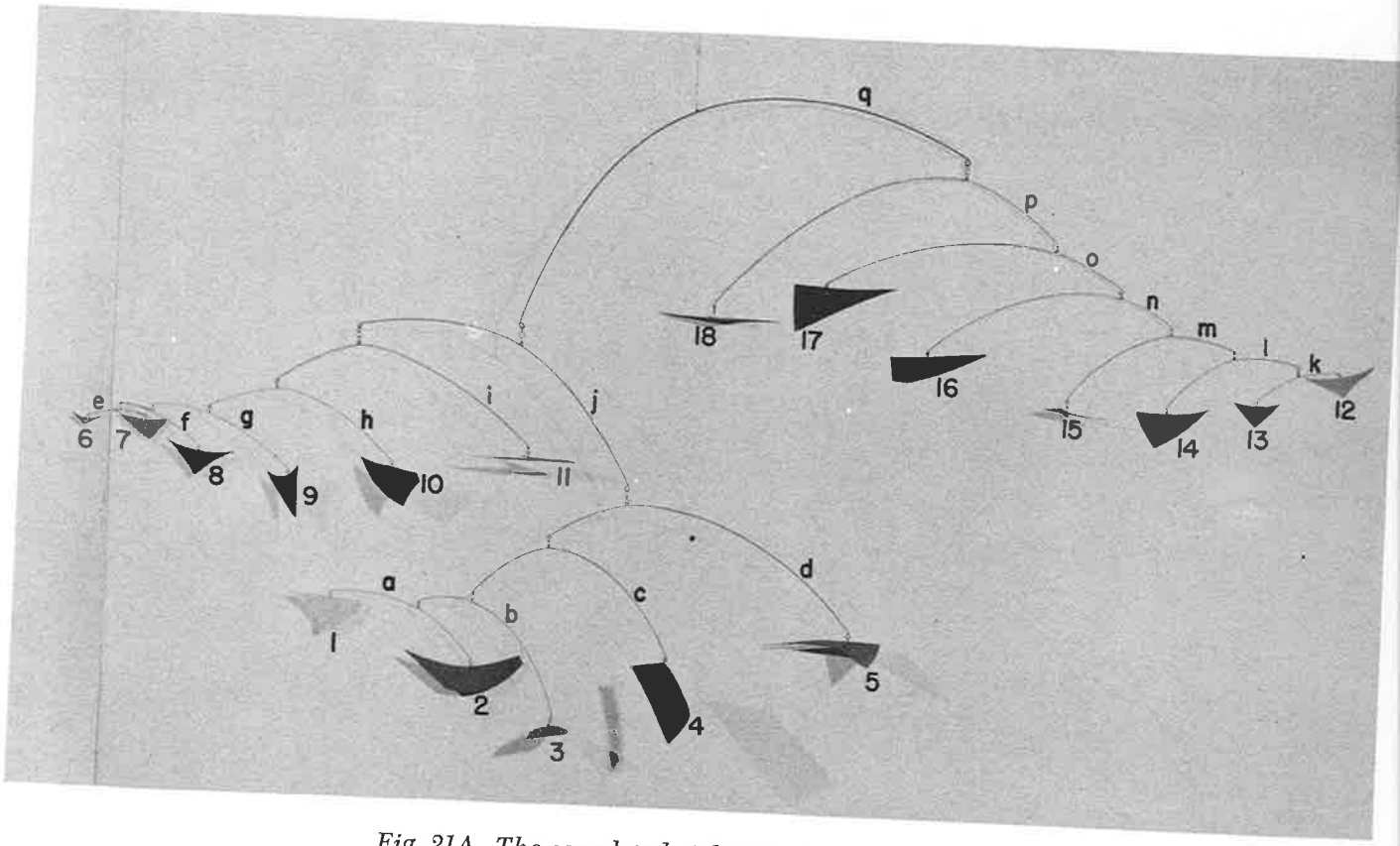


Fig. 21A. The completed eighteen-piece metal mobile.

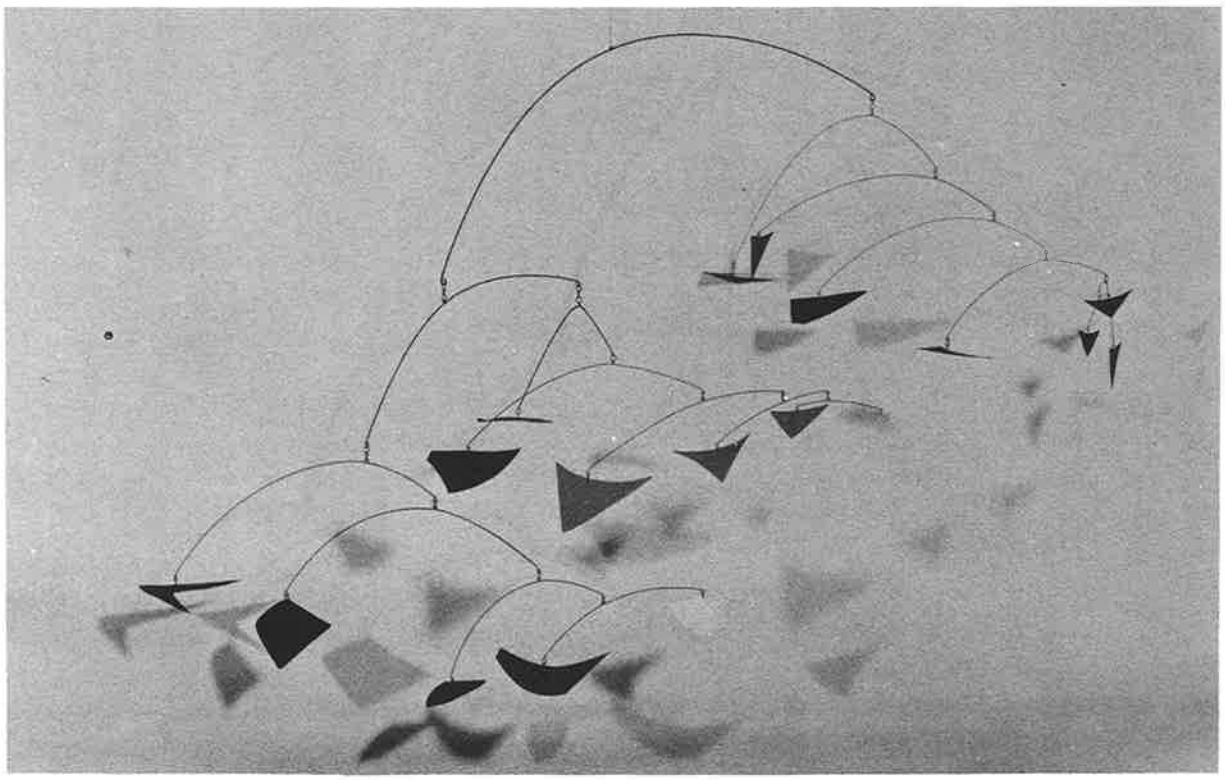


Fig. 21B. The eighteen-piece metal mobile in motion, showing how the composition at once changes.

12. Attach piece 15 to arm *m*, make balance loop, and attach to arm *n*.

13. Attach piece 16 to arm *n*, make balance loop, and attach to arm *o*.

14. Attach piece 17 to arm *o*, make balance loop, and attach to arm *p*.

15. Attach piece 18 to arm *p*, make balance loop, and attach with chain of three rings to arm *q*.

16. Make balance loop in arm *j* and attach with chain of three rings to other end of arm *q*.

17. Make balance loop in arm *q* or suspend with string tied at balance point.

8. FINISHES AND COLOR SCHEMES

When you are working with colored cardboard, the question of painting it may not occur. However, as suggested for the first example in the book, when you do paint cardboard the best type of paint for the purpose is poster color. This comes in small jars and is sold by art supply stores. Good substitutes are tempera, or casein, paints which are also mixed with water. Cardboard is absorbent and water-base paints will dry quickly and to an even flat or mat finish. However, it is advisable not to try to paint a light color over a dark board, for the dark will show through. The difficulty may be overcome by covering with several coats of light paint, but this is an unnecessarily tedious process.

When using water-mixed paints, avoid making the mixture too watery or too thin. Try to get enough paint on the brush to cover the entire surface with a few smooth, light strokes without runs or drips. A second coat can be applied if necessary after the first one has thoroughly dried. Nothing but water is needed as a medium for thinning the paints and cleaning the brushes. If the paints dry out in the jars through lack of use, they can be restored with a little warm water. Also use warm water to open jars with stuck covers and to soften hard brushes. The latter should not be necessary if the brush is properly cleaned after the last operation.

If you want to paint the wire arms of a cardboard mobile, poster-color paint is not the best choice. Although by repeated application the poster color may be made to cover the wire, it is better to use oil paint for this part of the mobile.

OIL PAINTS

Metal or wood mobiles can be painted either in a flat, mat finish or with a gloss paint. For the latter finish, use enamel or buy lacquer in a can with a spray gun on top and spray the paint

on without the use of a brush. Personally, I prefer the flat finish. Oil-base paints can be obtained in hardware stores in a wide range of colors and in half-pint cans—the most economical way to buy it when you are painting only one or two mobiles. The paints are ready mixed and usually no extra thinning is necessary; however, turpentine will do this job if you find the paint too thick for easy application.

For painting metal with flat paints, a brush is especially important. It should be a soft, thin, square-tipped camel's hair brush about an inch wide. Apply the paint quickly to each of the surfaces and brush over each piece several times until the paint is evenly distributed. If runs occur, it means you are either using too much paint on the brush or have mixed too much turpentine with it.

Oil paint can, of course, be used over the wire when this is to be colored, and it is recommended for this purpose, the wires of the cardboard mobiles being no exception.

WHEN TO PAINT

While the separate pieces of a mobile can be painted before assembling, it is usually best to do the painting job after the mobile is constructed. First of all, you may decide to add to the mobile and would then have to go back and match the paint used in the original pieces. Also, paint would rub or crack off the wires if these were painted before being shaped. By turning the mobile and painting as it hangs in place, you can also make sure that no small areas are left uncovered. There is the additional advantage that the hanging mobile is in the best possible place for drying—without danger of any wet pieces touching each other, or anything else. It is a simple matter to cover the floor with newspaper to protect it should any drips occur.

COLOR SCHEMES

A mobile always looks well when all the pieces are painted black. If you are in a more experimental mood, there are, of course, many possible combinations of color. These, at least to some extent, should be dictated by the position the mobile is to occupy in a room and by what will look best in the setting.

Satisfactory color contrasts can be made by painting all pieces black with the exception of one or two, which can be white or

any one of the primary colors—red, yellow, or blue. Each piece should be painted the same color on each side. On mobiles with a lot of pieces, the proportion with other colors can increase. Variations in color can also be achieved by painting all pieces in one color and the arms in another. You might then have black, olive green, or red pieces with white arms; red pieces with black or green arms; or any other such combination.

In choosing which pieces to paint in a contrasting color, consider the question of balance. In other words, you would not paint two neighboring pieces in the same color, leaving the rest black. Nor would you paint one piece at either extremity of the mobile in a color, leaving the pieces in between black, as it would spoil the effect of the outline or rhythm of the design. Nearly all mobiles have an asymmetrical balance, and it would therefore be wrong to try to work out a symmetrically balanced color scheme on asymmetrically balanced forms. In the first mobile suggestions were made for introducing extra colors which may help to demonstrate this principle. It is a good idea to make a quick sketch of your mobile (if you haven't already done so in planning your shapes) and work out your color scheme on paper before painting the mobile. However, when using oil paint on metal mobiles, you can always paint over a piece if, after having lived with the mobile for a few days, you feel that you have made a mistake in the color arrangement.

Avoid introducing too many colors into a mobile design, as this breaks the rhythm and makes the composition spotty. One exception to this rule may be found in a case where the design calls for one very large piece balanced by several small pieces. Here it may be in order to paint the large piece in one color, such as black, and the smaller pieces in several different colors. The large piece will very often give the necessary weight or balance to the design.

For some reason pastel colors never look well on mobiles, unless only one piece is painted in such a color for a definite reason—such as to tie in with the color scheme of a specific location—and the rest of the pieces are black. Besides black, the safest colors to work with in the design of any mobile are strong reds, blues, white, olive green, and yellow ocher. On metal mobiles contrasts can also be obtained by occasionally using the natural color of the tin or copper. When using other materials, such as wood, the natural color of the wood can also be utilized on some pieces,

the rest being painted black. A mobile with carved wooden pieces is shown in figure 27.

Sometimes an interesting color scheme can be worked out by painting the pieces of mobile in a series of shades of one color, such as dark green to light yellow, or dark red to light yellow-red, starting with the dark color at one corner and ending with the lightest color at the opposite end. This has the effect of increasing the space between the various pieces. Black, gray, and white can be used in the same way.

A mobile in which all pieces are black may have one piece toward the outer extremity painted white on one side and red on the other. Or all pieces could be painted black on one side and red, white, gray, or yellow on the other.

Although there are any number of color schemes possible, it should always be remembered that colors must be subordinate to the design. They should complement, finish, or accent the design rather than compete with it.

9. MOBILES WITH GLASS AND OTHER MATERIALS

Besides the metal mobiles that have been shown in more or less traditional designs—if we can use that term in relation to such a comparatively new art—there are many other design possibilities using other materials.

GLASS AND WIRE MOBILES

Taking the outline of a fish as our motif (it could also be a plain oval or circle), a quite different type of mobile can be constructed, as shown in figures 22 to 26.

In the first example, figure 22, which measures 18 inches long by 8 inches deep and with a thirty-inch arm, the following materials were used:

- 11½ gauge aluminum wire for the fish outline and arm.
- 26 gauge wire for suspending the glass.
- 8 pieces of colored glass cut in diamond shapes with a glass cutter. (Plain glass, though not so colorful, could also be used.

It is a comparatively easy matter to shape the heavier gauge wire into the oval fish design. Handle the wire from the coil in the same manner as described for the first mobile project in this book. The wire shaping can be done entirely by hand, molding it into curving lines with the thumb and fingers. Bend the wire around, making a kink for the fish's mouth and connect the joint of the wire at the back of the fish with a strip of tin cut approximately 1/16 inch wide. Wrap this strip both vertically and horizontally, then fold the horizontal and vertical ends back and forth on themselves until secure, ending horizontally. Now cut the wire, allowing for the two ends to spread out in a suggestion of a tail. See illustration.

The glass attachments may pose rather a greater problem unless

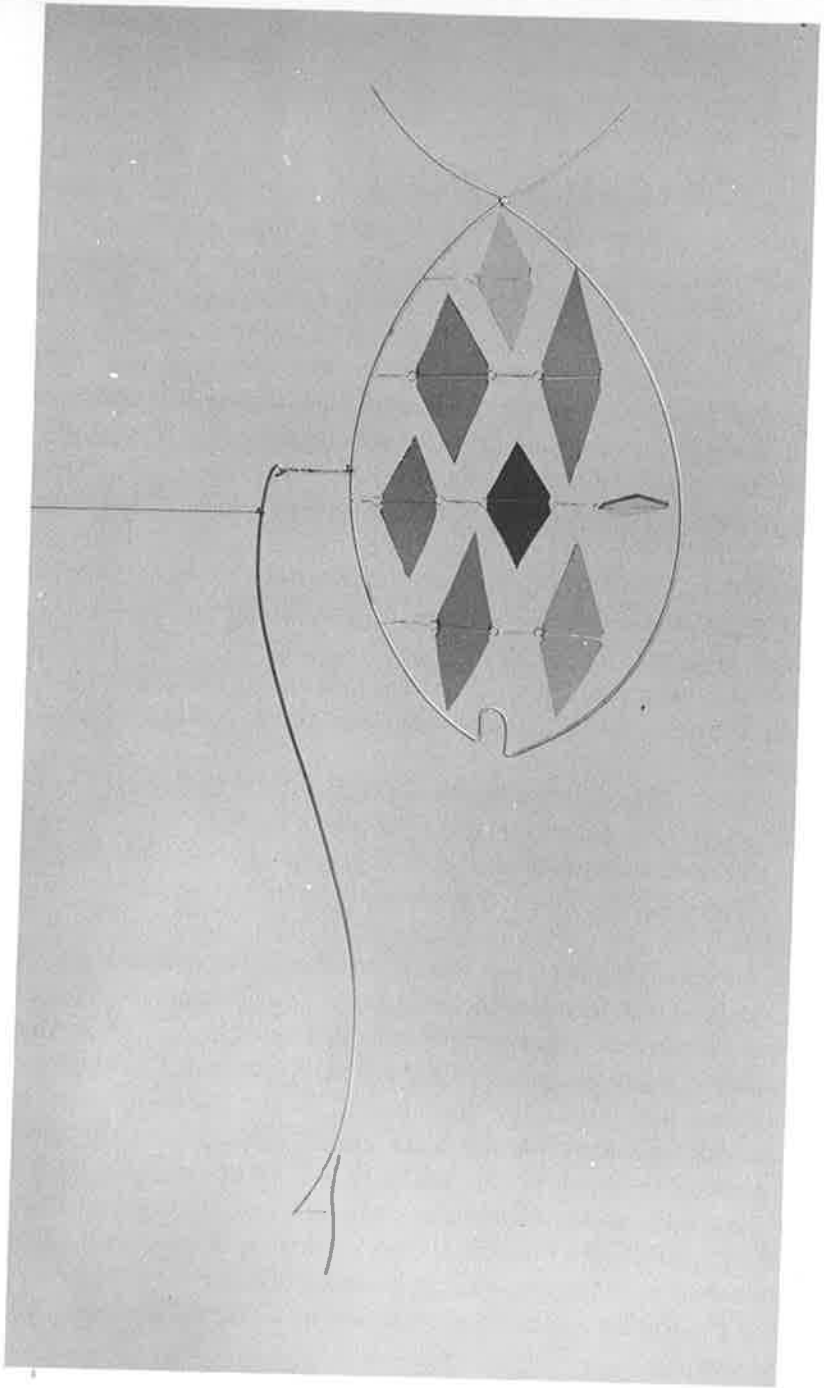


Fig. 22. Fish design No. 1, using colored glass cut into diamond shapes.

you use plain glass, for it is not easy to find a wide assortment of colored glass if you live in the country. Try the local builders' supply company, hardware store, or comb antique shops for odd pieces of broken glass or inexpensive pieces that can be cut up, such as old colored-glass panels so popular in Victorian homes. Junk shops may also yield sheets or fragments of colored glass. The local glaziers may be in a position to supply you with what you want, or at least advise you where it can be obtained. In addition, look in the classified directory under stained glass.

Once you have your glass, it can be cut with a glass cutter into the eight diamond-shaped pieces shown in this design. If you are not adept at glass cutting, the hardware store may be obliging if you ask for help when there are no other customers around. It is, however, quite easy to cut glass as long as your cutter is sharp, the glass not too thick, and you lay the glass on a flat surface. The shapes in this and the other fish designs are purposely cut crudely. No great precision is necessary.

With the glass shapes cut, make a concave nick with the cutter at the top and bottom points of the diamonds so that the wire which will hold them, as shown in the illustration, will not slip.

To attach the glass shapes, use 26 (or 28) gauge wire. Wind the wire around each shape so it holds in the nicks you made and incorporate at the same time a small ring above and below as shown in the illustration. Following the pattern in the illustration, connect the glass units with other pieces of the same or slightly heavier gauge wire and suspend from the top wire arc of the fish. Make nicks in the top wire at intervals where the glass pieces are to hang and bind the suspending wires tightly around at this point so the glass pieces do not slip to one side or the other.

Having completed the fish unit, shape the wire balance arm above the fish and make a loop at one end. Next tie a small piece of curved wire to the other end of the arm with a thin thread. Now tie a small hook made of 18 gauge wire to a heavy thread and attach the hook to the fish unit at its balance point. Leave about 1 inch of thread and attach the fish unit to the hook on the end of the balance arm.

To hang the mobile, tie a piece of string around the balance arm and slide it along until you find the balance point, then tighten it and suspend the entire unit.

The effect of this mobile is most pleasing. The fish and the glass

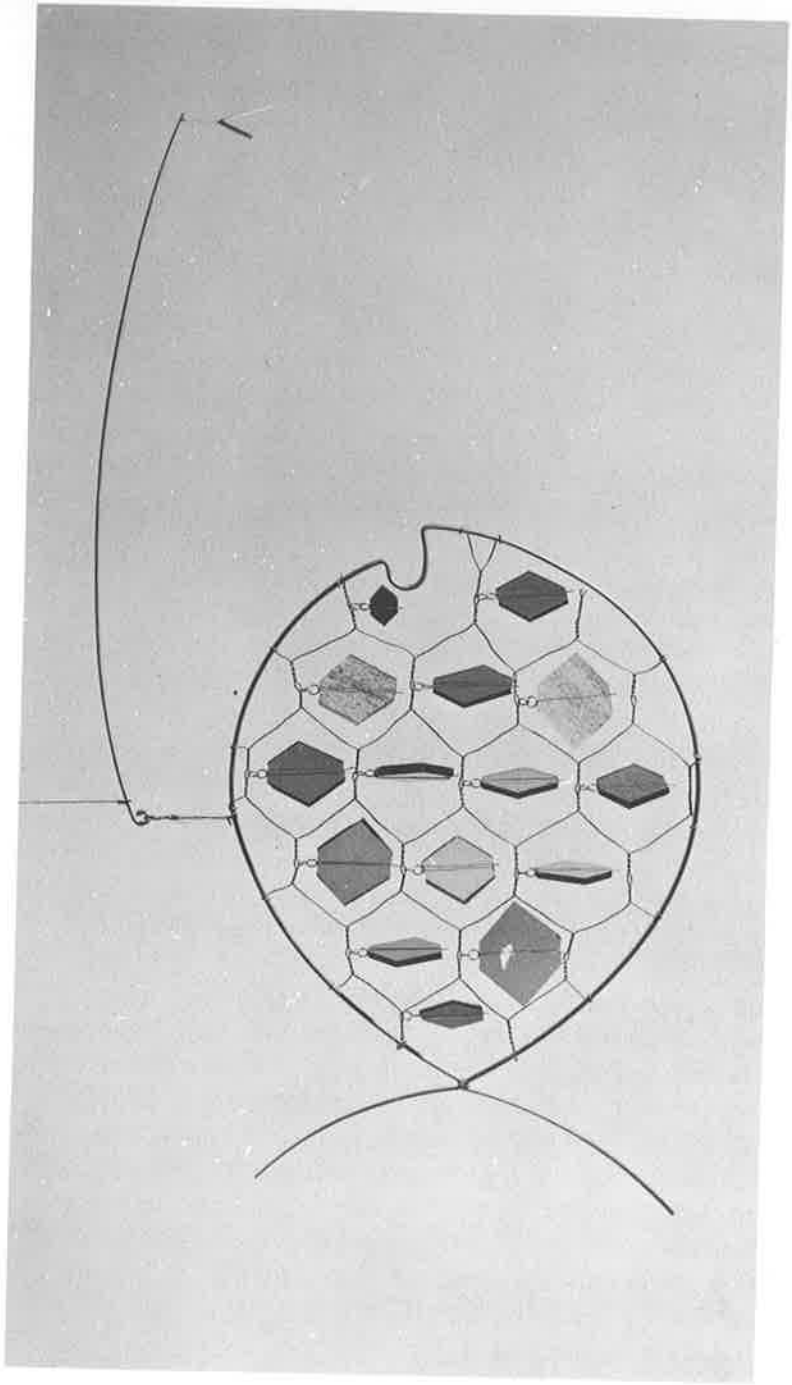


Fig. 23. Fish design No. 2. The outline of the fish is filled in with chicken wire from which colored-glass shapes are suspended.

units within it will move freely and independently and so will the balance arm at the top.

In the illustration the pieces of glass are in eight shades of red. The design could be varied by using any other series of colors that might more readily be available, or by using all one color. If you are able to obtain only plain glass but want to use colors, the glass can be painted, using paints specially prepared for this type of surface.

The designs in figures 23 to 26 are variations on the same theme and can be constructed in similar manner. Note the pieces of glass which represent eyes in figures 23 and 26. Also in figure 23 a piece of chicken wire has been cut to the shape of the fish and the loose ends wrapped around the frame so it holds securely. The pieces of glass are suspended from two small rings so that they will move freely in the openings of the chicken wire.

In figure 25, wire hoops are fastened by rings to the wire outline of the fish, and in the same gauge wire. The pieces of glass hang in the middle. This gives another dimension to the fish as it turns.

Other forms besides fish can be worked up into similar type mobiles, and pieces of metal could be used in place of the glass and painted in colors. The object of using glass, of course, is to allow the light to shine through. Plastic will give a similar effect. Use a plastic which is thick enough to hold its shape. In this case small holes can be punched for attaching the pieces in much the same manner as with metal or wood.

MOBILES WITH PAPER, WOOD, AND OTHER MATERIALS

If you have followed through the examples given so far, you should be ready to tackle almost any kind of mobile. There seems to be little point in repeating step-by-step instructions because all mobiles follow the same principles of design and balance, though the forms and materials used in each may differ greatly.

The beautiful design using fish forms carved from wood and suspended in balance in figure 27 also shows how attractive mobiles can look in a modern room setting. The designer cleverly uses the natural grain of the wood for some of the fishes while painting the others for contrast. Naturally to carve figures like these requires considerable skill.

A very different type of design with pieces carved from natural

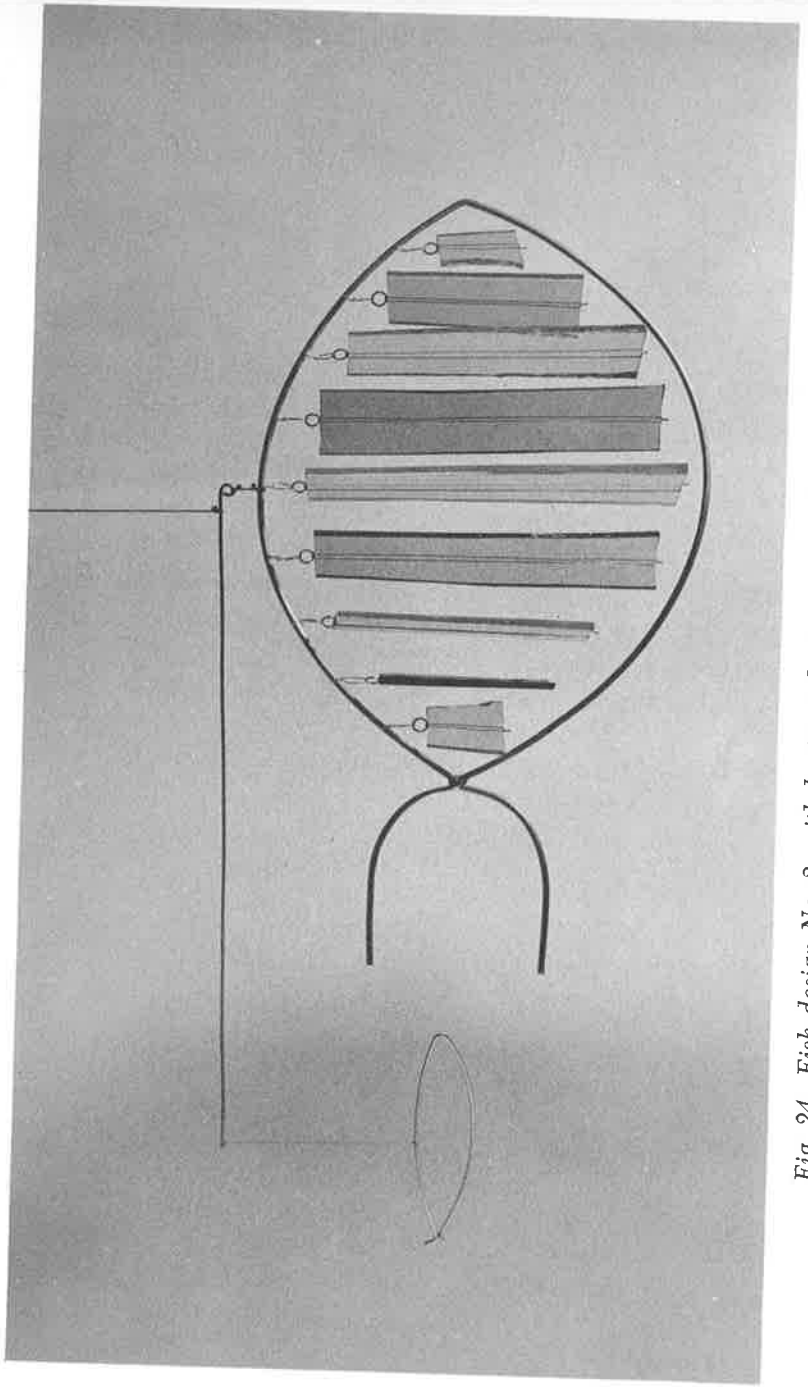


Fig. 24. Fish design No. 3, with horizontal colored-glass shapes suspended from loops. Note small outline of fish at other end of balance arm.

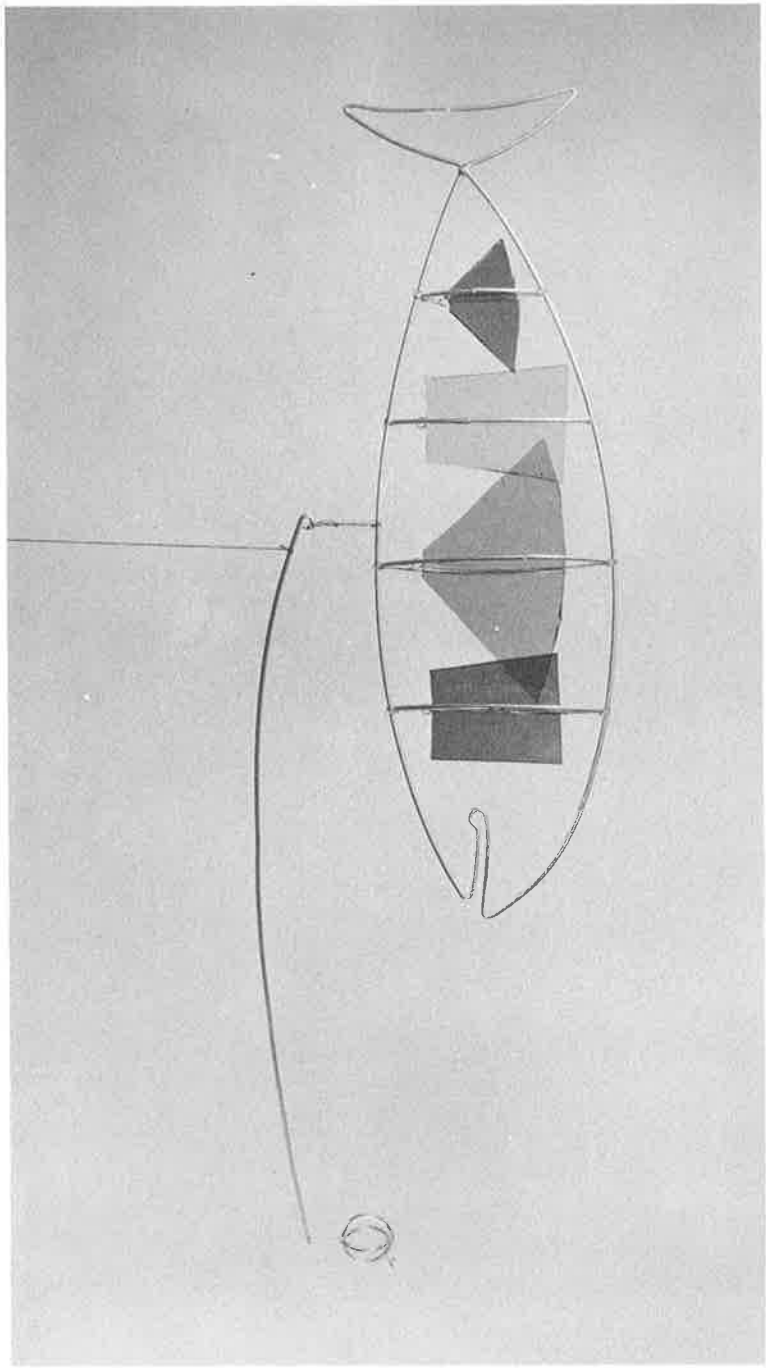


Fig. 25. Fish design No. 4, using odd-shaped pieces of glass and four loops of wire hooked at right angles to the outline of the fish.

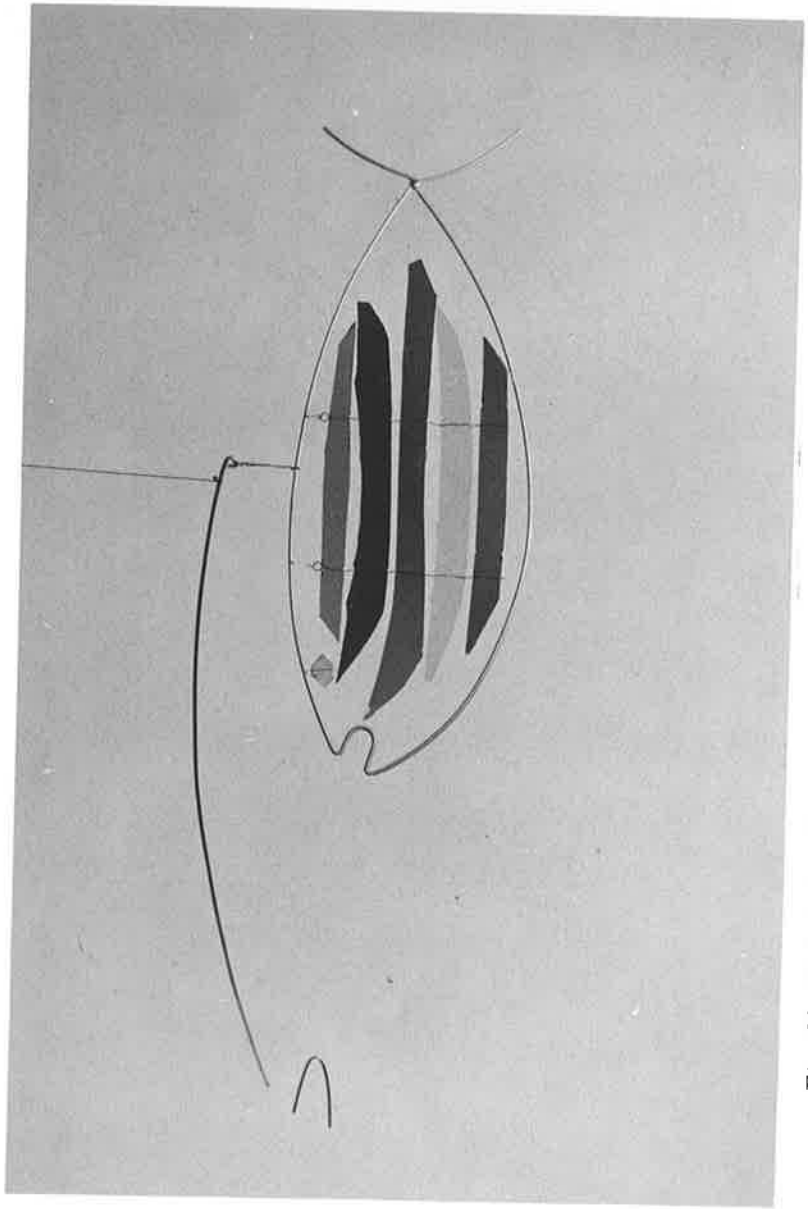


Fig. 26. Fish design No. 5. Several rough-cut pieces of glass are suspended to suggest stripes. Note small piece representing an eye.

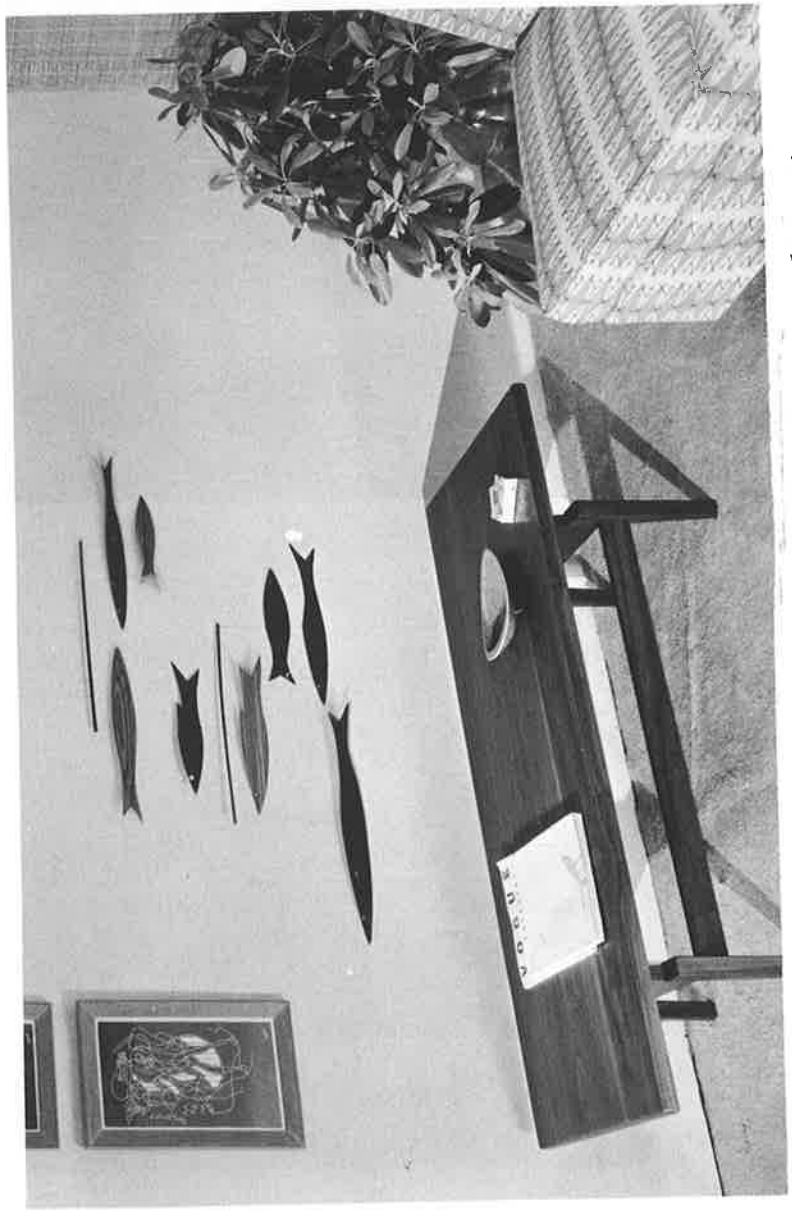


Fig. 27. Carved wood fishes by Clark Voorhees are hung in a modern setting. (Courtesy Jens Risom Design, Inc.)

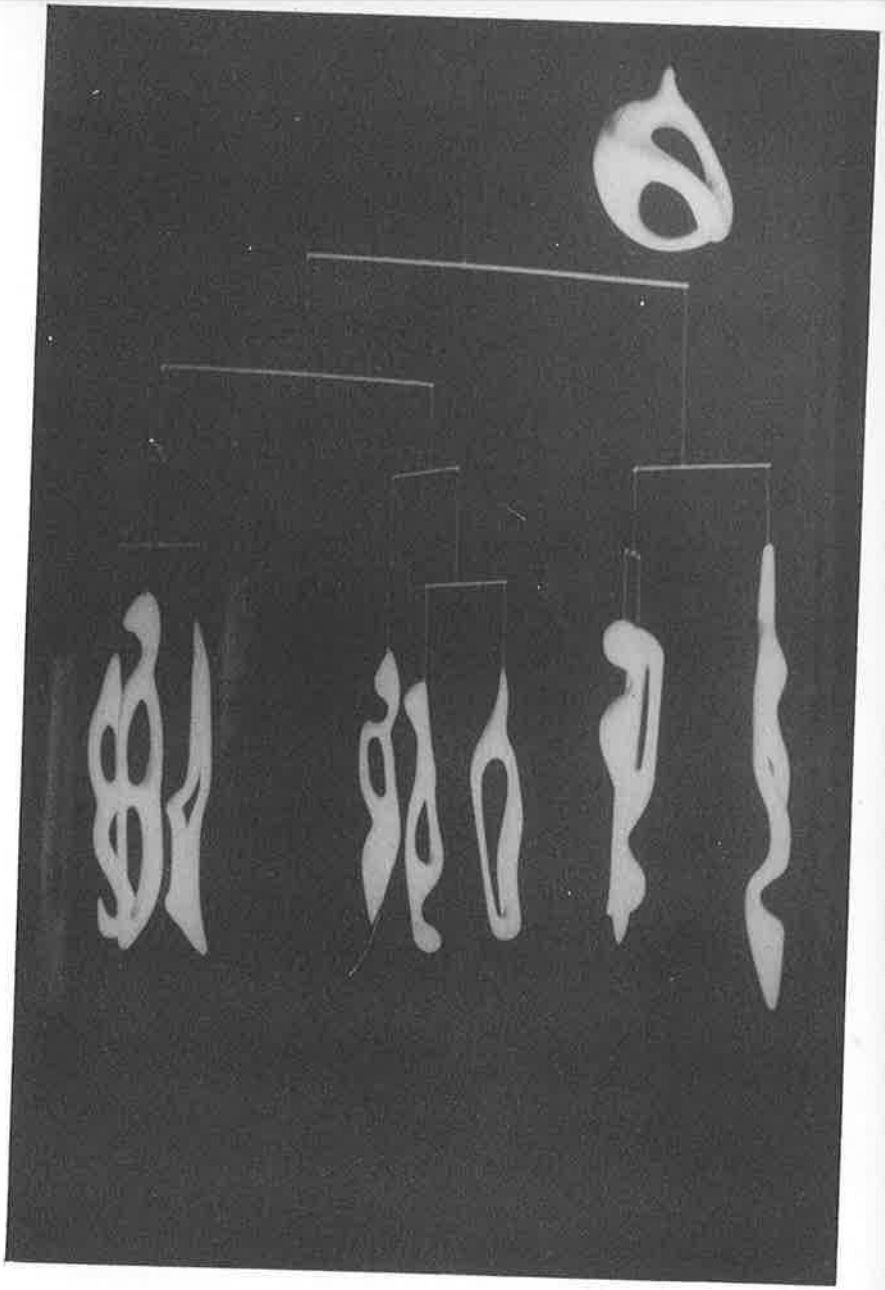


Fig. 28. A mobile with abstract forms cut from natural balsa wood. The artist, Marechal Brown, calls it "Four Dancers Under the Moon."

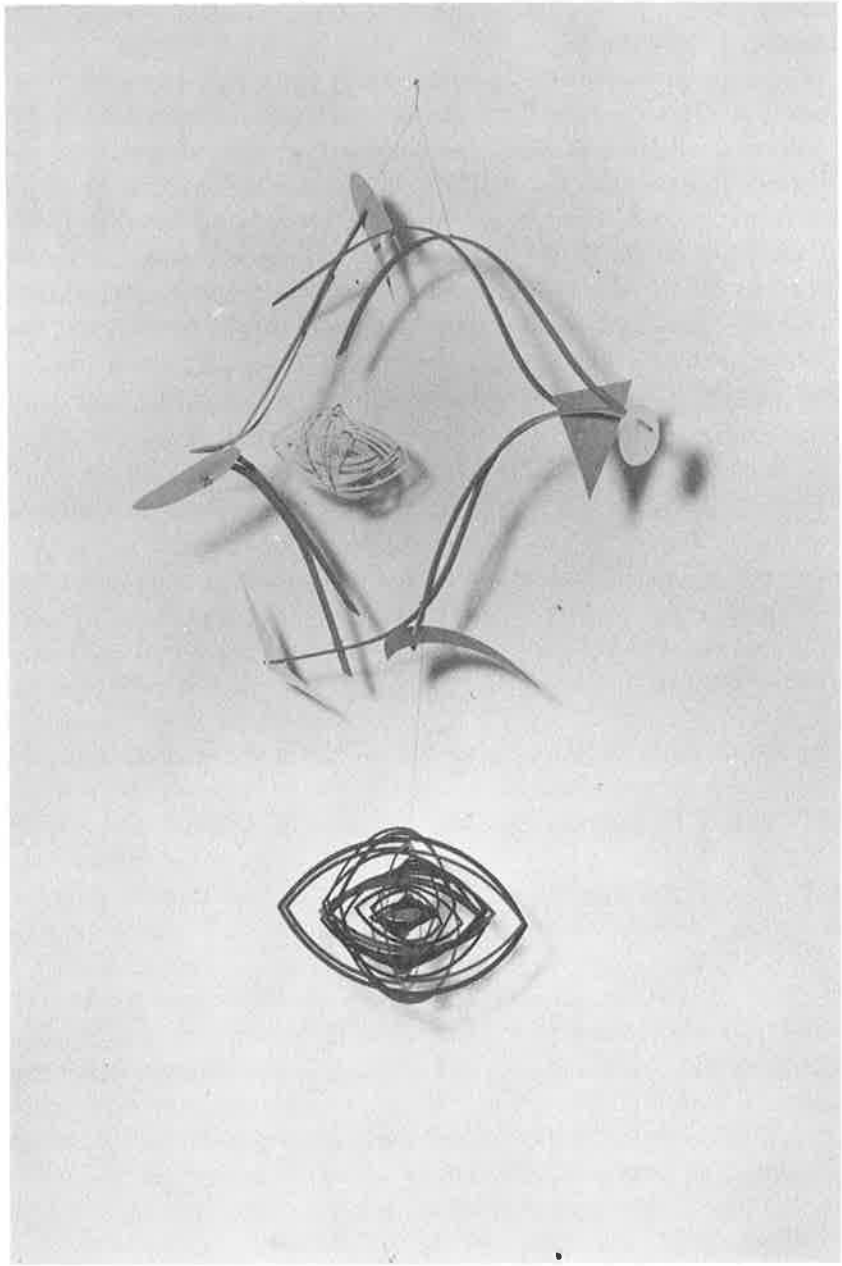


Fig. 29. Mobile made with paper forms by Joseph Zalewski.

balsa wood is shown in figure 28. The artist calls this design "Four Dancers Under the Moon."

Paper is another material which lends itself well to mobile construction. The example shown in figure 29 utilizes different colored cardboard which has been cut into strips, then shaped into an abstract framework. Contrasting shapes are cut in flat pieces of heavy paper and attached by thread or pieced and fitted together at strategic points in the composition. Balance points are established in the usual way and the pieces strung together with thread or wire. Variations of this type of design would be amusing for Christmas decorations, using a variety of colored or metallic papers and possibly Christmas tree balls.

10. IDEAS FOR CREATING MOBILES OF YOUR OWN

When we are looking for ideas for mobile designs, there are many shapes that can inspire us. The Old World windmill in figure 30 is a typical example, with the light wind-catching forms on the arms. Shapes such as these make a natural choice for mobile sculpture.

Quite a different source of inspiration can be found in abstract paintings, such as the one shown in figure 31 by Richard Pousette-Dart: The design provides interesting shapes easily adaptable to a mobile. Museums and exhibitions showing modern art and even certain primitive designs are well worth further inspection with the same object in view.

Any shape used in a mobile, whether borrowed from an abstract painting or the outline of a Greek vase, should be simple, rhythmical, and flowing, or else interestingly geometric, rather than naturalistic in form.

While a painting or a piece of sculpture might not literally suggest a mobile to us, some of the forms are interesting enough to inspire a design.

I do not suggest that a mobile artist should necessarily look for specific shapes in paintings, sculptures, or decorative objects. However, it is always useful to study the relationships of form, space, color, and movement in any modern work of art, where a certain consistent mood or feeling can often suggest ideas.

For example, the piece of unfinished sculpture in figure 32, which the artist, Mary Callery, calls "Acrobats with Birds," shows sculptural effects which might find their place in a mobile designed with other materials. The light, sinuous forms and the open ribbonlike quality of the sculpture suggest movement and a delicate balance nicely in keeping with its title.

The metal construction "Spiral Nebulae" in figure 33 composed

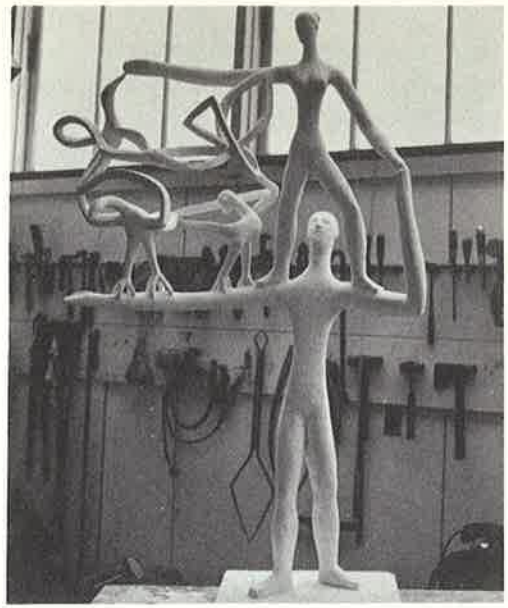
Fig. 30. The wind-catching arms of this windmill suggest forms that can be used in mobiles.

Fig. 31. An abstract painting entitled "XXI," by Richard Pousette-Dart, which also immediately suggests shapes that could be used with little change in a mobile.

(Betty Parsons Gallery)

Fig. 32. "Acrobats with Birds" by Mary Callery. This light and airy treatment relates closely to certain structural elements of a mobile.

(Curt Valentin Gallery)



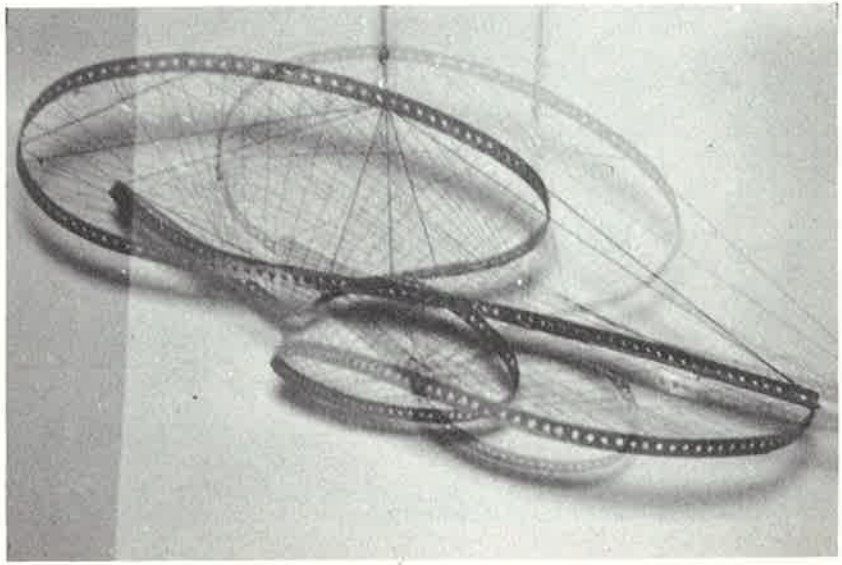
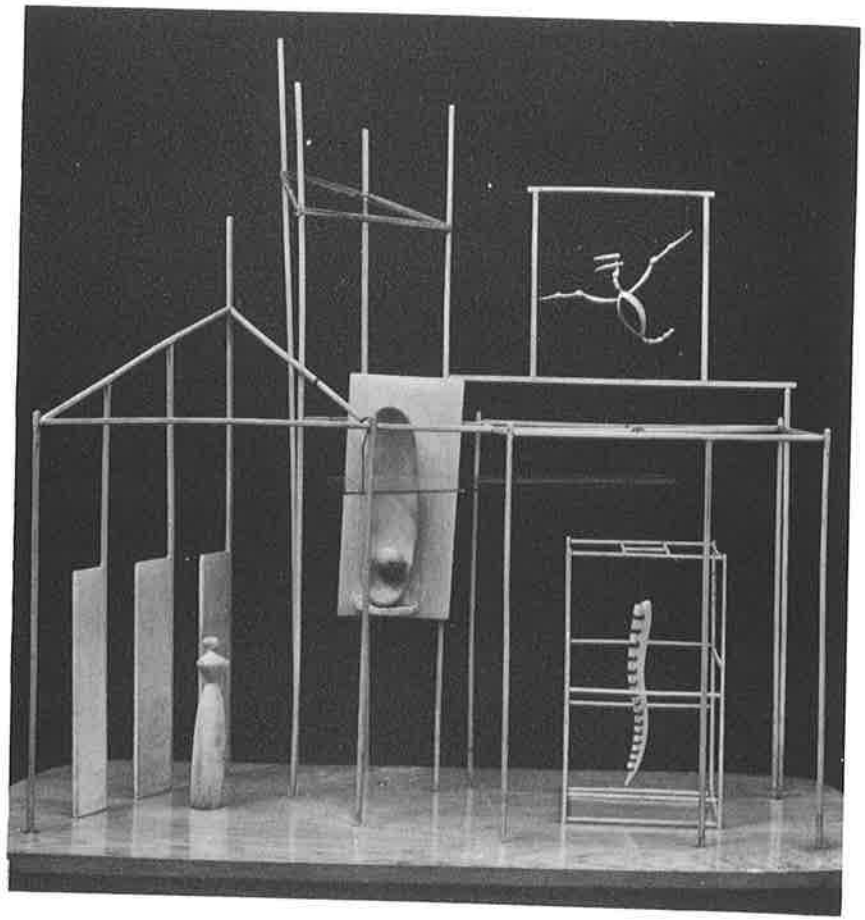


Fig. 33. "Spiral Nebulae," by Toni Hughes, made with iron banding and plastic cord.

of soft metal banding (called plumber's tape) and plastic cord hangs as a mobile construction in the stairwell of a private home. Again, figure 35 furnishes another interesting shape outlined in a wide ribbon of plastic. These and the other examples illustrated on these pages may provide a springboard for designs of your own. The illustrations from figure 36 on page 84 are again mobiles using different design forms that may provide more definite suggestions for future experiments by the reader.



(Museum of Modern Art)

Fig. 34. Flowing mobile forms are in sharp contrast to the rigid lines of this construction of wood, glass, wire, and string which the artist, Alberto Giacometti, calls "The Palace at 4 A.M."

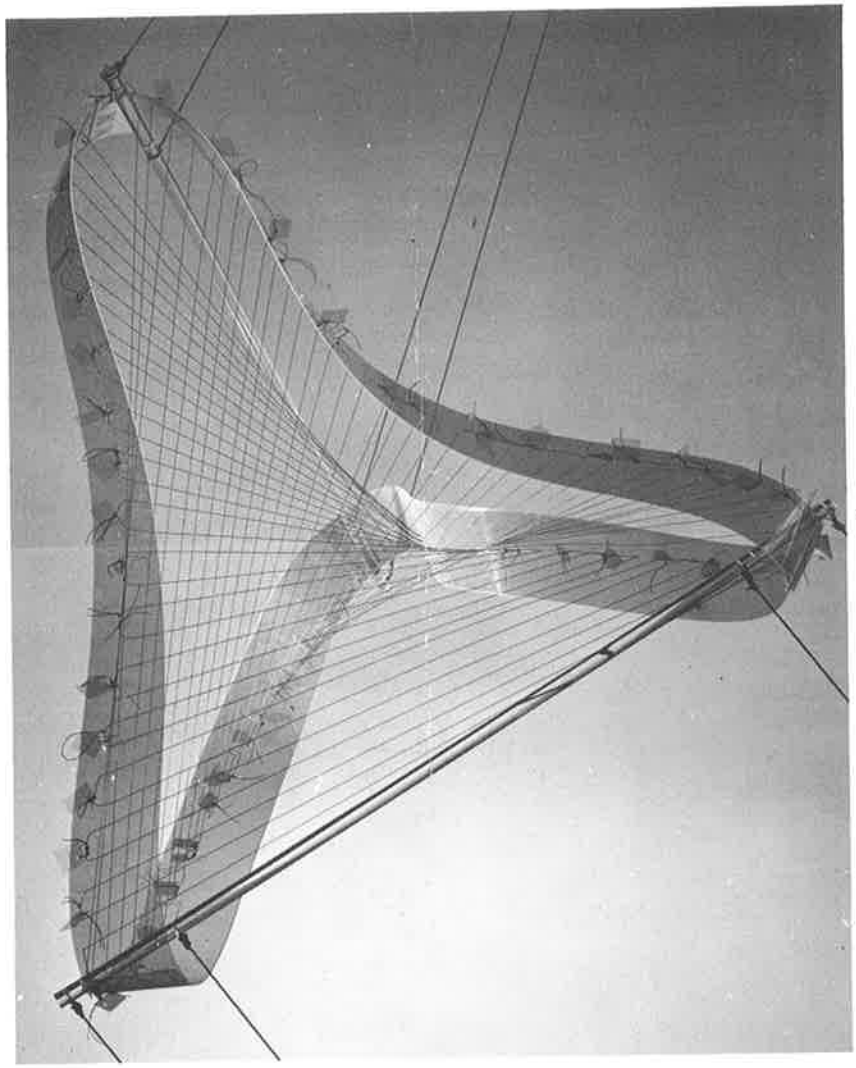


Fig. 35. Plastic cord, strips, and rods strung together by Toni Hughes in intricate balance.

(Museum of Modern Art)

Fig. 36. Paper, cardboard, and string mobile by Joseph Zalewski.

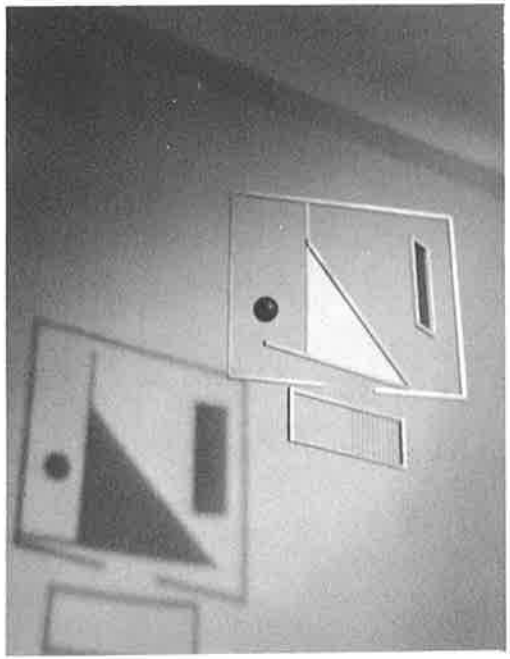
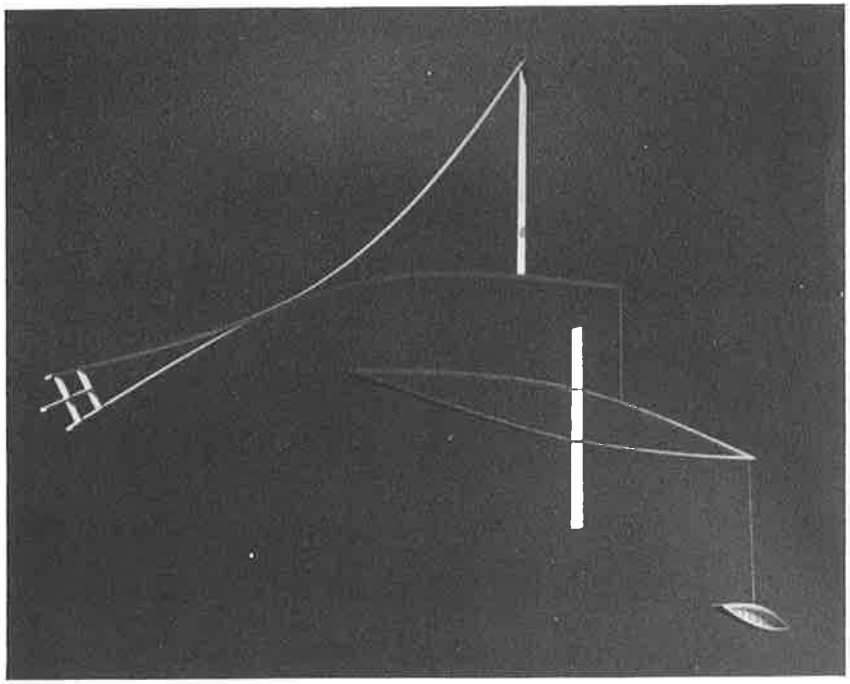


Fig. 37A. Simple geometric forms in a mobile by Xenia Cage. The shadow cast on the wall reflects the changing patterns.

Fig. 37B. Steamed bent wood, paper, and string are the basis for the somewhat more subtle curves and forms of another Xenia Cage mobile.



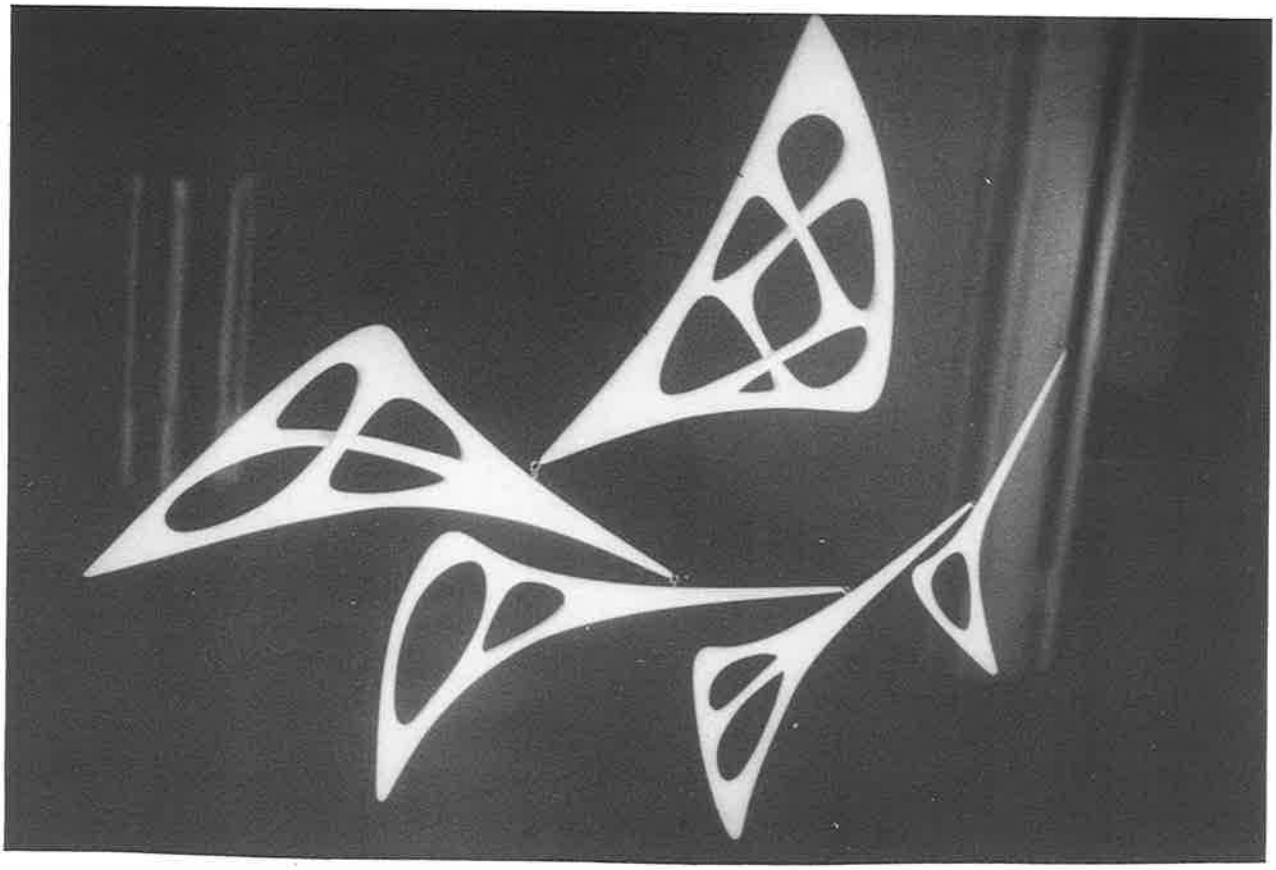


Fig. 38. Carved balsa wood mobile, "Variations on a Theme," by Marechal Brown.

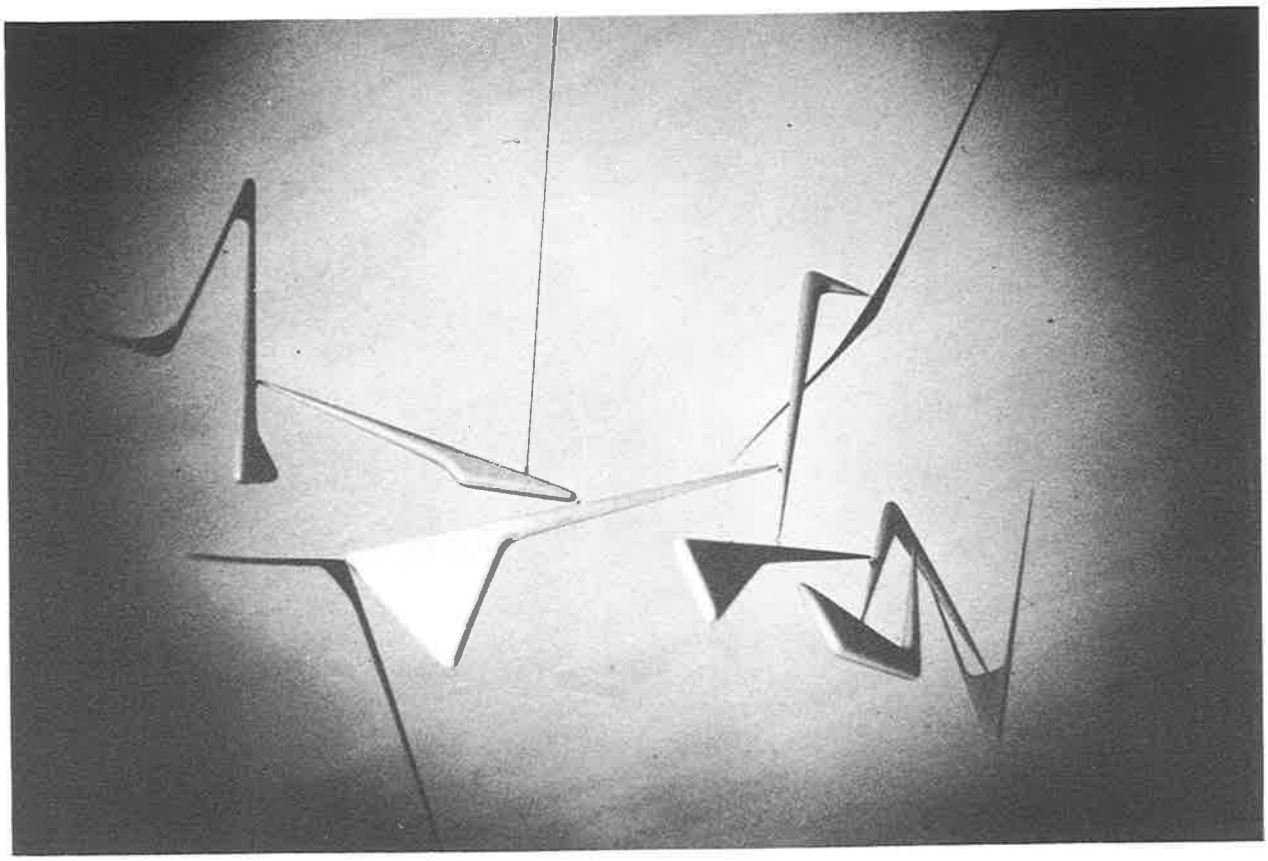


Fig. 39. Marechal Brown has preserved the odd angularity of the "Mantis in Flight" in a mobile of light green balsa wood.

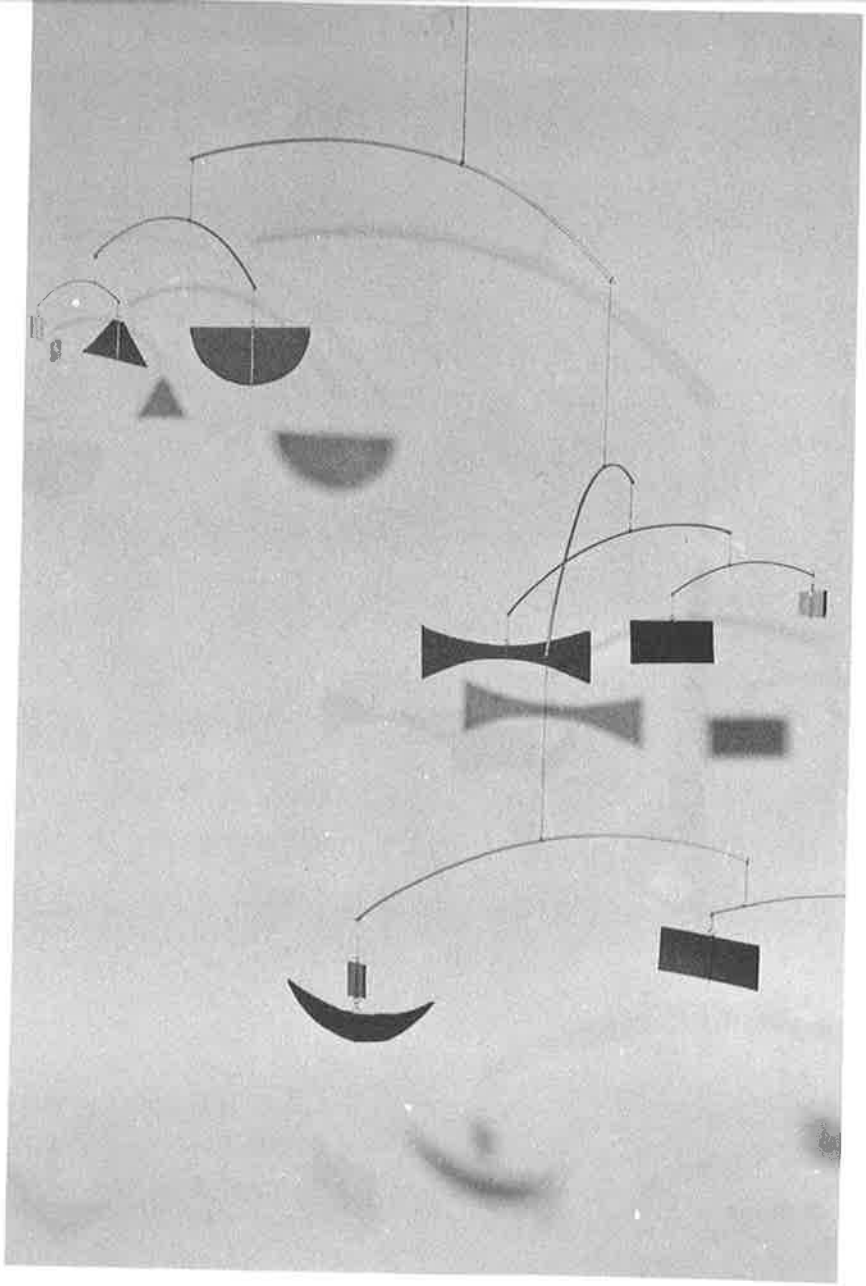


Fig. 40. Semicircles, crescents, rectangles, and other odd-shaped pieces of colored glass are the basis for an airy mobile by the author.

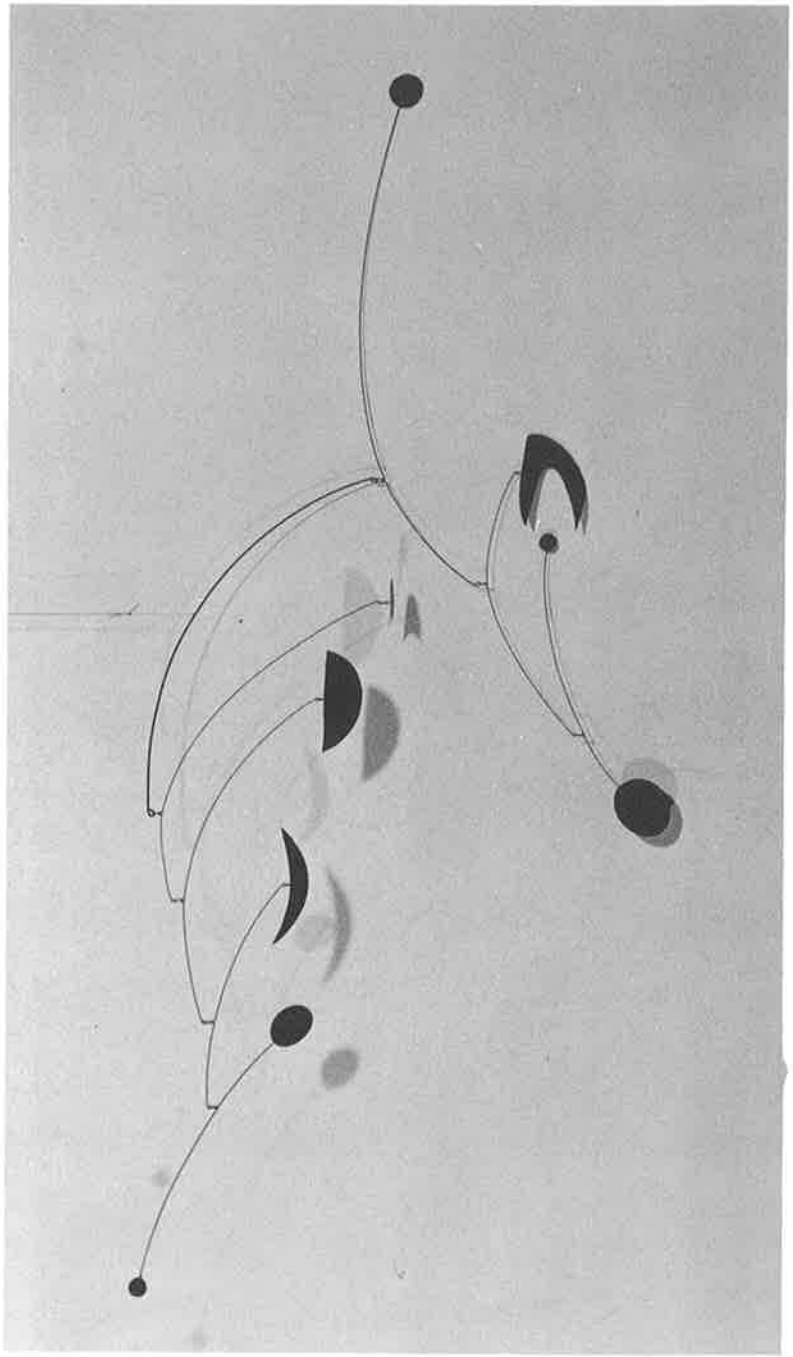
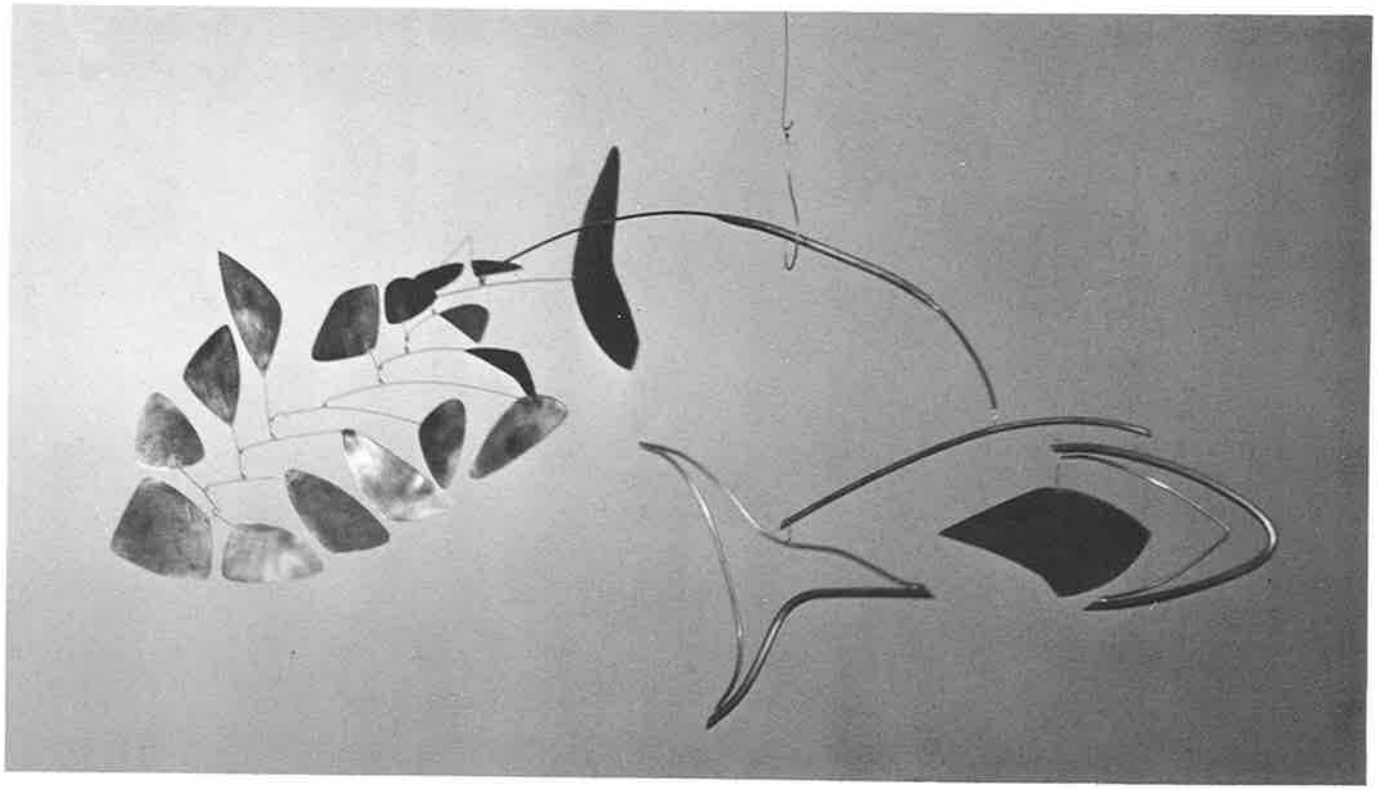


Fig. 41. Painted cardboard and wire mobile constructed by the author.



(Kraushaar Galleries)

Fig. 42. The metal shapes and wires of this mobile, "Aquarium," by George Rickey, skillfully characterize three aspects of the fish in water, its form, motion, and scaly texture.

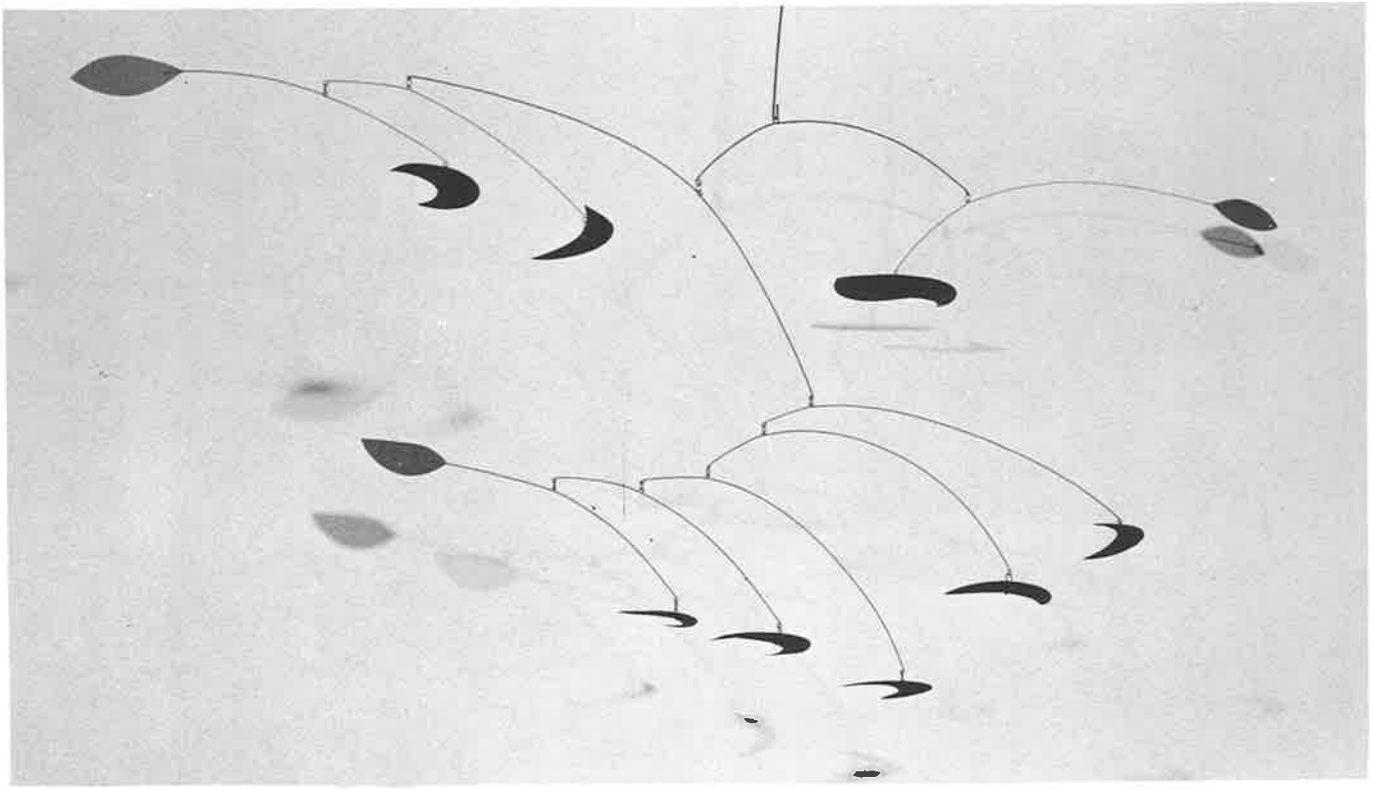
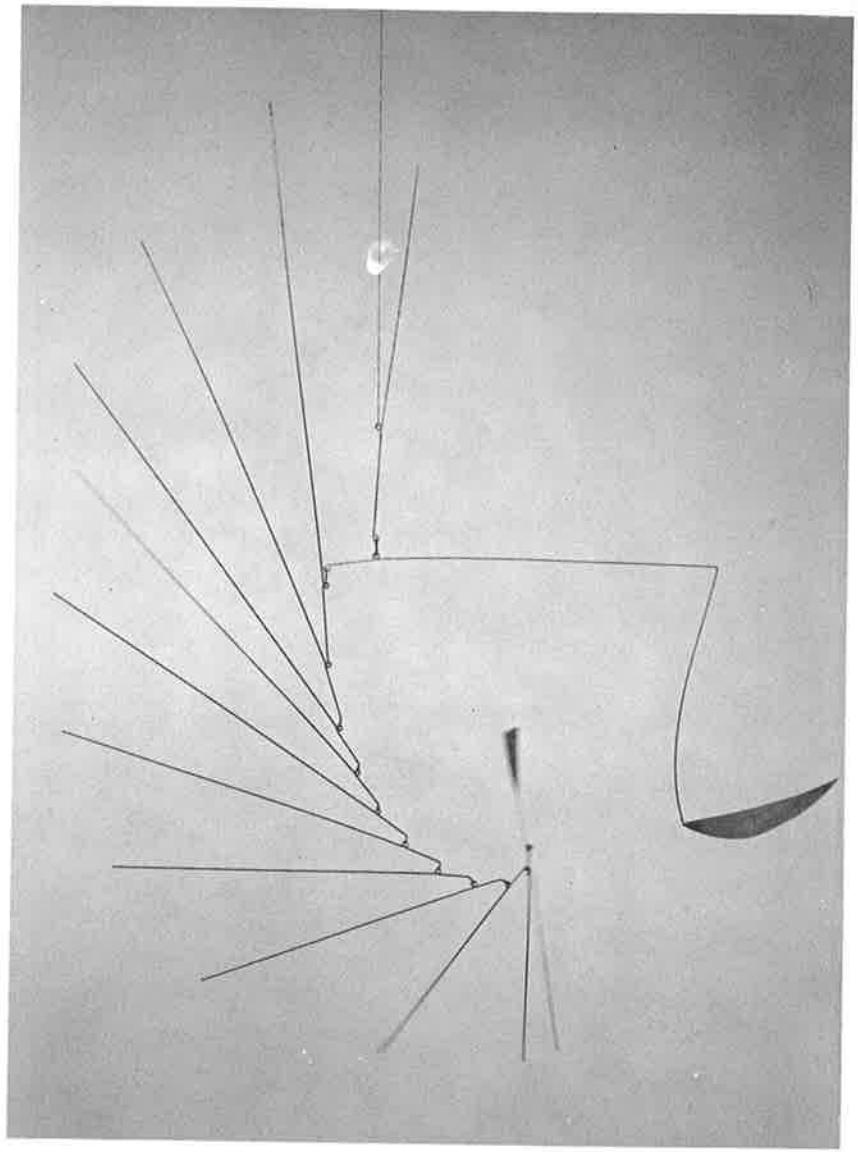
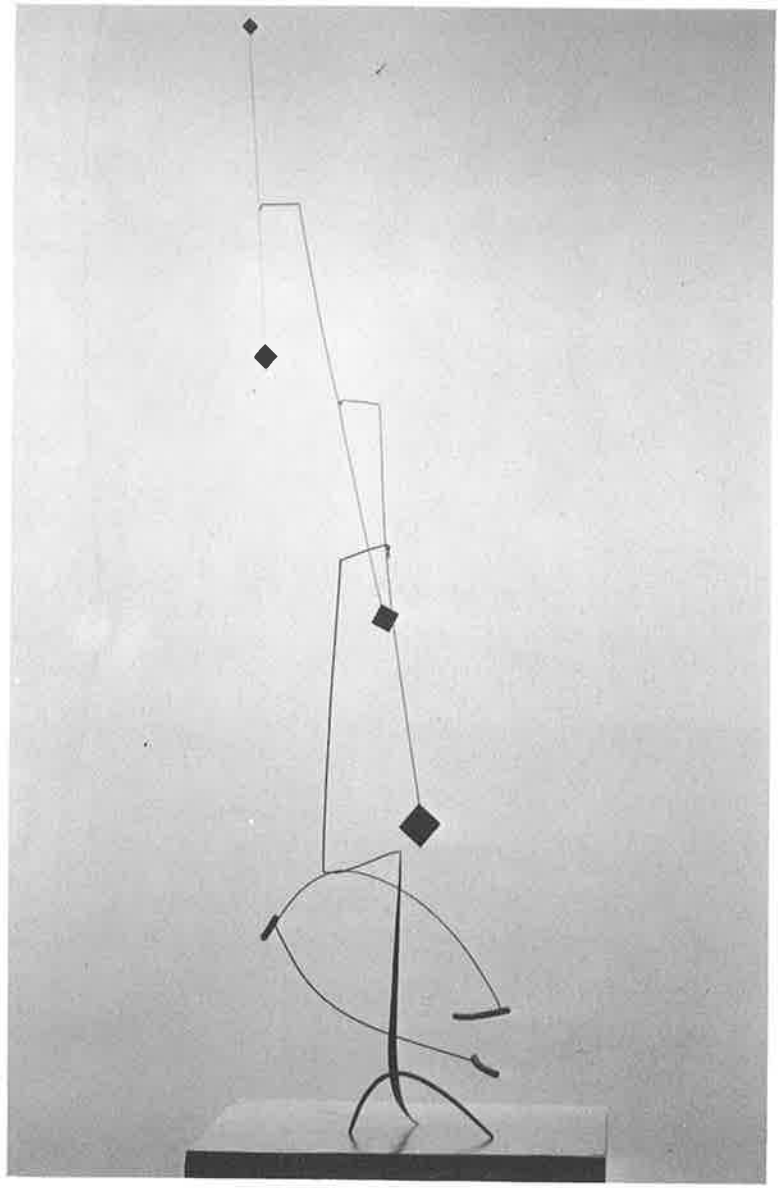


Fig. 43. Cardboard and wire mobile by the author.



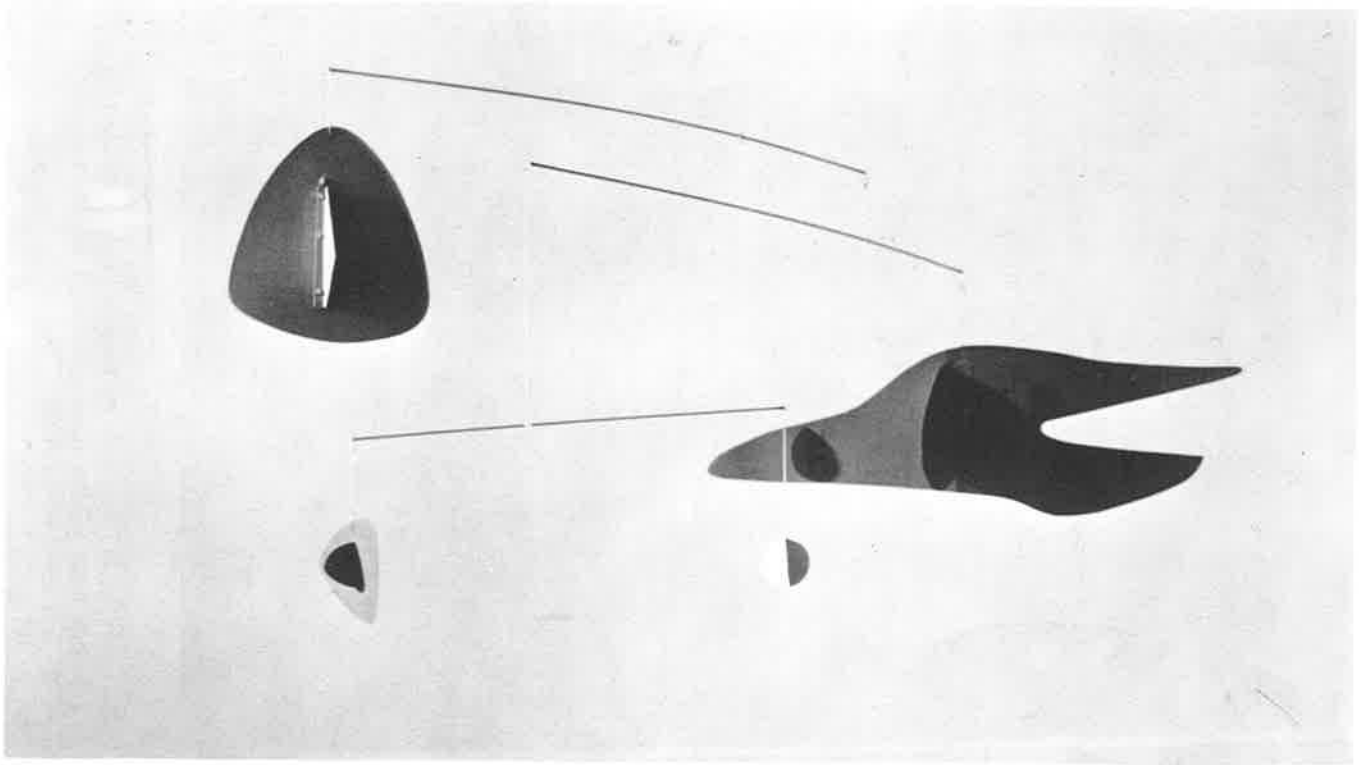
(Kraushaar Galleries)

Fig. 44. "Sun and Moon" wire and metal mobile by George Rickey. Successful use of straight rods to suggest rays.



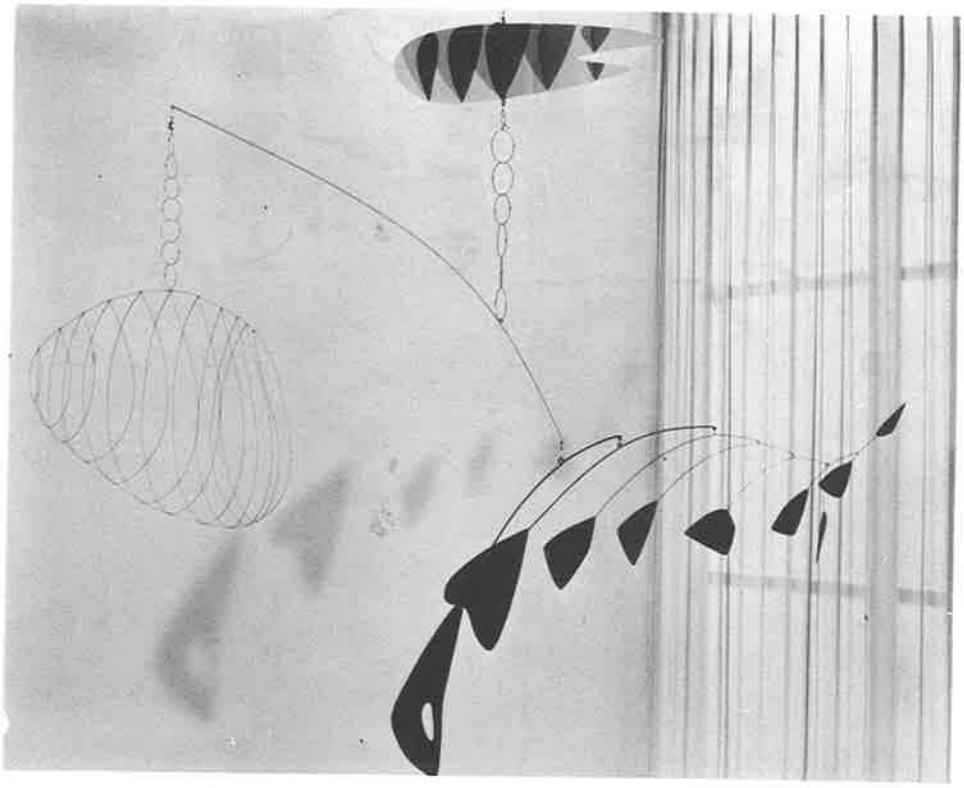
(Kraushaar Galleries)

Fig. 45. "Leaning Tower," a stabile by George Rickey, so closely resembles a mobile that, turned upside down, it might easily be mistaken for its less stationary cousin.



(Collection of the artist)

Fig. 46. Painted metal and wire mobile by Alexander Calder.



(Museum of Modern Art)

Fig. 47. Alexander Calder made this mobile, "Lobster Trap and Fish Tail," of steel wire and sheet aluminum.

(Museum of Modern Art)

Fig. 48. A Calder stabile, strikingly similar in its use of odd forms to his mobiles, forms a decorative setting in company with a chair and coffee table designed by Charles Eames.