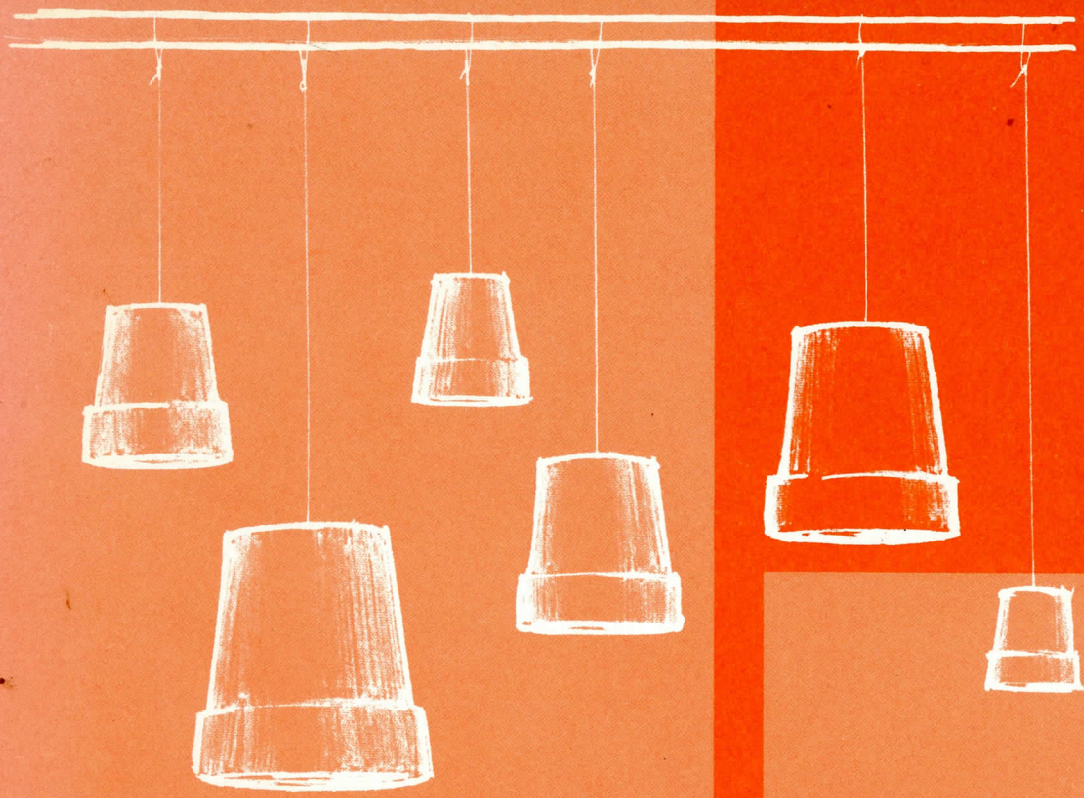
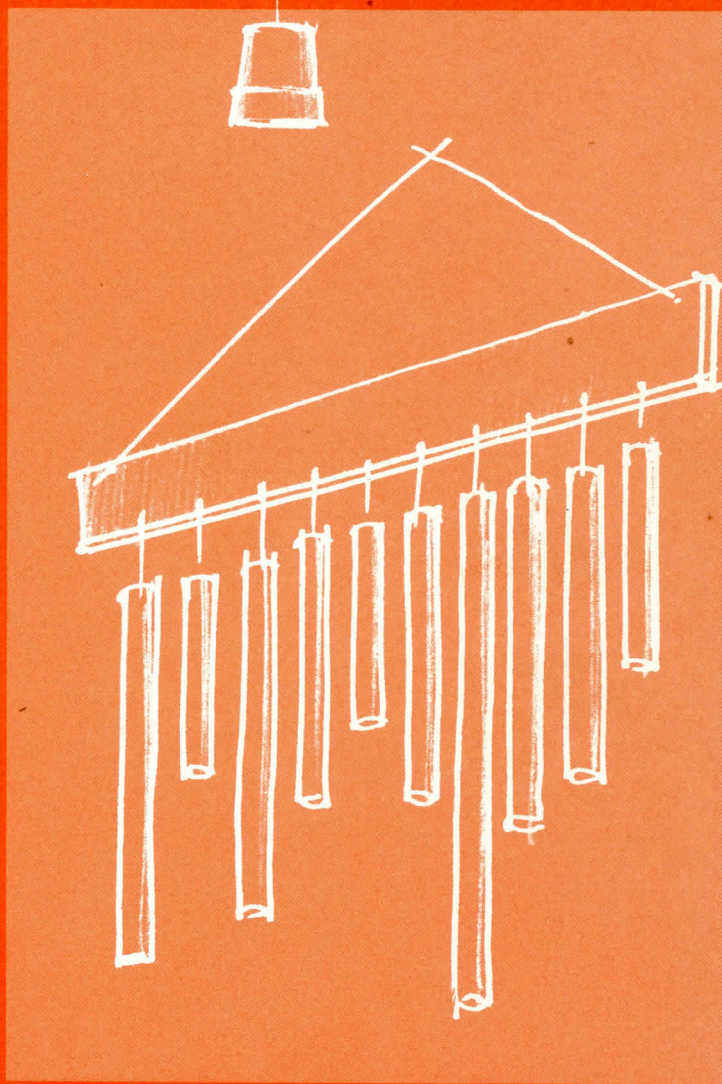




Musical Instrument Recipe Book

MUSICAL INSTRUMENT RECIPE BOOK

Elementary Science Study

WEBSTER DIVISION, McGRAW-HILL BOOK COMPANY

New York • St. Louis • San Francisco • Dallas • London • Sydney • Toronto

Related Units

Batteries and Bulbs II
Structures
Whistles and Strings

ISBN 07-017730-9

PREFACE

The Elementary Science Study is one of many curriculum development programs in the fields of science, social studies, and mathematics under preparation at Education Development Center, Inc. EDC (a private nonprofit organization, incorporating the Institute for Educational Innovation and Educational Services Incorporated) began in 1958 to develop new ideas and methods for improving the content and process of education.

ESS has been supported primarily by grants from the National Science Foundation. Development of materials for teaching science from kindergarten through eighth grade started on a small scale in 1960. The work of the project has since involved more than a hundred educators in the conception and design of its units of study. Among the staff have been scientists, engineers, mathematicians, and teachers experienced in working with students of all ages, from kindergarten through college.

Equipment, films, and printed materials are produced with the help of staff specialists, as well as of the film and photography studios, the design laboratory, and the production shops of EDC. At every stage of development, ideas and materials are taken into actual classrooms, where children help shape the form and content of each unit before it is released to schools everywhere.

ACKNOWLEDGMENTS

The MUSICAL INSTRUMENT RECIPE BOOK grew out of two instrument-making projects. During the early development of WHISTLES AND STRINGS, Dan Watt and I were looking for ways to produce interesting sounds and make instruments from simple objects. At the same time, a few teachers in a summer workshop at the EDC Design Lab in 1967 concentrated on making simple instruments for their classrooms. We eventually collected the best designs from both projects to make the Trial Teaching Edition of the MUSICAL INSTRUMENT RECIPE BOOK. Two teachers, Patricia A. Miller of Boston, Massachusetts, and Margery Thurber of Sudbury, Massachusetts, worked very closely with us on many of the early designs. Many of the instruments have been used with delight by the children in their classrooms. We have enjoyed and appreciated all the visits, letters, tapes, and photographs we have received from instrument-making enthusiasts.

So many people have contributed suggestions, ideas, and assistance for this edition that it is impossible to acknowledge each of them personally. I am indebted to George Cope, Joan Hamblin, David Alexander, Dan Watt, and Lois Cannon for the photographs which appear in this book, to Gerald Foster and David Alexander for the drawings, to Adeline Naiman who edited the manuscript, and to Nancy Weston who designed the book.

I should also like to thank Nat Burwash and Bruno Kansanniva of the EDC Design Lab, whose original designs for instruments, solutions to all sorts of design problems, and continued enthusiasm for instrument building have made possible many improvements in the *Recipe Book*.

Emily Romney

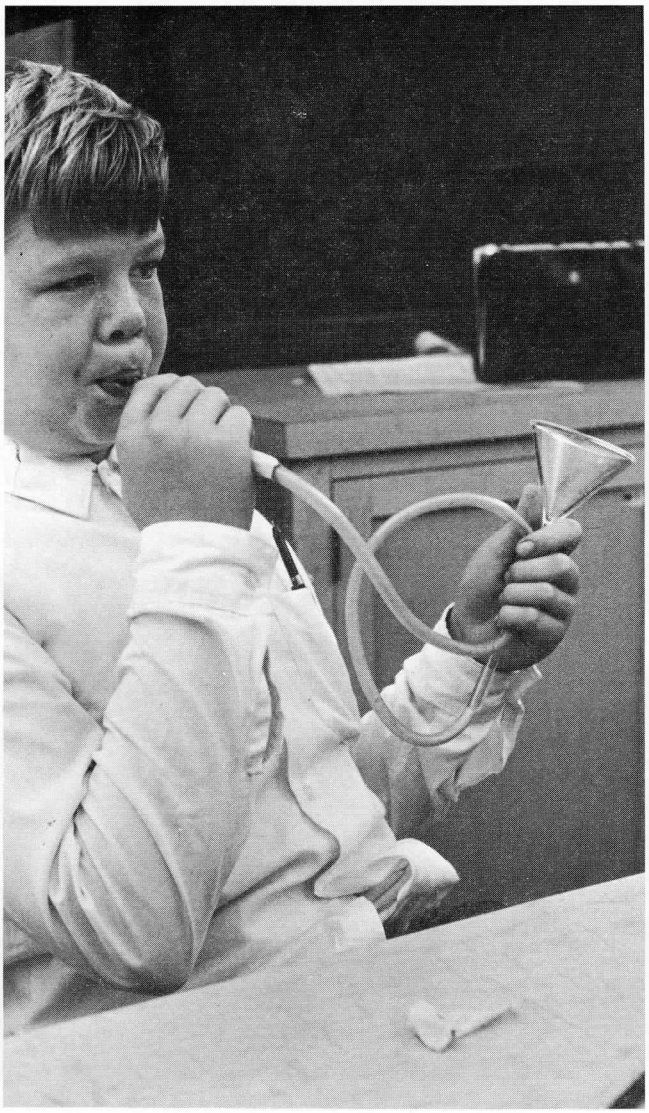
TABLE OF CONTENTS

INTRODUCTION

Many children and adults like to build musical instruments. Anyone who makes even the simplest instrument becomes involved in working with tools and with the materials which he must alter and combine to build his design, and he listens critically to the sounds his instrument makes.* There is great satisfaction in being able to make an instrument which is pleasing and which works.

The instruments in the *Recipe Book* can be constructed with simple tools and inexpensive, commonly available materials. Most of them are quite sturdy. The designs are simple enough so that children can do all or at least some of the work themselves. A number of designs can be built in both simple and more complicated versions.

* Children working with the ESS unit WHISTLES AND STRINGS may find the *Recipe Book* a good source of ideas for further instrument building.

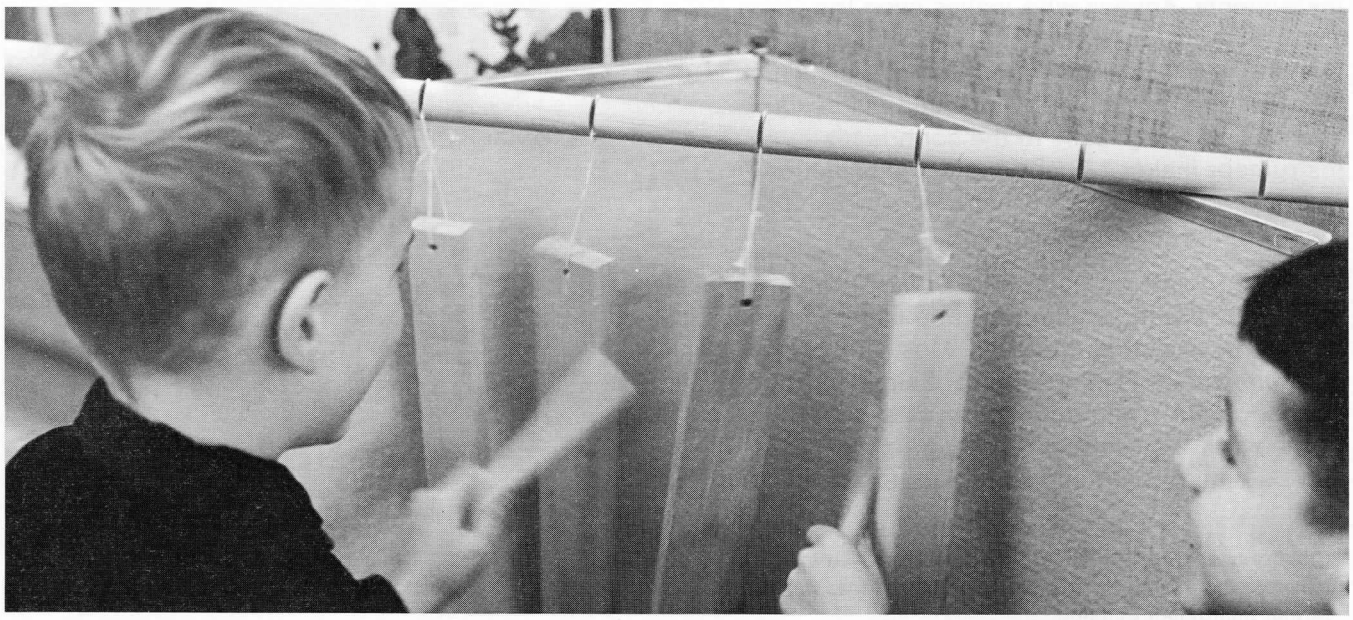


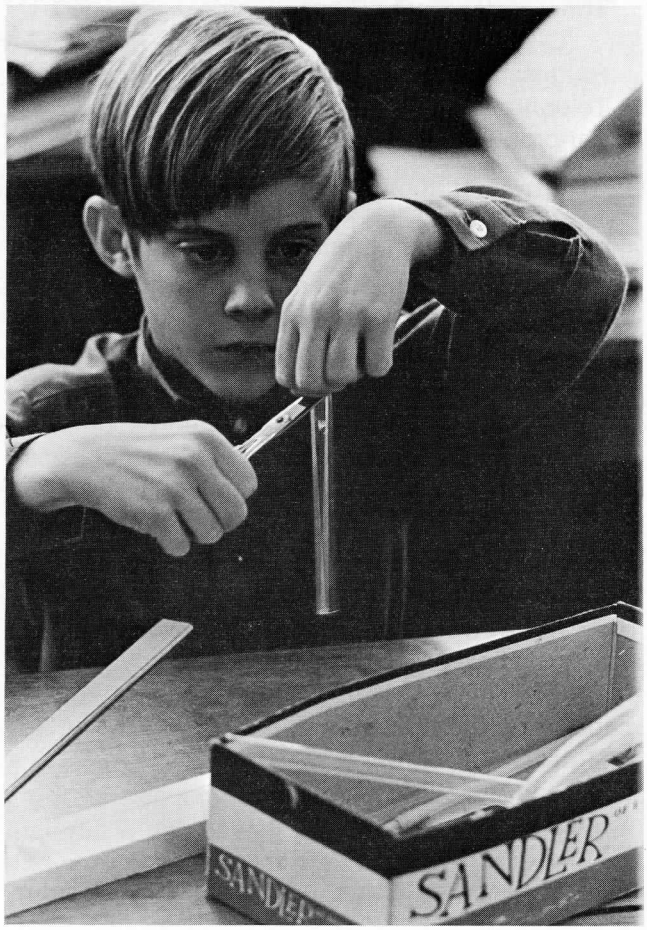
USING THE RECIPE BOOK

For each basic instrument, there are instructions given in a cookbook format. Each "recipe" tries to supply enough information to ensure success for a beginner. You'll also find photographs and drawings of variations on several of the basic designs, along with suggestions for alternative materials.

How carefully people need to follow the instructions will depend upon what they want to do. If someone is setting out to construct an exact copy of an instrument in the book, it is best to follow the recipe quite closely. Otherwise, there's no particular reason to stick to the instructions. Just browsing through the book has given many instrument builders ideas for inventing instruments or making their own version of ones that were already familiar.

Young children may enjoy looking through the book, but they will probably find it difficult to read the instructions. Children often get a clear sense of how to construct an instrument if they can examine and play it before they make it. One teacher of four- and five-year-olds made a bleach-bottle banjo and left it for her class to play with for several weeks. When materials for making banjos arrived, the children were able to construct their instruments with very little help. Making an instrument yourself is a good way to test the design and tools and will help you anticipate any construction problems your students may encounter in building it.





PLANNING

Children in school—from kindergarten to eighth grade—and outside school—in camps, community art centers, scout meetings, summer recreation programs, music schools, and at home—have made the instruments in the *Recipe Book* or similar ones.

Making musical instruments is an informal activity, which can fit into many kinds of learning situations. In whatever context you and your students make instruments, you can expect diversity in the skill with which children will handle tools and materials and in the aspects of instrument making which appeal to them. Some children have made instruments for playing tunes, making up songs, and making music together. Others have painstakingly decorated their instruments . . . or built them mostly for the sake of building something . . . or investigated the ways their instrument made sounds . . . or done a number of different things with them. Such a range of interests will develop in any group if children have leisure to work on their designs and can make some of their own decisions about what they make and how they work.

In planning an instrument-making project, you'll need to gather tools and materials and to consider the kind of working space at your disposal. Also you should keep in mind how much experience your students have had building things in and out of school.

Some instruments are easier to construct than others.

1. These instruments can be made even by young children without a great deal of help.
   - Ear Harp
   - One-string Stick Guitar
   - Bleach-bottle Banjo
   - Wind Chimes
   - Water Bells
   - Flowerpot Bells (untuned)
   - Wooden Chimes (untuned)
   - Sand Blocks
   - Wood-block Tambourine
   - Rhythm Sticks

Tongue-depressor Finger Piano
(C-Clamp version)
Rattles
Telephones
Panpipe (untuned)

2. These instruments require a few precise procedures. They can probably be made by older children without much help or younger children with some help from a teacher or an older child.

Variations on the Washtub Bass
Tuned Flowerpot Bells
Hose Horn
Tuned Panpipe
Wood Block
Shingle-box Drum

3. These instruments require some skill with tools and a fair amount of care and precision. They are, however, among the most versatile and appealing. Young children will enjoy using them, even if the instruments themselves are made by an adult or an older child.

Metal Chimes
Garden-hose Recorder
Slide Whistle
Tuned Wooden Chimes

ORIGINAL DESIGNS AND INVENTIONS

Encourage children who wish to, to make variations on the design recipes and to invent instruments of their own. A good collection of interesting materials almost invariably inspires new ideas for instruments. As you and your students gather supplies, bring in—besides materials for specific designs—any oddments which look promising.

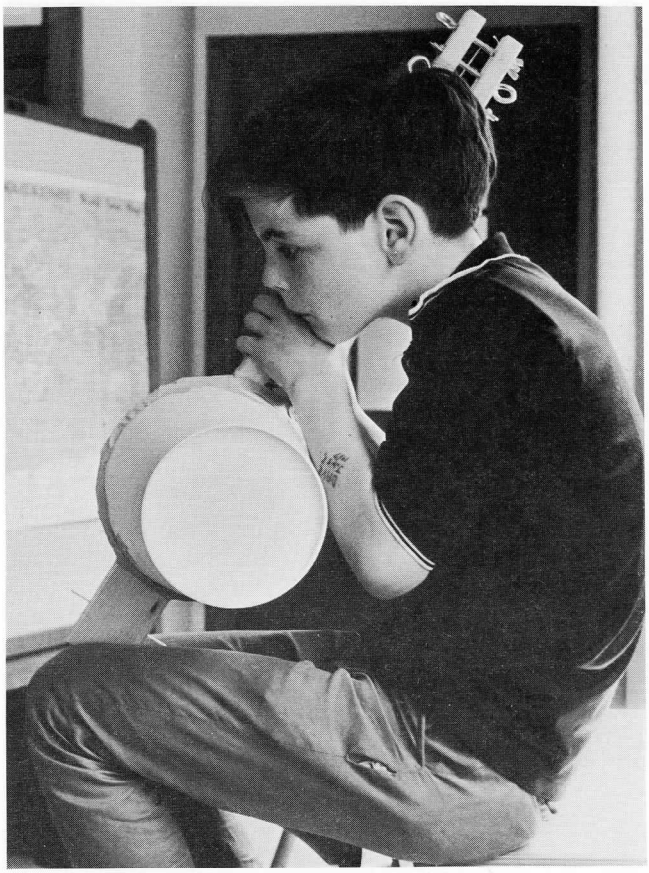
Certain materials seem to be especially versatile for instrument making. With fishline, wooden boards of various sizes, and screw eyes, children have made many different kinds of stringed instruments. They have used everything—from pocket combs and pencils to blocks of wood and paper cups—to make bridges for their string instruments. They have found that paper cups, cardboard paint buckets, wastebaskets, desk drawers, and desk tops can make excellent resonators.

Wooden roofing shingles are resonant, inexpensive, and relatively easy to cut into different shapes. Tri-Wall, a lightweight, sturdy cardboard is another resonant, easily worked material which is very inexpensive. Both Tri-Wall and shingles have been made into many varieties of string and rhythm instruments.

Plastic tubes are very good devices for exploring sounds made by columns of air. Children can cut tubes of different lengths to play tunes, make wind instruments with holes and slides for pitch changes, and combine plastic tubes of different diameters to make musically unpredictable contraptions.*

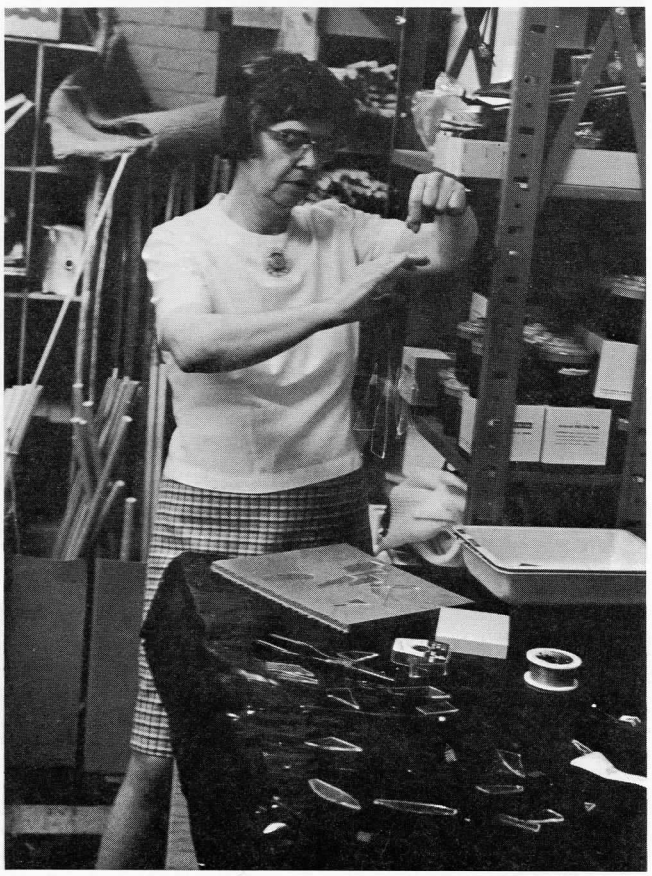
Drums can be made from almost any kind of hollow container.† Pieces of wood will vary in pitch and quality, depending on their variety, size, and shape. Odd pieces of metal—from washers to knives and forks—make interesting sounds when struck, as do different kinds of bottles, cups, and glasses.

Informal exploration of sounds can often lead to an idea for an original instrument. That's how many of the instruments in the *Recipe Book* came about.



* You'll find many suggestions for investigating sound with plastic tubes in the ESS unit WHISTLES AND STRINGS.

†There is only one drum design in the *Recipe Book* ("Shingle-box Drum," page 50). You will find a number of interesting drums to make in the first group of books in the "Book List," page 13.



ADULTS AND INSTRUMENT MAKING

Teachers in Headstart training programs and in-service workshops have enjoyed building instruments. Adults have as many approaches to instrument making as children do. Some people who have never had the opportunity to make an instrument find it very satisfying to try. Teachers often use the opportunity to make instruments which they otherwise could not afford to have for their classes, or to build models which they take back to their students to start an instrument-building project.

One music teacher organized a workshop area in a school and invited both teachers and their elementary students to come and make instruments together. It was a great success, and a number of children had, for the first time, an opportunity to help out their teachers as equals.

In many instances, teachers in a school have collaborated on an instrument-making project: two classroom teachers; a music, science, art, or shop specialist with a classroom teacher; or a teacher with a parent. Instrument making combines elements of science, music, art, social studies, and carpentry, and so it invites this kind of joint effort. You might consider building instruments if you are looking for an opportunity to work with another teacher in your school, or ask another teacher to help you if you are hesitant to take on the project by yourself.

MATERIALS

Besides buying materials, you and your students may find a good many items at home or at school. Some shopkeepers and merchants in your area may be willing to give you small quantities of materials. You may also have good luck in obtaining such things as scrap wood at lumberyards, empty plastic bottles at laundries, and tubing from discarded fixtures at plumbing suppliers, junk yards, or the town dump.

Each recipe in this book gives a list of the materials you will need to make that particular design. On page 12 is a general list of all the materials that are used to make the instruments in this book and suggestions for places to find them. Most of them can be purchased at hardware or department stores.

TOOLS

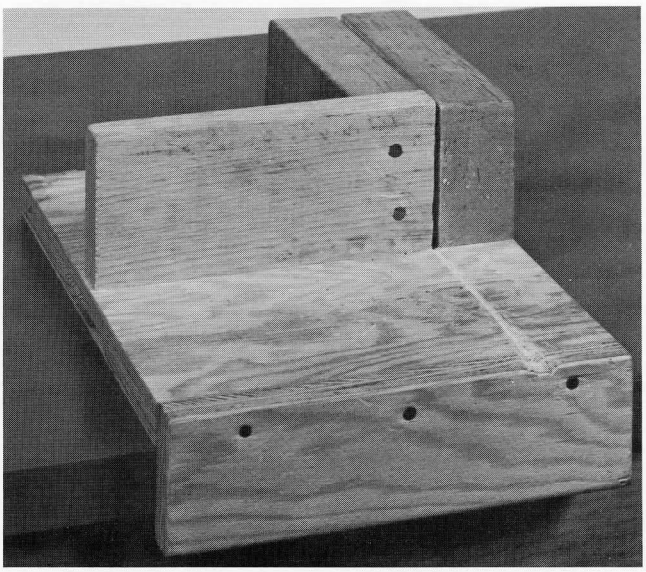
You and your students may be able to find all the tools you need at home or around the school. Each recipe gives a list of the tools you will need to make that design.

ALL THESE TOOLS CAN BE PURCHASED AT HARDWARE STORES.

- hammer
- handsaw (A 10-point crosscut saw with a 20″ blade is a good kind to buy.)
- hacksaw
- keyhole saw
- tubing cutter (The "Craftsman" Tubing Cutter, model 9-G 5528, available at Sears Roebuck for about $5 worked well in trial classes. Cheaper ones tried were unsatisfactory.)
- sandpaper, emery paper
- ruler
- single-edge razor blade
- pliers
- utility, mat, or X-Acto knife
- 8″ hacksaw blade
- drill (hand or electric) and $\frac{1}{4}$″ bit for drill
- vise or benchhook

You will need a vise or some kind of bracing device to hold metal and wood in place while you saw or cut. Carpentry or classroom workbenches usually come with a vise attached. No inexpensive clamp-on vise tried has worked well enough to be recommended, but the homemade benchhooks described below are good substitutes for a vise and are fairly simple to make.

With one of these, you can saw or drill on any ordinary desk or counter top without damage.



To make the benchhook* in this picture, nail *and* glue pieces of wood of the following sizes together:

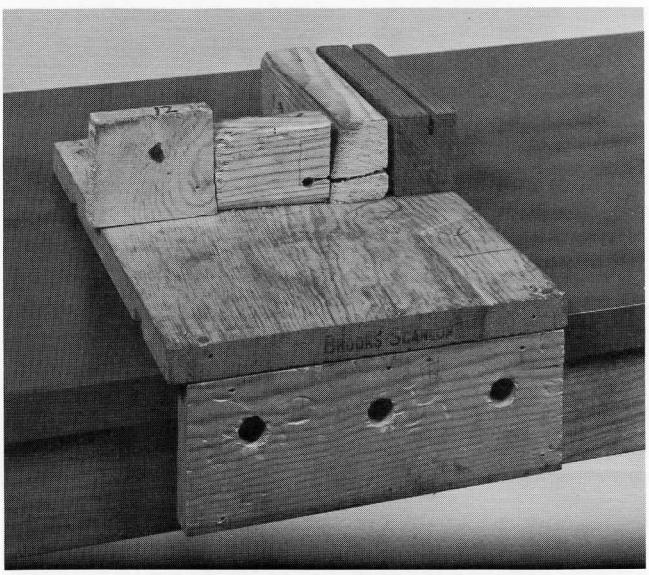
One 12″ length of 1″ × 8″ (bottom)

One 3″ length of 1″ × 8″ (brace to overlap table)

One 3″ length of 1″ x 6″ (crossbar)

Two 6″ lengths of 2″ x 3″ (guides)

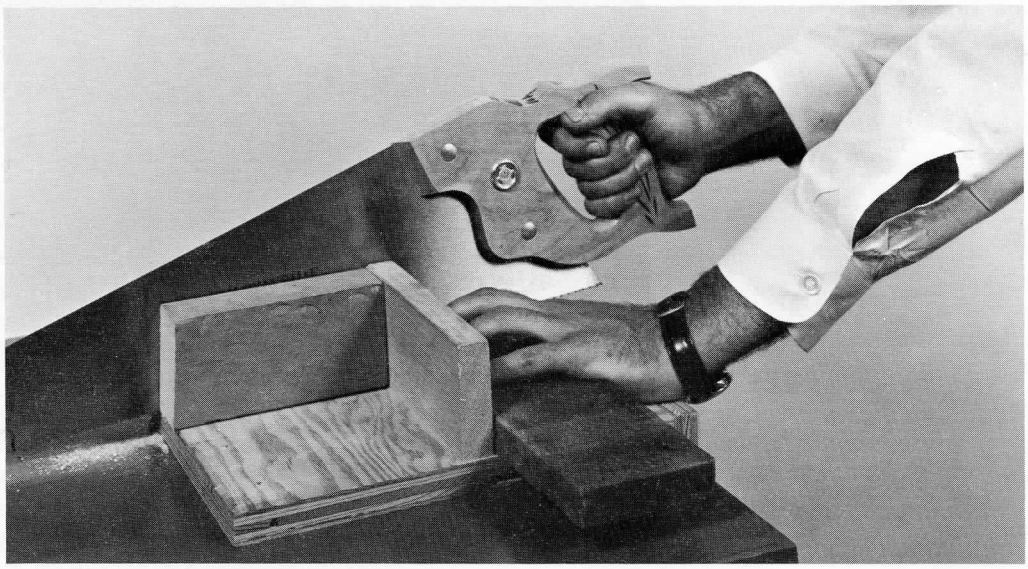
Be sure to leave a space between the two guides for the saw.



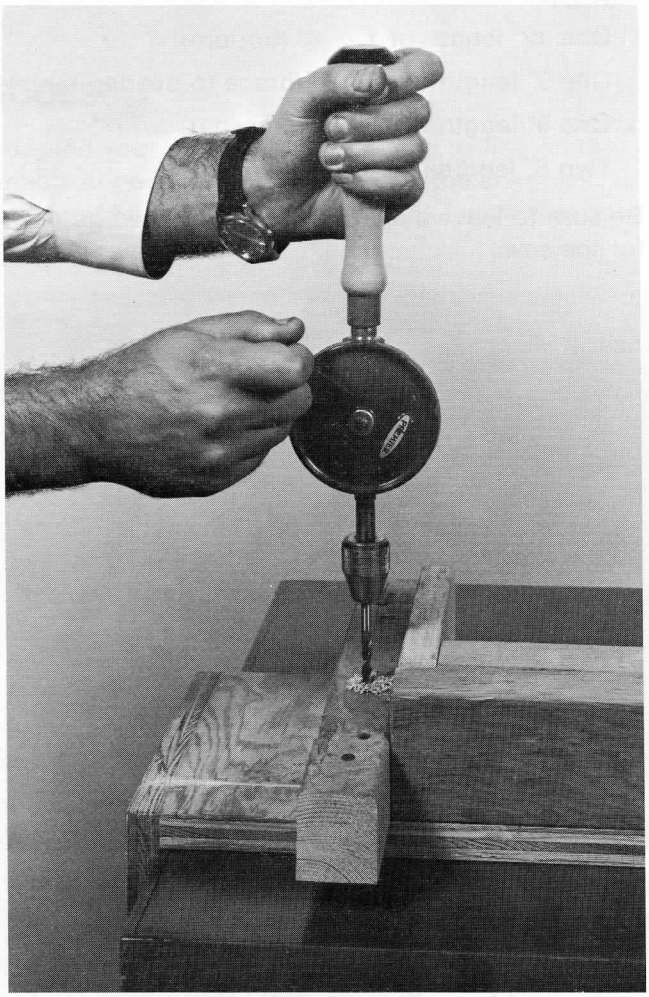
In the picture is another sturdy benchhook made from scrap wood, glue, and nails.

The benchhook can be used for sawing and for drilling and for cutting metal tubing.

* This information is adapted from the ESS unit **BATTERIES AND BULBS II.**

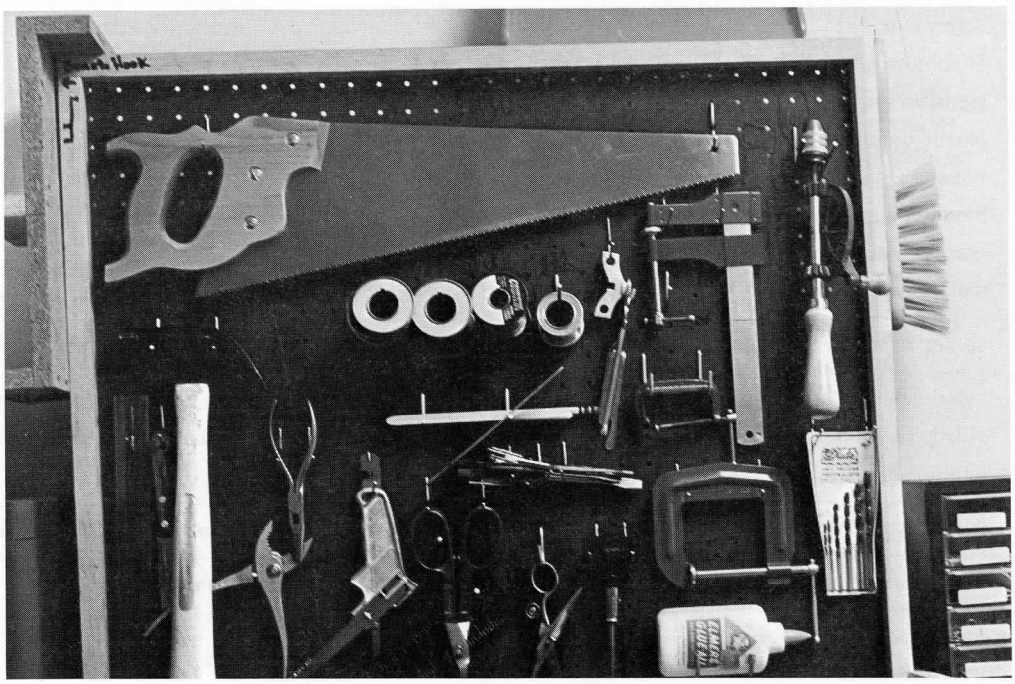


The saw is guided by the slot.



The benchhook keeps the wood from spinning while it is being drilled. You will find it easier if someone else holds the wood against the benchhook while you drill.

This takes two people—one person to turn the tubing cutter and another to hold the tubing steady.



A workbench and other carpenter's facilities are nice to have but not necessary for making instruments. If possible, reserve a place in your classroom or some other area where you can keep the tools and supplies together for instrument making, as well as for other kinds of building projects.

HAPPY TIMES!

MATERIAL	AVAILABLE FROM
cord (Thin clothesline will do.) water glasses, jars, bottles scraps of metal or glass scraps of plastic household sponge soda-bottle caps small containers for rattles small objects to fill rattles (beans, tacks, pebbles) thumbtacks plastic-coated paper coffee cups paper clips vacuum-cleaner or hair-dryer hose large metal containers (washtubs, wastebaskets, oil cans)	home or school
gallon, plastic bleach bottles or other large plastic containers	laundries, restaurants, or the school cafeteria
plastic and metal funnels Sterno large and small nails long dowels of various sizes, also broom sticks mailing tubes screw eyes (#112) aluminum tubing aluminum angle ($\frac{1}{2}''$ x $\frac{1}{16}''$) plastic garden hose Elmer's Glue-All or an equivalent wood glue medium-size C-clamps (4″ is a good size.) masking tape bailing twine, sisal twine (or other packaging twine)	home or hardware stores
scraps of wood in various sizes and shapes, also shingles	lumberyards and building suppliers
nylon fishline (Squidding line is best.) plastic golf tubes monofilament fishline	sporting goods stores or department stores
earthenware flowerpots	greenhouses or large florist shops
electrical conduit tubing	electrical supply shops
tongue depressors popsicle sticks	craft stores or variety stores
bamboo poles	rug cleaners or stores
stiff plastic tubing of various diameters	plastics supply stores (Look in the Yellow Pages of your telephone book under "Plastics, Rods, Tubes, Sheets, etc." for local suppliers.) Large quantities of "flexible butyrate stock tubing" are available from Israel Andler & Sons, 130 Gore Street, Cambridge, Massachusetts.
Tri-Wall 3-ply cardboard	Tri-Wall Containers, Inc., 1 Dupont Street, Plainview, Long Island, New York 11803.

BOOK LIST

Here are a few books that contain ideas for making simple musical instruments.

Making and Playing Classroom Instruments, by Marcelle Vernazza (Fearon Publishers, Inc., Palo Alto, California, 1959) and *Make Your Own Musical Instruments,* by Muriel Mandell and Robert E. Wood (Sterling Publishing Co., Inc., New York, 1959) are two handbooks for making musical instruments.

Musical Instruments of Africa, by Betty Warner Dietz and Michael Babatunde Olatunji (The John Day Company, New York, 1965) contains pictures and descriptions of many unusual instruments which children may want to try to make.

Indian Music Makers, by Robert Hofsinde (William Morrow & Company, New York, 1967) gives an interesting account of musical instruments and singing in the life of American Indian tribes. The author includes descriptions of how several Indian musical instruments were constructed, in enough detail for readers to make them.

Two out-of-print books which are available in many libraries are *Creative Music for Children* (G. P. Putnam and Sons, New York, 1922) and *Creative Music in the Home* (The John Day Company, New York, 1922), both by Satis N. Coleman. These books contain many ideas for making simple instruments and for using them as part of a music education program.

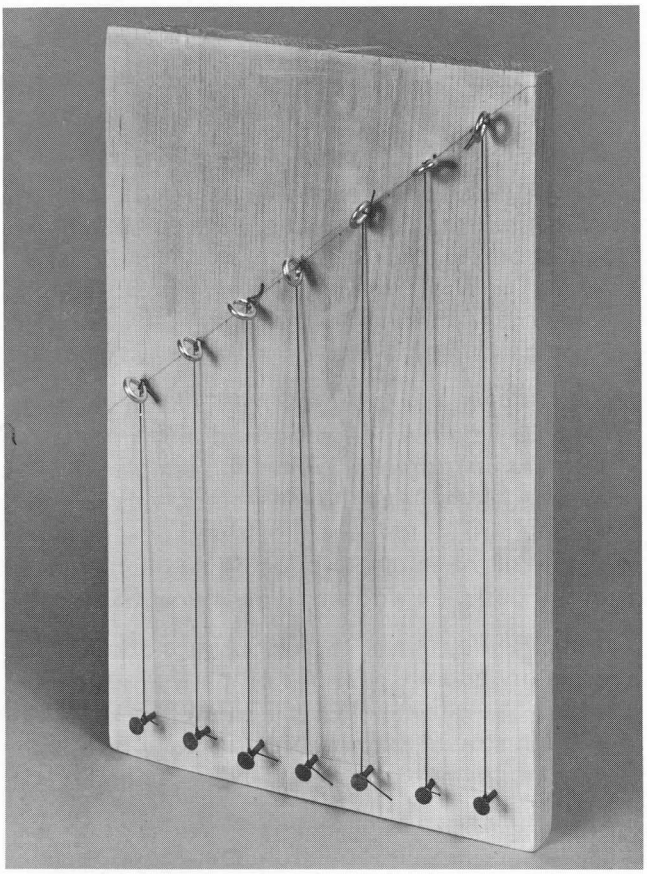
Each of the following books by Larry Kettelkamp (William Morrow & Company, New York) contains suggestions for making simple instruments and information about the history and construction of a family of traditional instruments. Each book is clearly and simply written and well illustrated.

Flutes, Whistles, and Reeds (1962) is an account of the development of woodwind instruments. There are instructions for making simple instruments, such as the elderberry whistle and the shepherd's pipe, and illustrated descriptions of some of the sound-producing mechanisms in more complex woodwind instruments.

Drums, Rattles, and Bells (1960) tells about the history and musical use of many kinds of percussion instruments from different parts of the world. Illustrated instructions for making drums, a xylophone, and water-glass bells are included.

Horns (1964) is a brief history of brass instruments, with information about how ancient and modern instruments were and are made and played. This attractive book also contains suggestions for experimenting with shower hoses, water pipes, and the like, as well as a detailed description of the process by which a modern French horn is made.

Singing Strings (1958) deals with the violin, guitar, and keyboard families of stringed instruments, in similar fashion.



EAR HARP

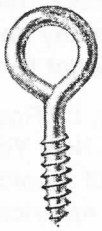
MATERIALS

15″ length of board (pine or other soft wood) about $\frac{3}{4}$″ x 12″ (sold as 1″ x 12″ at lumberyards) If possible, get "select" pine which has no knots in it.

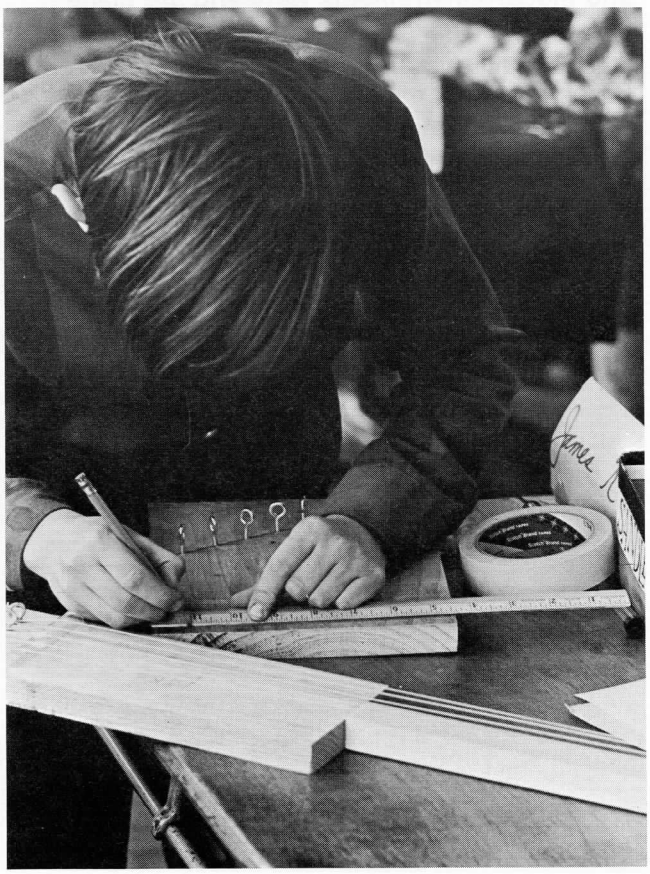
nylon fishline (Squidding line is best.)

6 or 8 nails about $1\frac{1}{2}$″ long with heads

either 6–8 screw eyes (size #112) and a large nail *or* $1\frac{1}{2}$ ft of $\frac{1}{4}$″ dowel and masking tape for tuning pegs



112



TOOLS

hammer

ruler

saw

drill (hand or electric) } for tuning pegs

$\frac{1}{4}$″ bit }

sandpaper

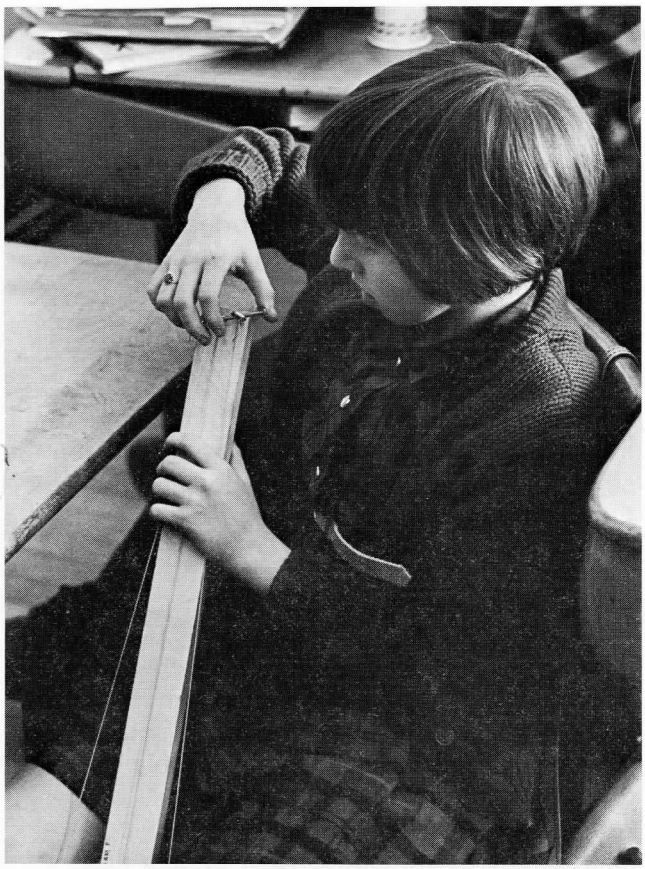
Draw a line near and parallel to one edge of the board.

Then draw a slanting line from an opposite corner.

Hammer an evenly spaced row of nails partway into the board along one of the lines, one nail for each string.

TWO WAYS TO FINISH YOUR EAR HARP

1. *Screw Eyes.* Using the large nail to start the hole, insert a screw eye partway into the board along the other line opposite the first nail.



Then attach a piece of fishline to the nail with a good firm knot. Pull the string fairly tight and tie it securely to the screw eye. You can make the strings tighter by turning the screw eyes.

Do the same for the other strings.

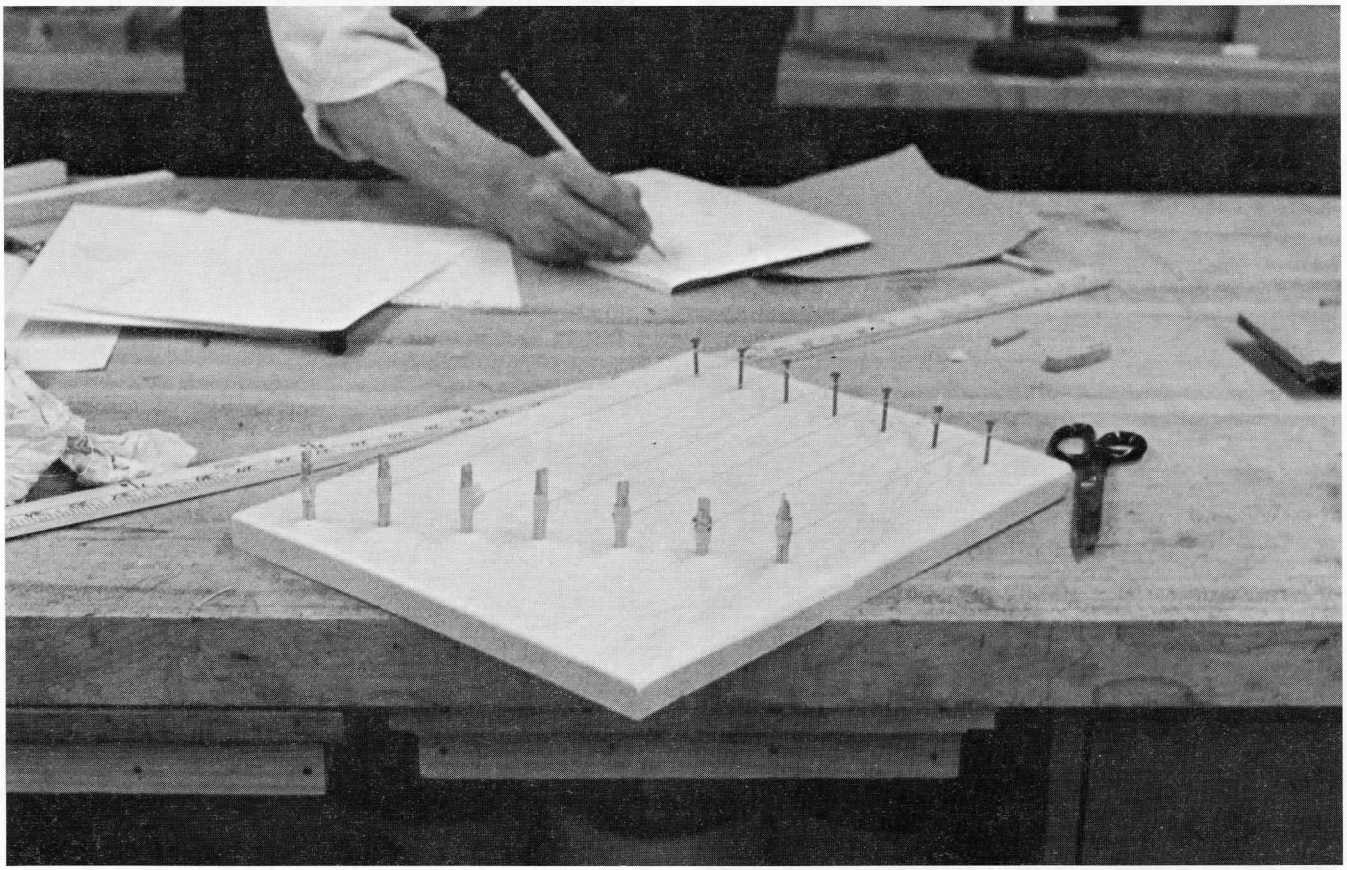
Screw eyes are easier to turn if you use a nail through the eye as a lever.

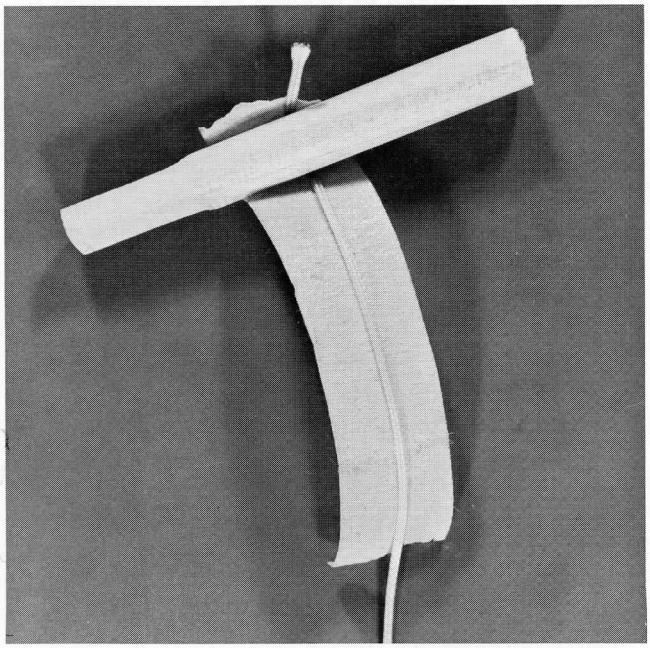
After the rest of the strings are connected, tune them as you like by tightening or loosening them.

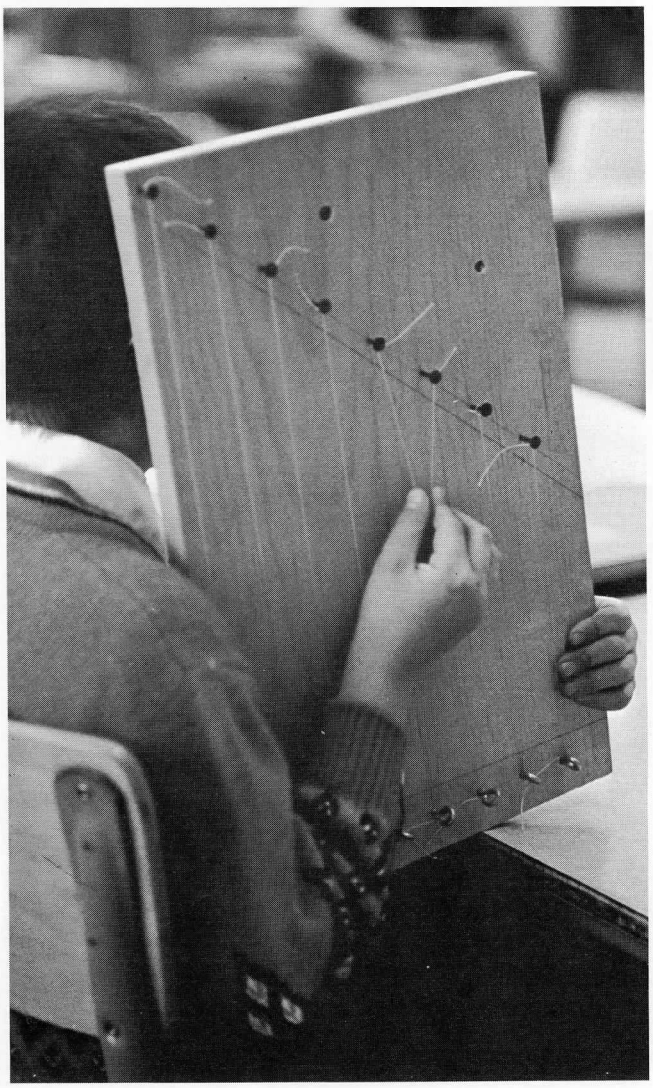
2. *Tuning Pegs.* These can be used for other string instruments, as well. Instruments with tuning pegs seem to have a richer sound than those with screw eyes. Screw eyes are easier to insert, but pegs can be twisted farther for tuning, and they look nicer!

To make tuning pegs, you need:

- $\frac{1}{4}''$ diameter doweling (2″ piece for each peg)
- drill (hand or electric)
- $\frac{1}{4}''$ bit for drill
- sandpaper
- saw
- masking tape





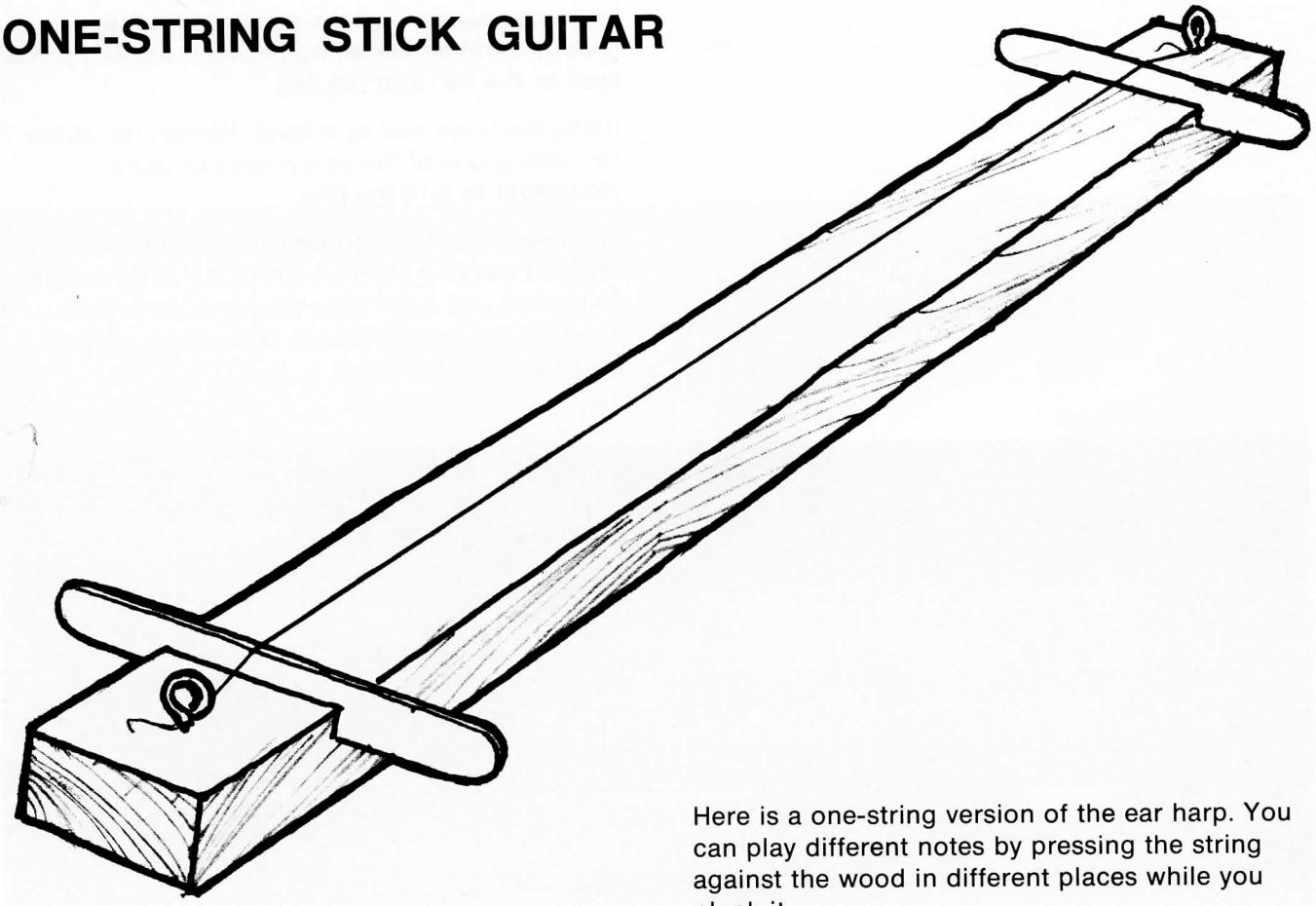


Saw the doweling into 2-inch pegs. (Make one for each string.) Sand each peg on one end so that the last $\frac{1}{2}$ inch is flat on one side. Then flatten the other side on the same end. (Wrapping the sandpaper around a ruler makes it easier to sand flat.) Drill a $\frac{1}{4}$-inch hole through your board for each peg. Attach one of the strings to a nail on the other end of the board with a good firm knot. Then put about 3 inches of masking tape along the free end of the string—sticky side toward the string. Wind the taped part of the string around the peg just below the flat end. Force the round end of the peg into its hole until it is firmly in place. You can tighten or loosen the string by turning the pegs. A wooden clothespin fitted over the flat end of a peg makes it easy to turn the peg for tuning.

HOW DOES IT SOUND?

If you hold the back of the harp against your ear while you play it, the sound will seem richer and warmer to you. Also some ear harps sound stronger if you prop them up on a table with a block of wood under one corner. If you want your harp to sound *much* louder, hook up a microphone to the loudspeaker system of a tape recorder or a phonograph and put the microphone on the board while you pluck the strings. Try this with other instruments, too.

ONE-STRING STICK GUITAR



Here is a one-string version of the ear harp. You can play different notes by pressing the string against the wood in different places while you pluck it.

MATERIALS

1 24″ length of wood about $1\frac{1}{2}$″ x $\frac{3}{4}$″ (sold as 1″ x 2″ at lumberyards)

1 yard nylon fishline (Squidding line is best.)

2 popsicle sticks or wooden coffee stirrers

either two screw eyes (size #112) and a large nail *or* a large nail and a 2″ length of $\frac{1}{4}$″ dowel and masking tape for a tuning peg

TOOLS

saw

hammer

drill (hand or electric)
$\frac{1}{4}$″ bit for drill } for tuning peg

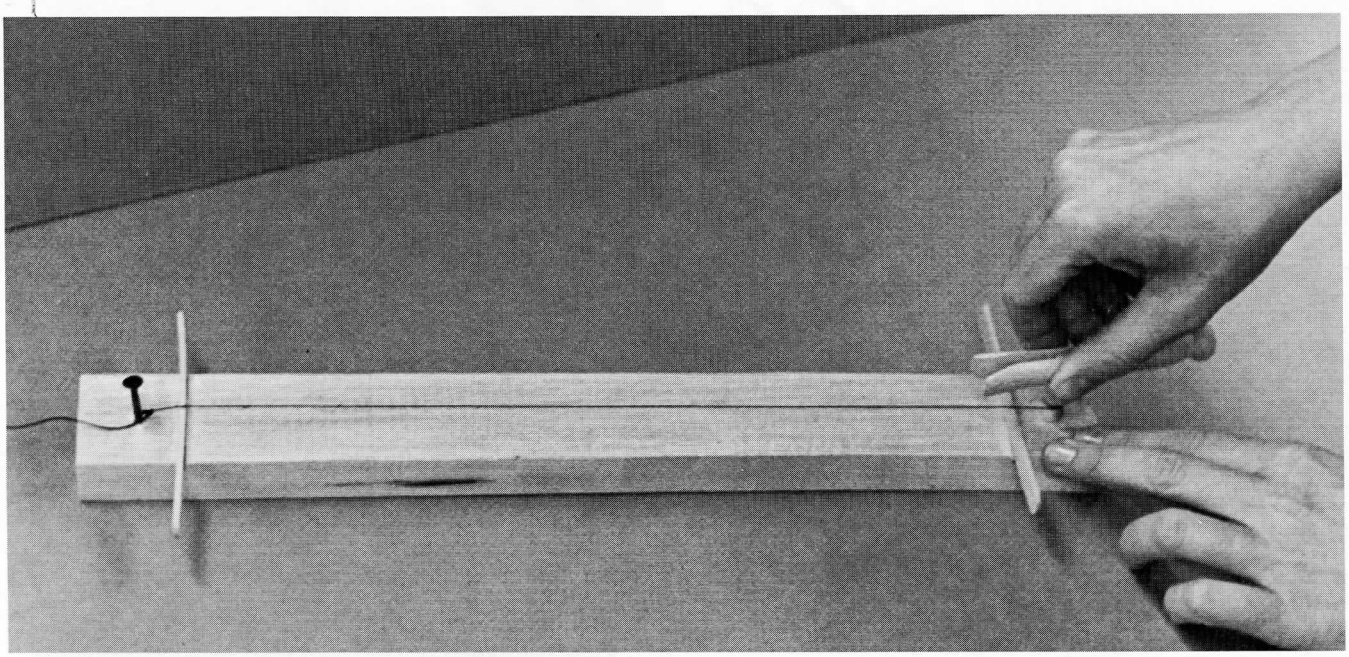
Insert a screw eye near each end of the wood strip, *or* substitute a large nail at one end and a tuning peg at the other. The kind of peg described on page 15 will work fine.

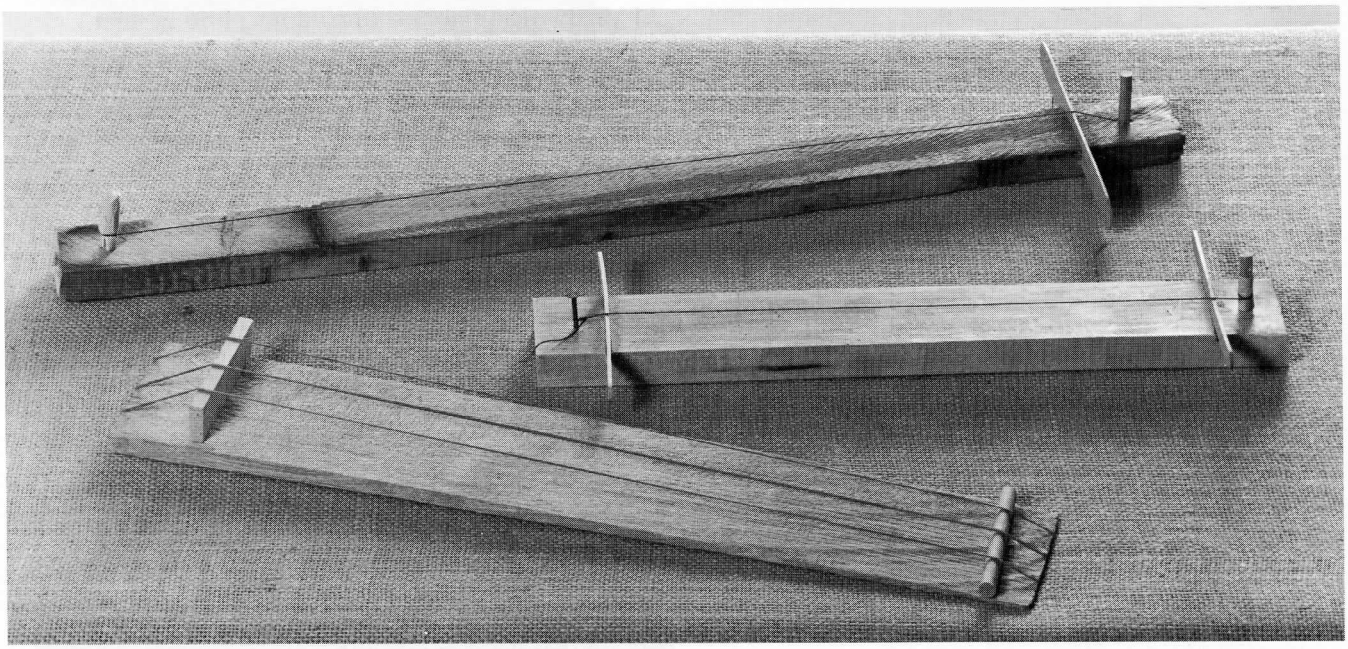
Saw a shallow groove across the strip about $1\frac{1}{2}$ inches from each end.

Insert the popsicle sticks sideways into the grooves, and tie the string between the two screw eyes or the nail and the peg.

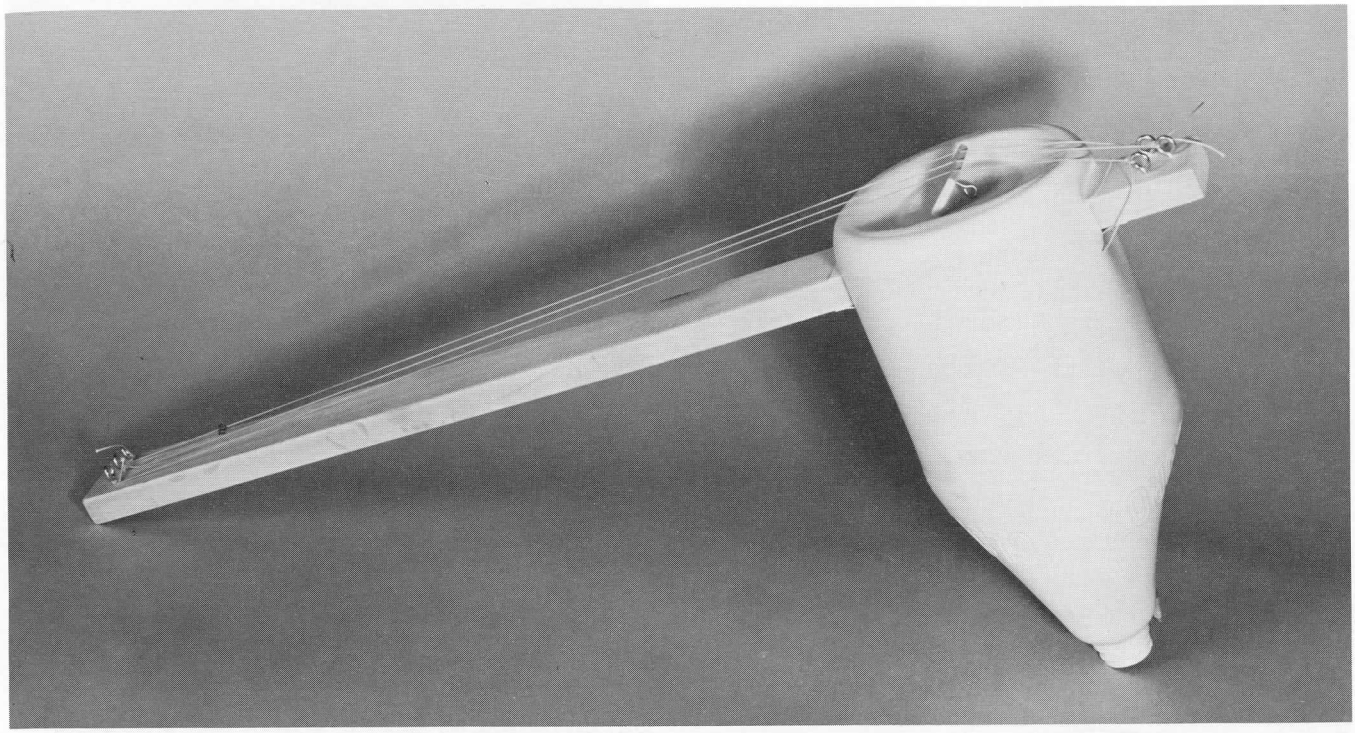
Using the large nail as a lever, tighten the string by turning one of the screw eyes or use a clothespin to turn the peg.

The one-string stick guitar will sound louder if it rests on top of a wooden table or a large hollow container, and it will also sound much louder to you if you hold the back of the strip against your ear while you play.





BLEACH-BOTTLE BANJO



MATERIALS

plastic bleach bottle or other large plastic bottle*

30″ length of wood, 2″ x ¾″ or 3″ x ¾″ (sold as 1″ x 2″ or 1″ x 3″ at lumberyards)

about 3 yards of nylon fishline (Squidding line is best.)

a cork or a small piece of wood (about ¾″ x 2″ x ¼″) and a screw eye

either 6 or 8 screw eyes and a large nail *or* about 6″ of ¼″ diameter doweling and masking tape for pegs

TOOLS

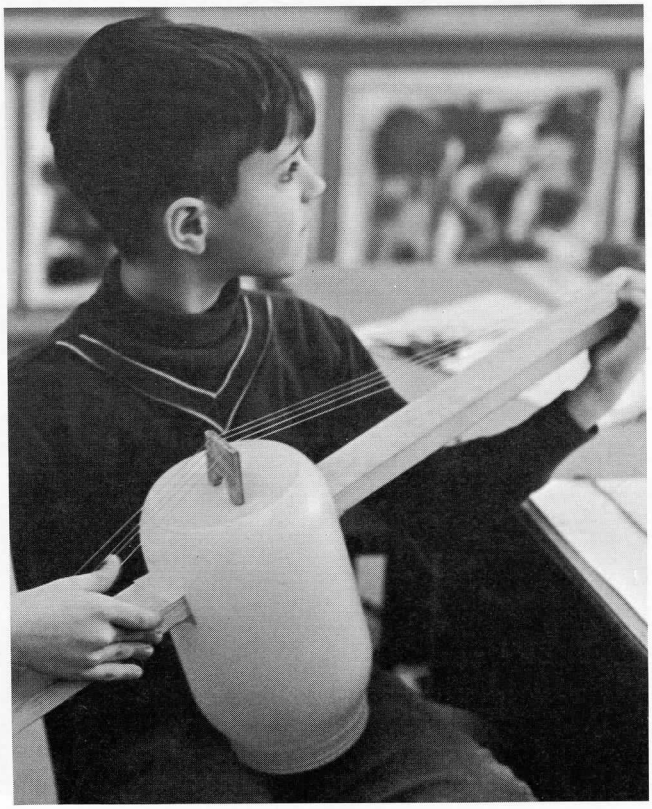
saw

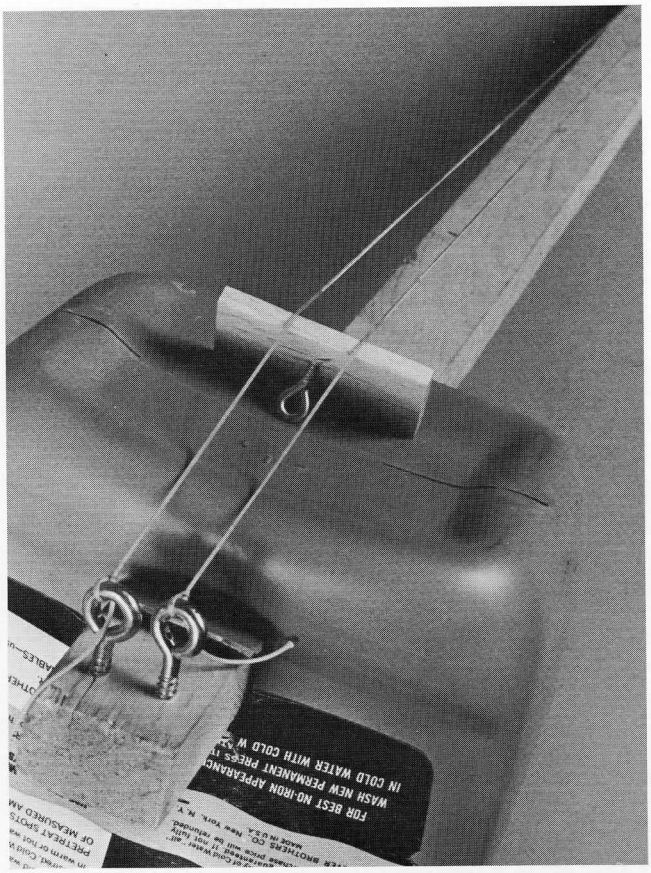
hammer

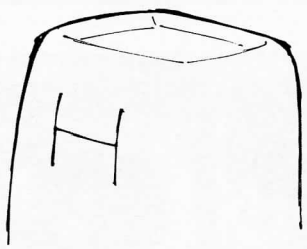
utility knife

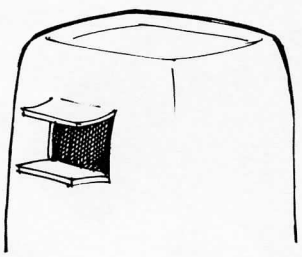
drill (hand or electric)
¼″ bit for drill
} for tuning pegs

* Try other hollow containers, such as cardboard paint buckets or one end of a large mailing tube.









Cut an H-shaped slot the size of the large wood strip starting about 1 inch from the bottom of the plastic bleach bottle. The wood strip should fit tightly into the slot when the sides of the H are folded out.

Make an identical slot in the same spot on the opposite side of the bottle.

Using the large nail to start the holes, insert a screw eye (or a nail) for each string you want near one end of the wood strip. Space the screw eyes evenly. Then slide the strip through the bleach bottle, with the nails or screw eyes turned toward the bottom of the bottle.

Insert the same number of screw eyes or tuning pegs in the other end of the strip. (See page 16 for making tuning pegs.) Then tie fishline tightly between each pair of screw eyes or between the nails and pegs.

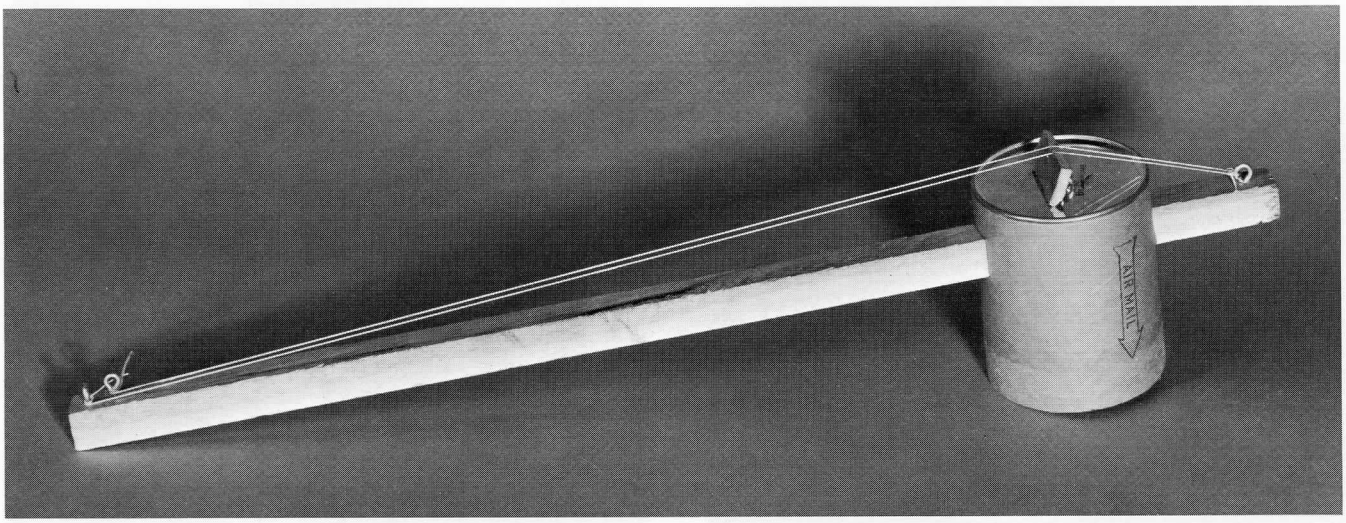
TO MAKE A BRIDGE

Here are two ways to make a bridge:

1. Slide a piece of cork or a small piece of wood propped up with a screw eye between the bleach bottle and the strings (see pictures).

2. Insert a screw eye into the center of a small piece of wood, so that the wood will stand in a slanting position. You may have to make a small notch for each string in the top of the bridge to keep the strings from sliding off.

To tune the strings, tighten or loosen them by turning the screw eyes or pegs on the wood strip. (Use the large nail as a lever to turn the screws or a wooden clothespin for the pegs.)



VARIATIONS ON THE WASHTUB BASS

The washtub bass is a delightful instrument. The classic version employs a washtub for the sound box—hence the name—but other varieties can be made in many sizes out of different materials. All you need is a stick, a string, and a hollow container as a resonator.

Here is one which is inexpensive and easy to make.

MATERIALS

1 gallon cardboard paint bucket

30″ dowel or other stick, $\frac{3}{4}$″ or more in diameter

3′ to 4′ piece of string (Bailing twine is a good kind.)

wooden peg or small piece of dowel (1″ to 2″ long)

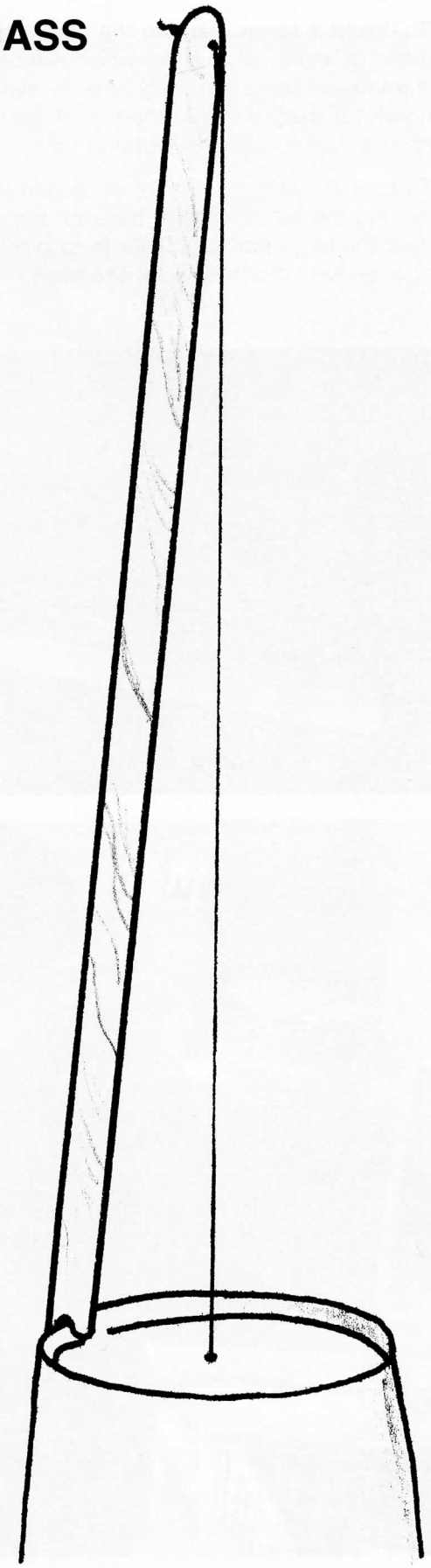
TOOLS

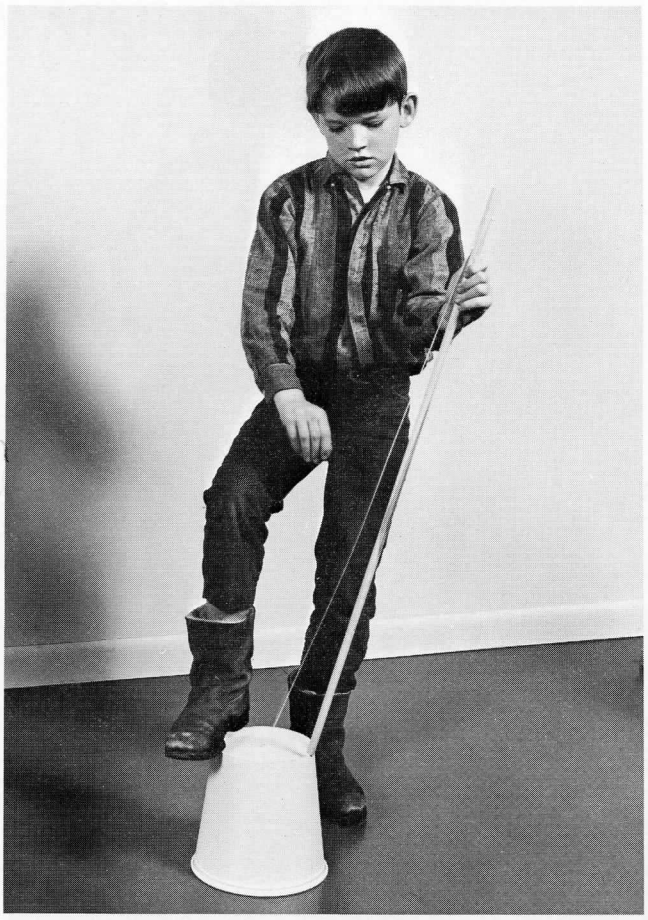
saw

hammer

drill (hand or electric)

$\frac{1}{4}$″ bit for drill





TO ATTACH THE STICK AND STRING

Drill a hole through one end of the stick, about 1 inch from the end. In the other end of the stick, saw a $\frac{1}{8}$-inch groove perpendicular to the direction of the hole. (This groove will hold the lower edge of the stick in position on the rim of the bucket.)

Then tie a small wooden peg or dowel securely to one end of the string. Punch a hole in the center of the bottom of the paint bucket. Thread the string through the hole in the bucket from the inside to the outside. (The peg will act as a brace against the hole.)

Then thread the free end of the string through the hole in the stick, and tie a large knot to hold it securely.

GETTING READY TO PLAY

Hook the notched end of the stick over the rim of the bucket. Brace the bucket by putting one foot on the opposite rim. Pull the stick toward you with one hand to tighten the string, and pluck away with the other!

The pitch of the sound will change when you tighten or loosen the tension on the string by moving the stick back and forth. The pitch also changes when you press the string against the stick with your fingers at different places. The bass will sound more resonant if there is a small hole in the side of the cardboard bucket.

A LARGER VERSION

For a larger version of the washtub bass (producing lower notes), these materials work well:

broomstick or other stick of comparable size

metal washtub, metal wastebasket, 2-gallon oil or turpentine can, or any large tin can

heavy string (Nylon cord or thin clothesline is fine, and bailing twine is excellent.)

The bass will sound more resonant if there is a piece of wood under one edge of the metal tub.

If pressing the string down on the large bass is too hard on your hand, hold a piece of cardboard between your hand and the string as you play.

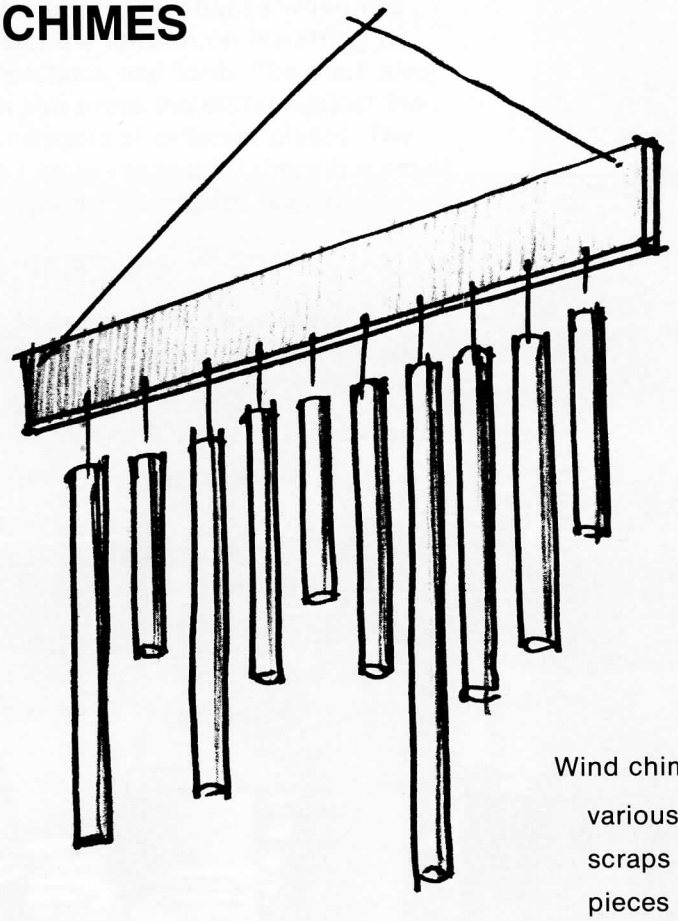
WATER BELLS

Water bells are easy to make. You'll need a supply of water and some drinking glasses or other glass containers that respond with clear ringing sounds when you strike them. Wooden pencils or dowels make good strikers.

Adding water to the containers will change the pitch of the sounds. To get a good range of pitches, you will probably need more than one size of container, since the difference in pitch between a full container and an empty one of the same size is often no more than a few notes.

Water bells are excellent instruments to use for experimenting with pitch changes, and for playing tunes and making up songs, too.

WIND CHIMES



Wind chimes can be made from many materials:

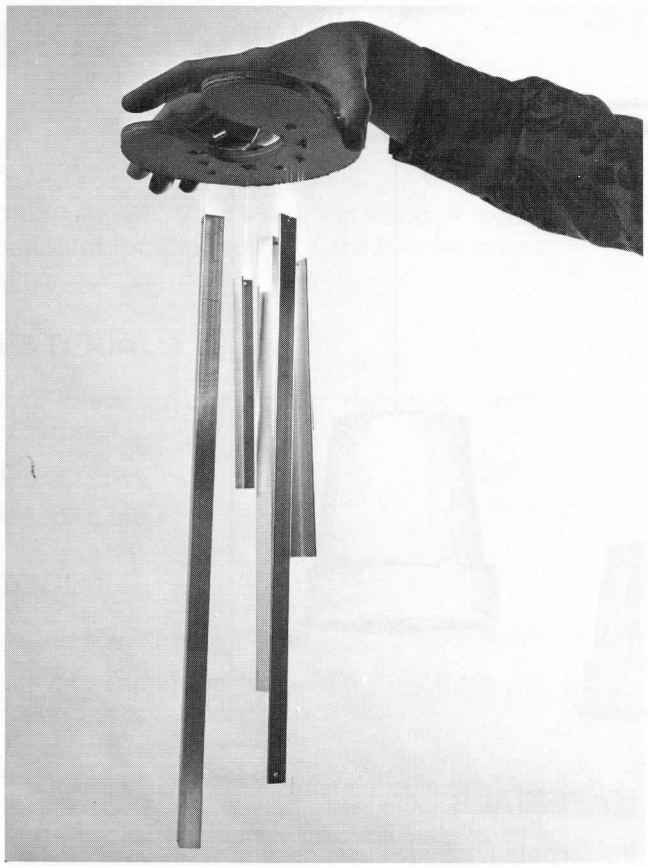
- various kinds of nails
- scraps of metal
- pieces of glass or plastic (Colored glass is beautiful moving in the sunshine.)
- strips of wood
- dowels
- pieces of bamboo
- short pieces of aluminum tubing* and aluminum angle (Both $\frac{1}{4}''$ diameter tubing and $\frac{1}{2}''$ diameter angle make a strong, clear ringing sound.)

Hang the pieces of material you choose, so that they will strike one another when they move.

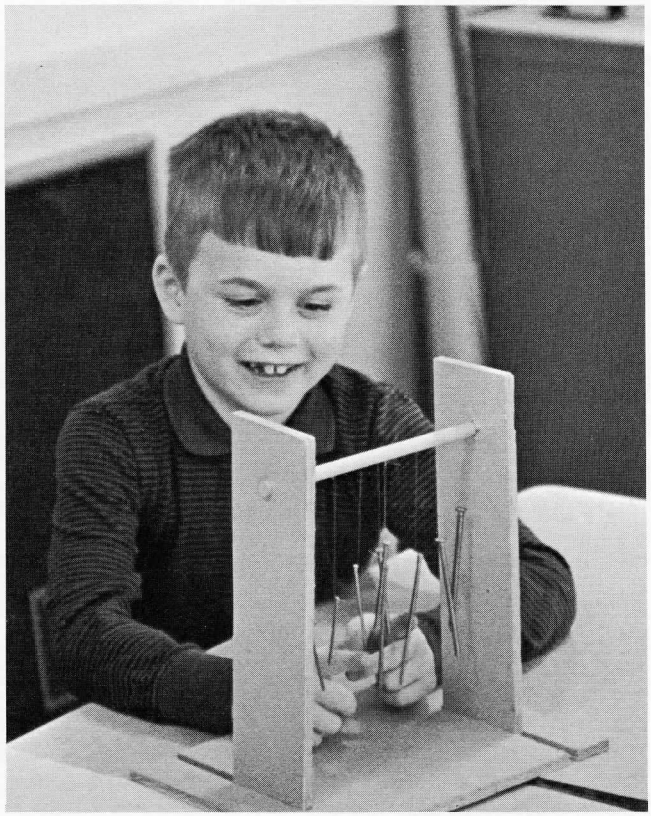
Suspend them from a straight bar or, for more collisions, hang them from a small triangular frame made by nailing three pieces of wood together. They may also be suspended from a circular band made from metal stripping, a small cheese box lid, or an embroidery hoop or from any small piece of pegboard, heavy cardboard, or metal sheeting.

For a variety of sounds, use pieces of several different sizes (the exact dimensions aren't important).

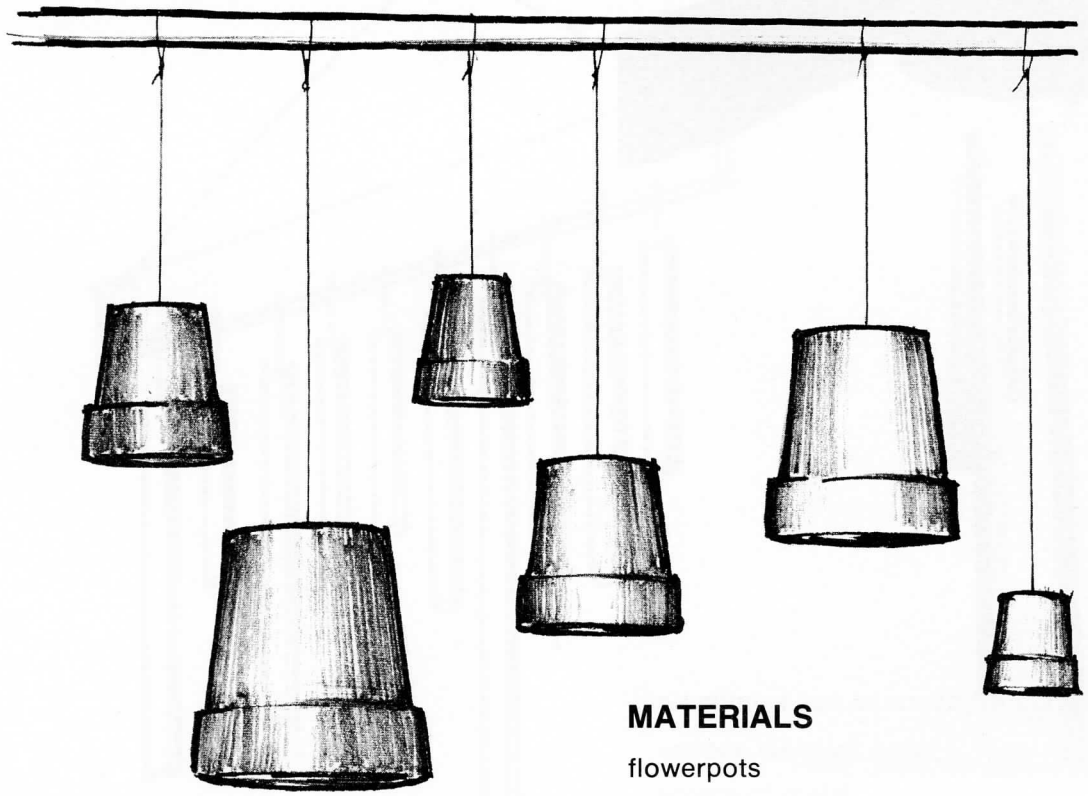
* For a tuned set of chimes from thin aluminum tubing, see page 31.



These chimes are made of aluminum angle.



FLOWERPOT BELLS



MATERIALS

flowerpots

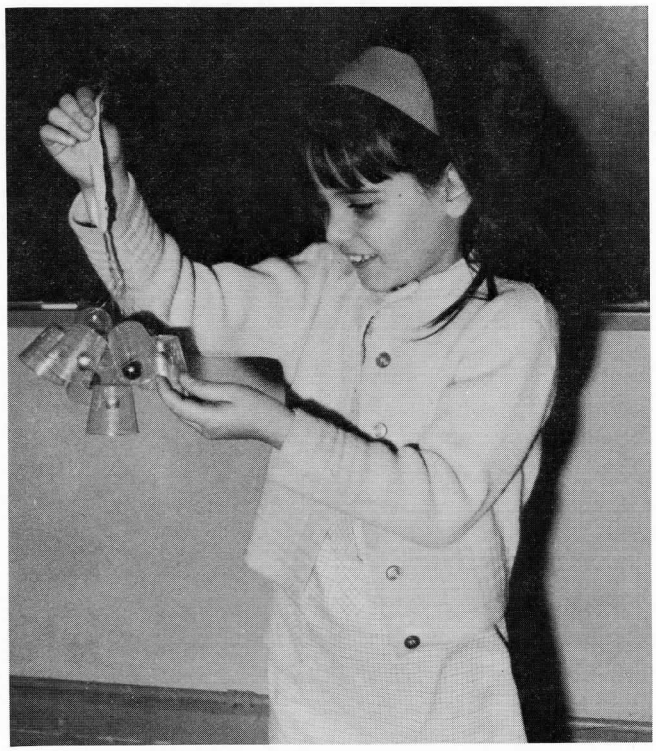
cord

a few popsicle sticks or wood scraps

a pencil or dowel for a striker

Clean, unglazed, earthenware flowerpots make beautiful bells. A number of different-sized pots hung on a cord from a support will give you a range of tones.

If you want a set of bells to play the scale or other pattern, you will need to compare the sounds of several pots to find a group in tune with one another. (Flowerpots of the same size often differ in pitch by as much as one or two scale tones.)



These "jingle bells" are made from plastic cups with small bells attached to wires for clappers.

BE SURE TO TEST THE FLOWERPOTS BEFORE YOU BUY THEM

In a tuned set, duplicates of some of the pots and a few very low tones come in handy for group song playing and for making harmonies.

FLOWERPOTS ARE FRAGILE

Even the slightest crack may spoil the tone (remember the Liberty Bell), so be careful about hitting the pots too hard.

METAL CHIMES

Chimes made from electrical conduit tubing have beautiful tone quality and are inexpensive to make.

MATERIALS

2 10′ pieces of $\frac{1}{2}$″ diameter electrical conduit tubing

string

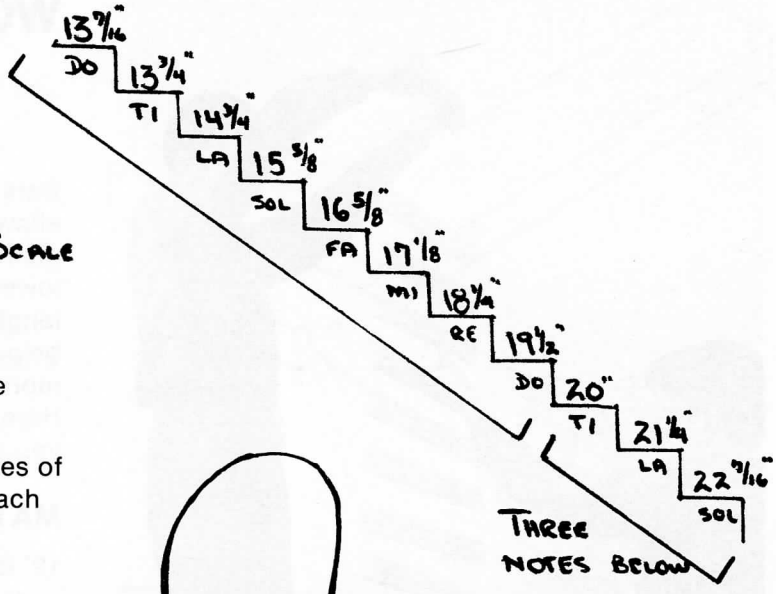
masking tape

TOOLS

hacksaw or tubing cutter*

vise or benchhook for holding the tubing while you cut it (see pages 8–11)

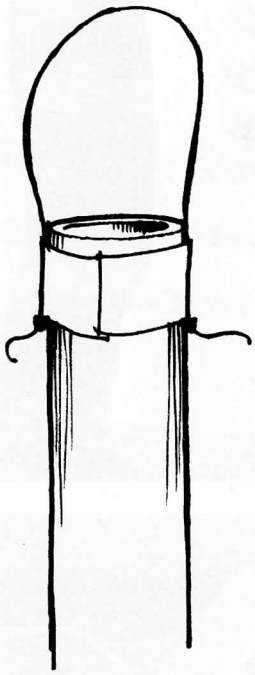
* Hacksaws are often more readily available, but a good-quality tubing cutter is much easier to use and to control. One kind of tubing cutter to purchase is suggested on page 8.



D MAJOR SCALE

Cut one tube of each length shown in the drawing. Measure the tubing carefully before cutting.

Tie double knots in both ends of 8-inch pieces of string. Then attach the string to the top of each tube with a piece of masking tape.†



TUNING THE CHIMES

It is only possible to make the pitch of a tube higher (by shortening it). If the pitch of a tube is too low, trim a little off one end. Test the sound. If the pitch is still too low, trim off a little more.

If the pitch is too high, you'll have to cut another slightly longer piece.

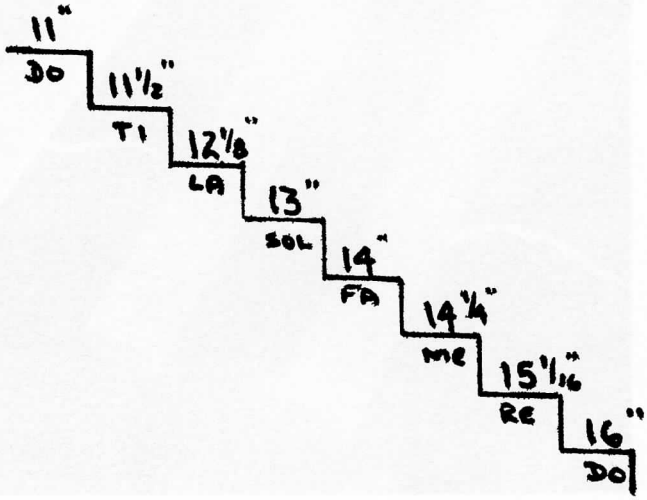
Hang the chimes at a convenient playing height. A classroom map frame does nicely as a support, or you may want to make one especially for the chimes.

If you need hooks to attach the chimes to a support, shower curtain rings, S-shaped drapery hooks, or opened paper clips work well.

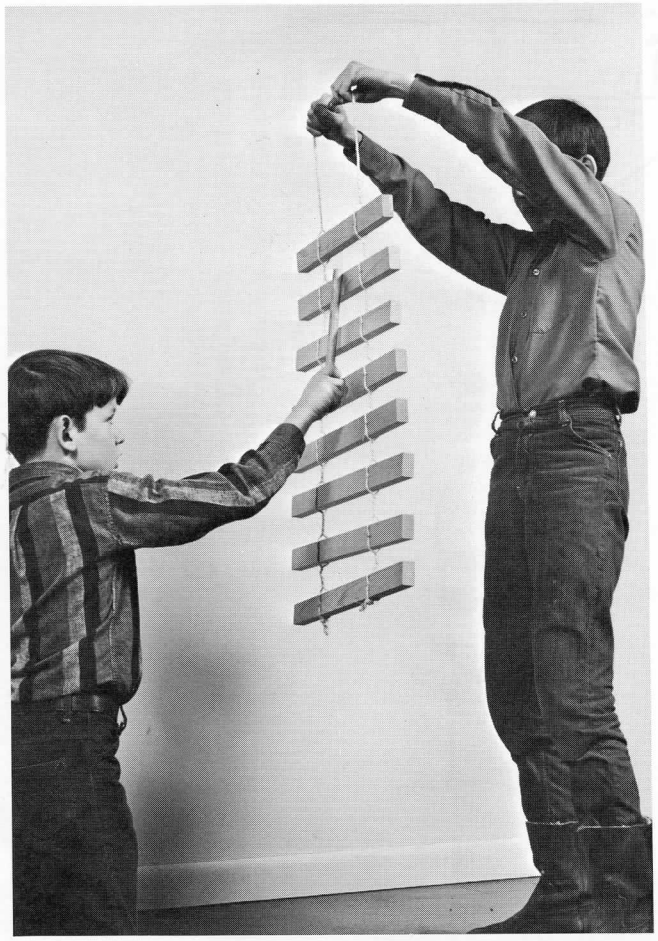
SMALL TUNED CHIMES

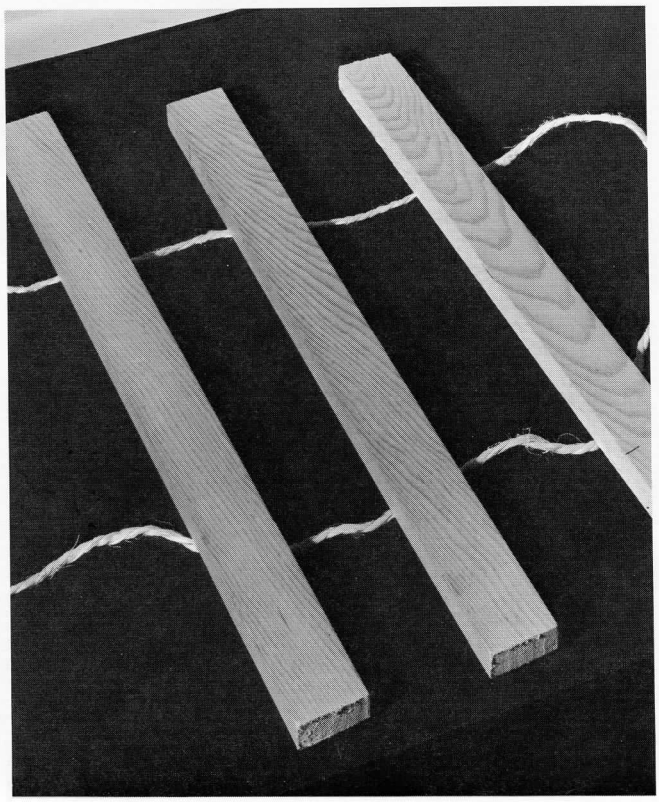
You can make tuned or untuned chimes from narrow tubing or from aluminum angle. The method is about the same as for the larger chimes, except that you use narrower pieces of tape and monofilament fishline to hang the chimes or drill holes in each tube and string them with the monofilament. (Don't use tape on aluminum angle. It spoils the tone.)

For a tuned set of chimes made from aluminum tubing with a $\frac{1}{4}$-inch outside diameter, cut one tube in each of the lengths shown in the drawing.



†If you have a metal drill, you can drill holes at one end of the tube to attach the string. It doesn't spoil the sound.





WOODEN CHIMES

Bars of wood struck with a hard object and allowed to vibrate freely make sounds of definite pitch. As a rule, the longer the piece of wood, the lower the sound it makes. Any group of random lengths will give you a variety of sounds. (See below for ways to suspend the bars.) With a bit more effort, it is possible to make a tuned set. Here are directions for making a set with which you can play an A major scale.

MATERIALS

12′ length of wood, $\frac{3}{4}$″ x $1\frac{1}{2}$″ (sold in lumberyards as 1″ x 2″) Soft woods, such as clear pine, are inexpensive and are easy to work with. *Avoid knotty pine. The knots almost invariably deaden the tone.*

6′ of heavy twine (Sisal or bailing twine works well.)

piece of doweling or other wooden stick for a striker

screw eyes or staples

TOOLS

saw

stapler or hammer

Measure the wood carefully before you cut it into bars, one each of these lengths:

20″	$16\frac{1}{2}$″
19″	$15\frac{1}{2}$″
18″	$14\frac{1}{2}$″
$17\frac{1}{2}$″	$13\frac{1}{2}$″

TUNING

The set of bars will need some fine adjustments to play a proper scale. Here are some suggestions. A convenient way to arrange the bars for comparing the sounds they make is to lay all of them out in order from shortest to longest on a piece of rope or twine. The vibration pattern in a wooden bar is such that there is a node point or "dead spot" about one-quarter of the way in from each end of the bar. If you arrange the bars so that they touch the twine only at these two points, they will be able to vibrate freely and produce a clear tone. (If the twine or the table top

or your fingers touch other places on a bar, the sound may be deadened.)

Start with the longest (20-inch) bar as the low *do*, and tune the other pieces in order. Tune the 19-inch piece so that the first two pieces play *do-re*. Then add the 18-inch piece and adjust it so that all three pieces sound out *do-re-mi*. Continue with each piece until the whole scale is in tune.

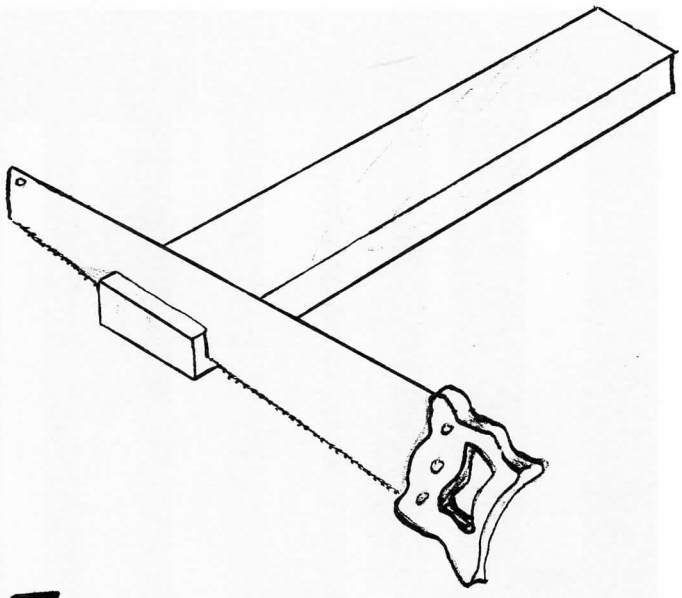
To make the sound of a bar a little higher, saw a bit off one end. *To make the sound lower,* saw a little way into the bar, perpendicular to the length, in the middle of the bar. In both cases, a little cutting can make a lot of difference in the sound, so go easy.

SOME FURTHER NOTES ON TUNING

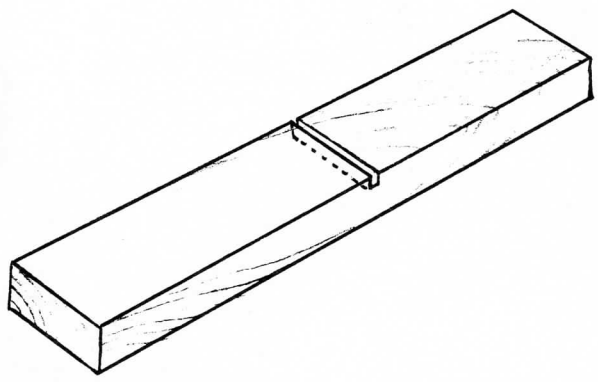
Tune in a quiet place.

Take your time. If you find it hard at first to hear pitch relationships between the bars, keep playing them until their sound is quite familiar to you. Most people's ability to hear pitch differences improves dramatically after they work with an instrument for a time.

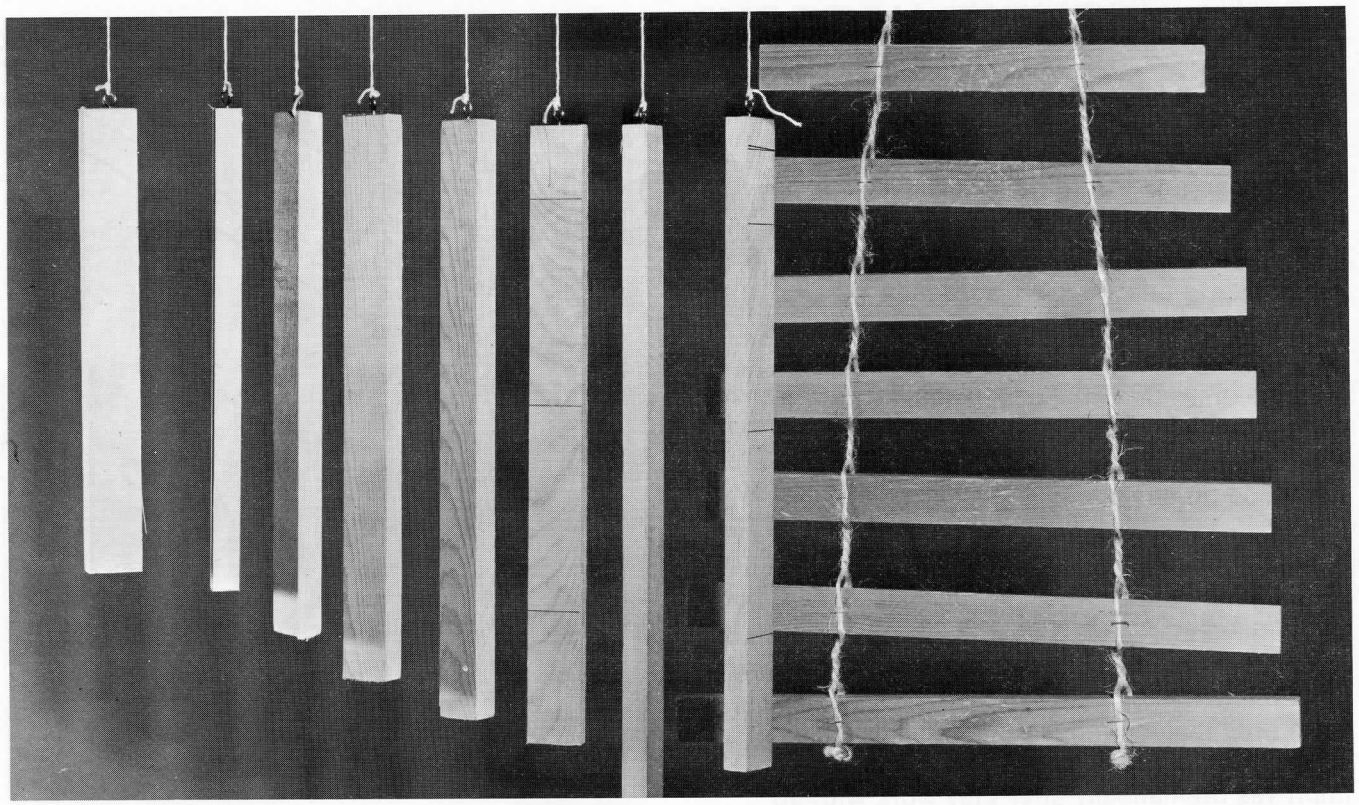
If you can't manage the tuning alone, *ask someone to help you.*



TO MAKE THE SOUND HIGHER, SAW A SMALL PIECE OFF THE END OF THE STRIP.



TO MAKE THE SOUND LOWER, SAW INTO THE STRIP THIS WAY.



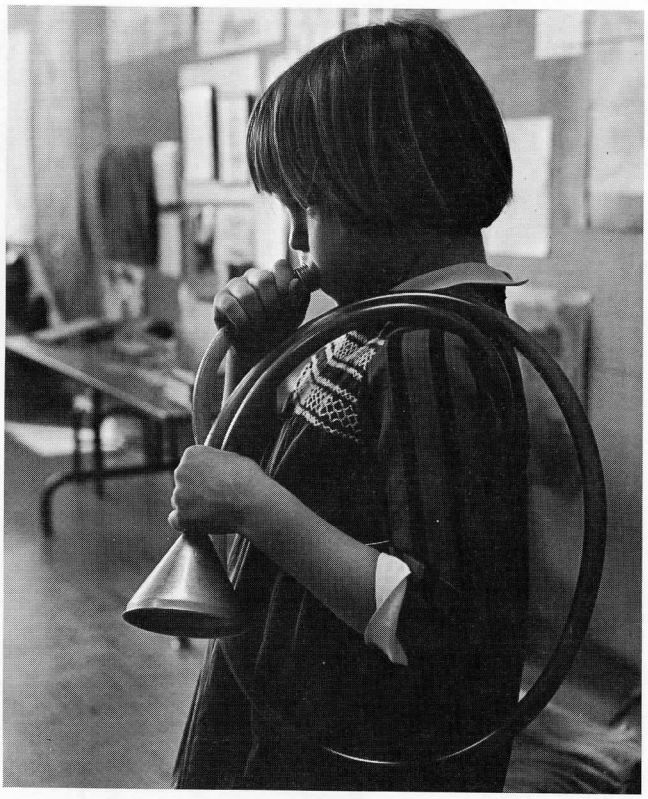
TWO WAYS TO FINISH YOUR INSTRUMENT

1. If you want your instrument to resemble a xylophone, complete it this way. Make a long upside-down U shape out of the piece of twine. Arrange the bars on top of the twine in order—shortest bar at the curve of the U and the longest bar nearest the open end of the U. Insert each bar between the strands of the twine by untwisting the twine just enough to push the bar ends through. The strands of twine should encircle the bars about one-quarter of the way in on each side (at the node points). When all the pieces are in place, the twine can be stapled to the bars of wood.

Tie a knot in the ends of the twine to prevent it from unraveling. The instrument can be laid flat on a table to be played, or it can be carried about or hung from a support and played in a vertical position. Wooden drumsticks, dowels, or mallets (made by gluing a thread spool onto the end of a stick) make good strikers.

2. If you wish to hang the bars like chimes, insert a screw eye in the end of each bar, and thread a length of string through the eye to make a loop. Suspend the bars from a broom handle, a wooden bar, or a classroom map frame.

HOSE HORN



Here is an instrument that you can play like a bugle or use as a talking tube.

MATERIALS

piece of plastic or rubber garden hose (any length)

fairly large plastic or metal funnel

2-oz plastic funnel

masking tape

TOOLS

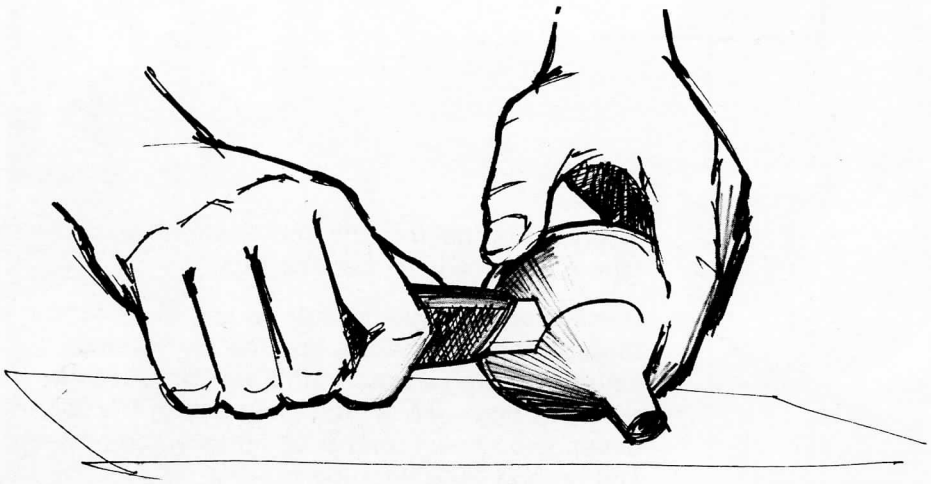
pair of pliers, test-tube holders, or tongs

utility knife

heat source (can of Sterno, Bunsen burner, or gas stove)

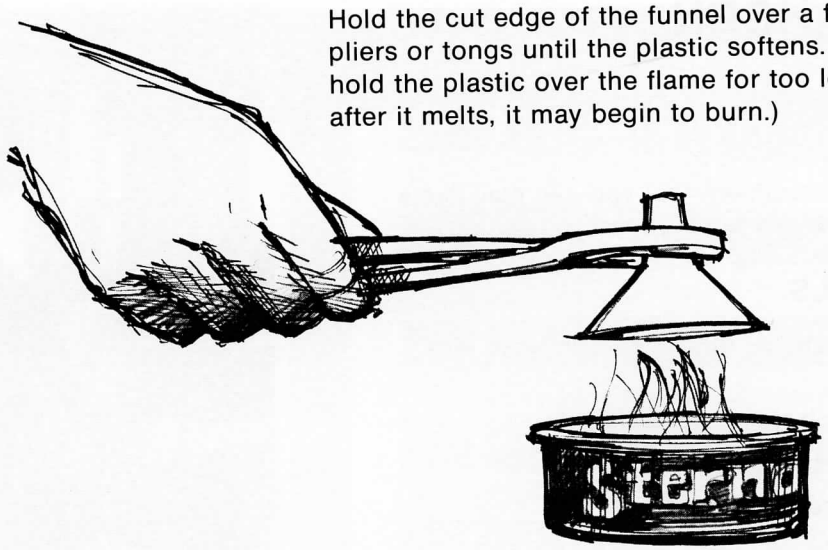
The body of the horn is a piece of garden hose with a funnel inserted in the end. The connector on the end of the hose can be used as a mouthpiece for the horn. You can make a mouthpiece for a piece of hose with no connector from a 2-ounce plastic funnel like this:

Cut the funnel down with a utility knife to about 1-inch length.*

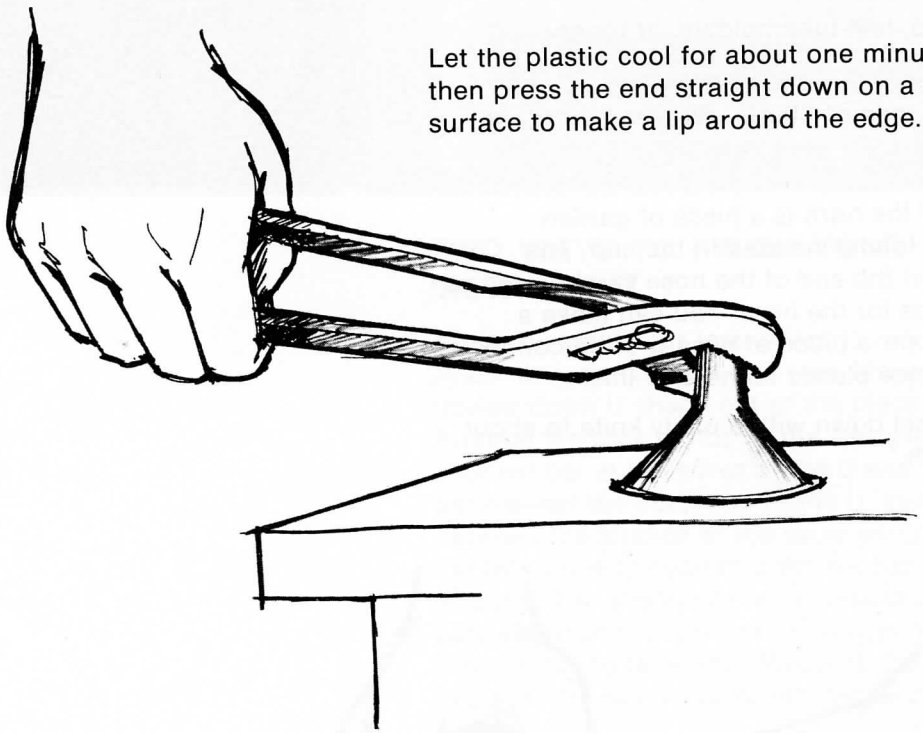


* Cutting stiff plastic with a utility knife can be dangerous. Younger children should have adults or children experienced with the tool do the cutting for them.

Hold the cut edge of the funnel over a flame with pliers or tongs until the plastic softens. (If you hold the plastic over the flame for too long after it melts, it may begin to burn.)



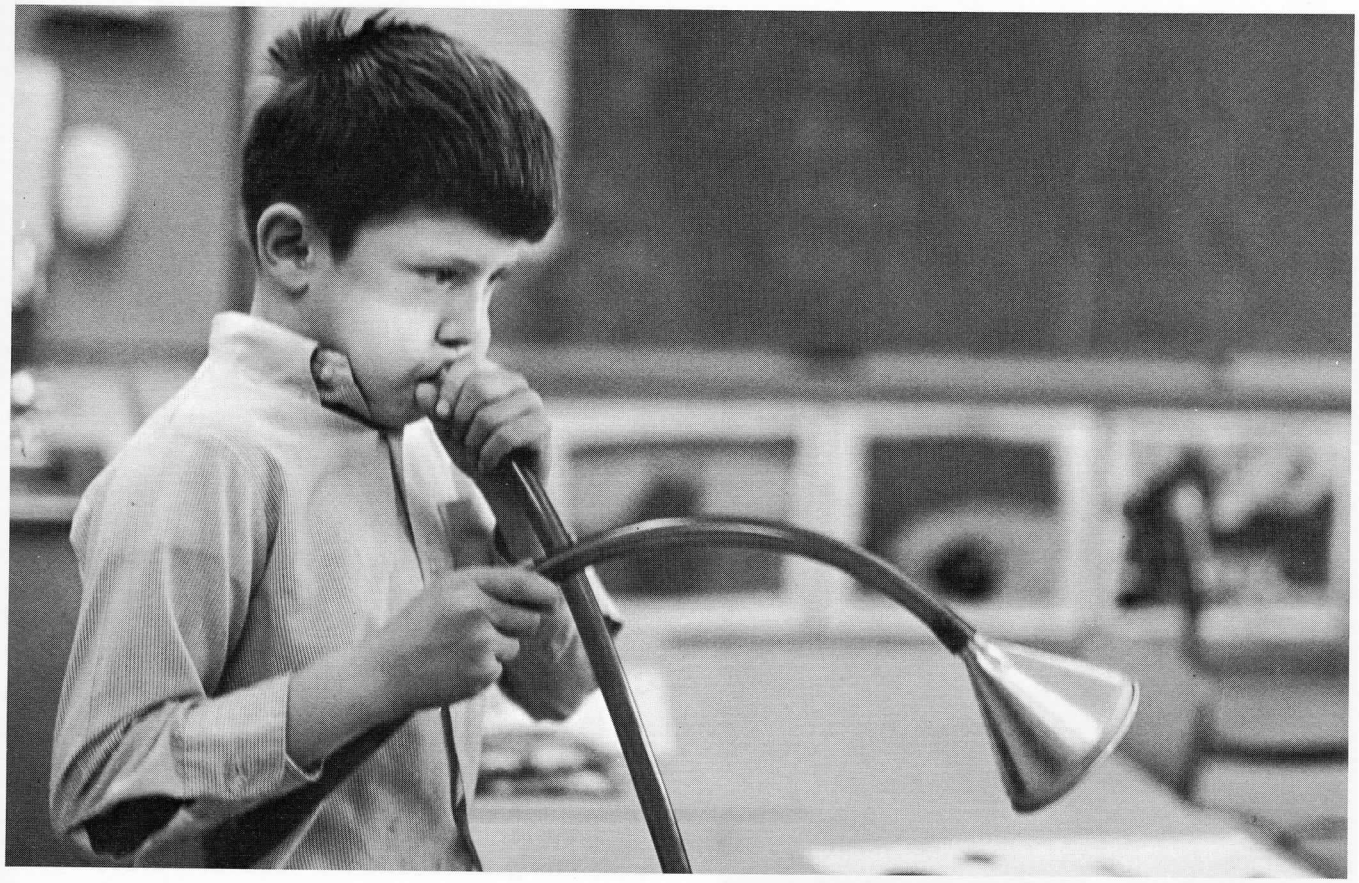
Let the plastic cool for about one minute, and then press the end straight down on a smooth surface to make a lip around the edge.



Insert the funnel into the end of the hose, and tape it in place with masking tape.

Press your lips together tightly, and blow out hard through them to make a buzzing or "razzing" sound. Blowing a horn in this way produces a resonant buglelike sound. The pitch of the sound depends on how tightly your lips are compressed and on how long the tube is.

Don't be discouraged if you don't get a good sound on the first try. You will get the knack of it with a little practice.



GARDEN-HOSE RECORDER

MATERIALS

piece of plastic garden hose, about 12″ long (transparent green hose with $\frac{1}{8}$″ wall works well)

1″ piece of dowel, wide enough to fit *snugly* inside hose

TOOLS

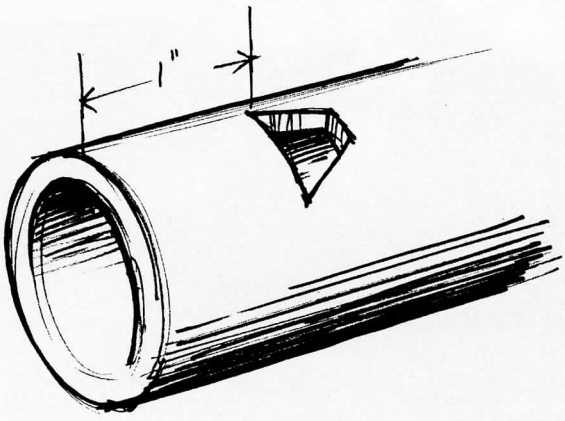
mat knife or utility knife

12″ piece of dowel, which fits *loosely* into hose

coarse sandpaper

CUTTING THE AIR HOLE*

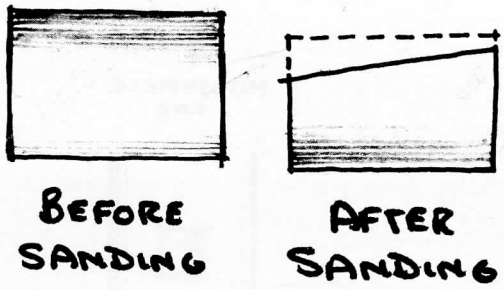
Cut an air hole like the one below, 1 inch from the end of the piece of hose. (You may want to trace the pattern and mark it on your hose.) It's much easier to cut the hose if you put the long *loose-fitting* dowel into the hose for a brace.



* Cutting a neat hole in plastic with a utility knife is difficult for young children. Adults or older children experienced with the tool should do the cutting for them.

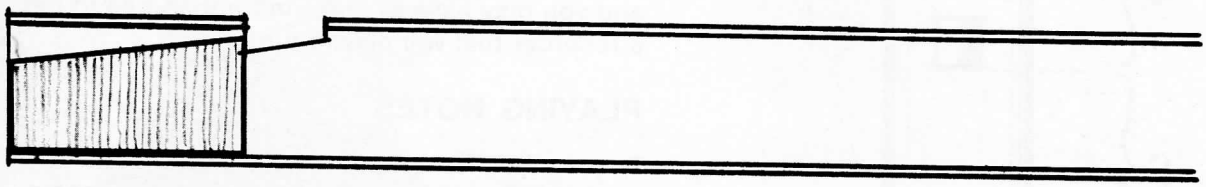
MAKING THE MOUTHPIECE PLUG

With the sandpaper flat on the table, sand the dowel until you have a smooth, flat, slanting surface along one side.



MAKING THE RECORDER PLAY

When you have sanded the plug, put it into the end of the recorder so that the sanded surface slants *up* to the air hole as shown.



If you are very lucky, you will blow a clear note right away.

If the recorder doesn't play well at first, try moving the plug backward or forward a little in the tube.

If it is hard to blow, the plug probably needs more sanding.

If there is a large air passage but the recorder still doesn't play, you may need to make the slant of the plug steeper.

If you have sanded the plug too much, you may need to get another piece of dowel and start over. However, don't start over until you have tried everything else.

MORE NOTES

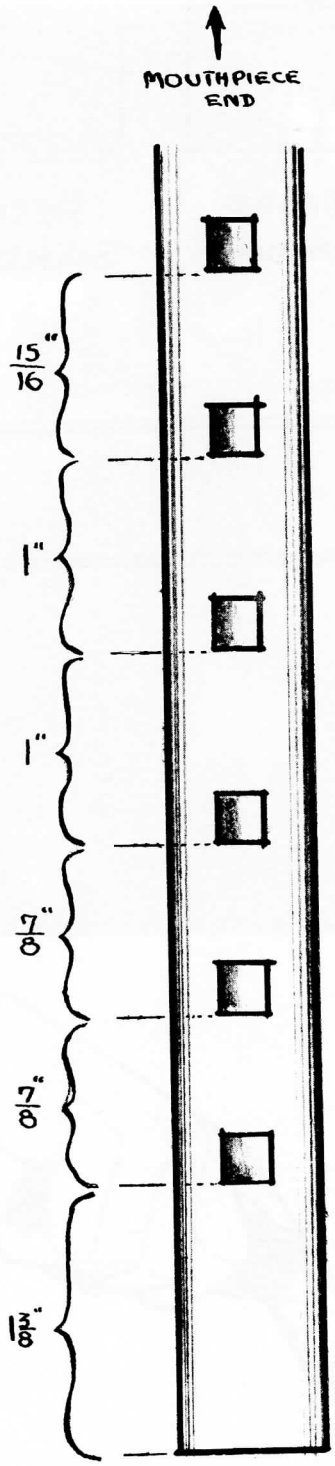
When your recorder will play one note nicely, you may want to make note holes.

First, just try blowing your recorder very softly, then harder and harder. See how many notes you can get simply by blowing in different ways.

Then insert the long loose-fitting dowel into the hose again at the end opposite the mouth-piece.

With your utility knife, make a $\frac{1}{4}$-inch square hole about $1\frac{1}{2}$ inches from the end of the hose.

Play the recorder while you cover and uncover the hole. Then add as many holes as you like, keeping them about 1 inch apart. With each new hole, play the recorder to see how it sounds.



A RECORDER TUNED TO THE MAJOR SCALE

To make a recorder that will play a scale involves precise work.

Use a piece of hose exactly $12\frac{3}{8}$ inches long with a $\frac{1}{2}$-inch *inside* diameter. Make all the note holes $\frac{1}{4}$-inch square, and place them as shown in the drawing.

Don't be discouraged if your first attempt isn't perfect. This is a hard instrument to make, and you may have to make more than one to get a recorder that will play in tune.

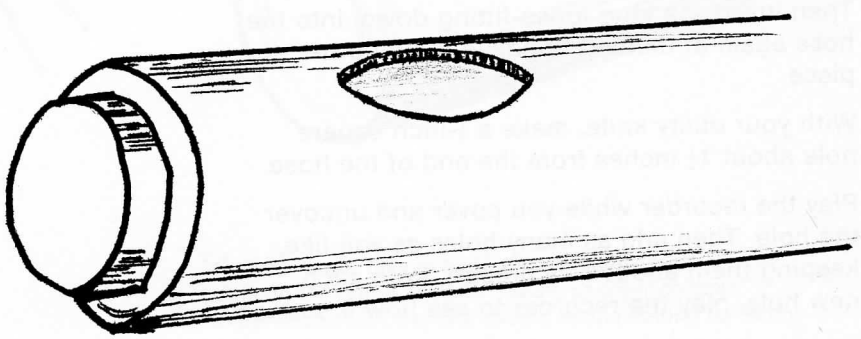
PLAYING NOTES

To play the first note of the scale, cover all the holes and blow softly. For the next six notes, remove one finger at a time, starting from the lower end of the tube. To get the highest note of the scale, replace all your fingers on the holes, and blow a little harder than you did before.

VARIATIONS

Any kind of fairly stiff tubing can be used to make a recorder. Simply make sure that you have a dowel for the mouthpiece that fits snugly into the tube. Use the pattern on page 38 as a model for your air hole, making adjustments for differences in diameter (wider hose, bigger air hole). It's best to make the air hole a little bit on the small side and then enlarge it if necessary.

A length of hula hoop will make a simple flute. Cut a piece about 12 inches long, and make a shallow hole about 1 inch wide about 1 inch from one end. Plug the end near the hole with a cork or a piece of dowel. Blow across the edge of the hole—as you would blow on a soda bottle.



SLIDE WHISTLE

MATERIALS

stiff plastic tubing, 12″ or longer

piece of dowel, 1″ long which fits snugly inside tube (for mouthpiece)

thinner piece of dowel, about 2″ to 3″ longer than tube (for slide)

small scrap of plastic household sponge, about $\frac{1}{4}$″ thick

Elmer's Glue-All or equivalent

TOOLS

utility knife, mat knife, or scissors for cutting tubing

coarse sandpaper

piece of dowel, at least 4″ to 5″ long, to fit loosely inside tube

MAKING THE SLIDE

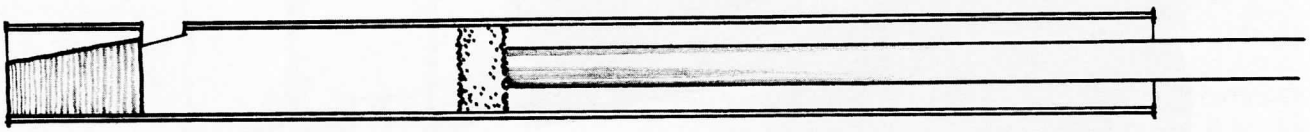
Cut a circle out of sponge slightly larger than the diameter of your tube. Then glue the sponge circle to the end of the dowel to make a plunger. (Let the glued plunger stand for at least half an hour before you try to use the slide.) The sponge circle should fit tightly inside the tube. If it is too tight a fit to slide evenly, trim a little from the edges.

MAKING THE MOUTHPIECE AND THE AIR HOLE

This is the same as for the garden-hose recorder (see pages 38–39).

MAKING THE WHISTLE PLAY

When you have sanded the plug so that it looks like the one in the diagram, insert it into the mouthpiece end of the tube. The flat surface should slant up to the air hole. When your whistle is finished, it should look like this:



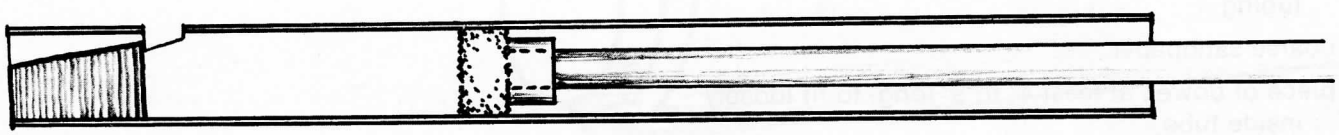
You can make different notes by blowing harder or softer, and by moving the slide in or out.

A DIFFERENT KIND OF SLIDE

You can make a very sturdy slide by using two pieces of dowel instead of one—a short piece which is almost as wide as the tube and a long, thinner piece.

Drill a hole in the center of one end of the short piece, just big enough to hold the end of the thin dowel.

Glue the dowels together, and then glue the sponge circle onto the end of the thick dowel. (Allow time for the glue to dry.) Your slide will now look like this:



"ROLL-YOUR-OWN" VARIATION

Make a "roll-your-own" slide whistle, with a piece of fairly stiff (but still flexible) plastic sheeting, about 12 by 3 inches, and a 15 inch piece of dowel, $\frac{3}{4}$ to 1 inch in diameter.

Using this pattern, make an air hole an inch from one end of the plastic sheet.

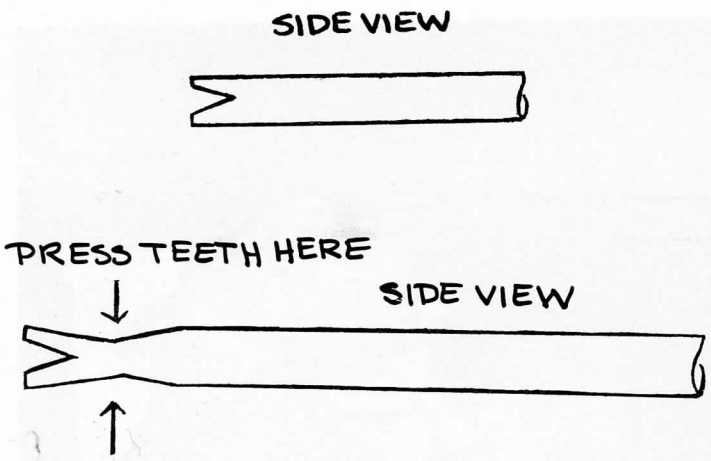
Then simply roll the plastic sheet around the dowel to form a tube. Adjust the plastic until the dowel slides fairly easily in the tube. Tape the tube together with masking tape to fix the shape.

Cut a 1-inch piece from the dowel for the mouthpiece plug. (To make the mouthpiece plug, look on page 39.) Use the rest of the dowel as the slide.

STRAW REEDS

Straw reeds are easy instruments to make. All you need is a drinking straw or two and a pair of scissors.

Take a plastic or paper drinking straw (plastic works better), and flatten a section about $\frac{3}{4}$ inch long at one end. With a reasonably sharp pair of scissors, cut the two sides of the flattened portion. The end of the cut straw looks like this:



From the side, the cut straw will look a little like the open mouth of an alligator.

To play the straw reed, put the end of the straw into your mouth, press the straw between your teeth at a point a little beyond the end of the cut, and blow!

You should get a buzzing sound from the straw reed. If you don't get a sound at first, you can vary the pressure of your teeth and the position of your teeth on the straw. Eventually, you will make a sound. When you have made the sound once, it will be much easier for you to do it again.

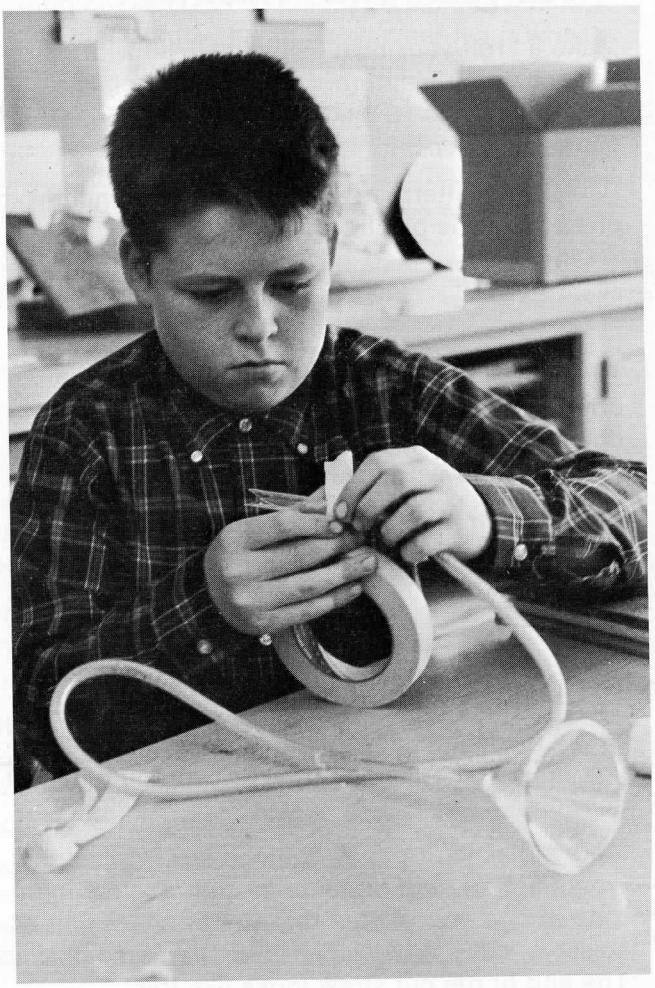
Try cutting off bits from the end of the straw while you blow, and listen to what happens . . .

or . . .

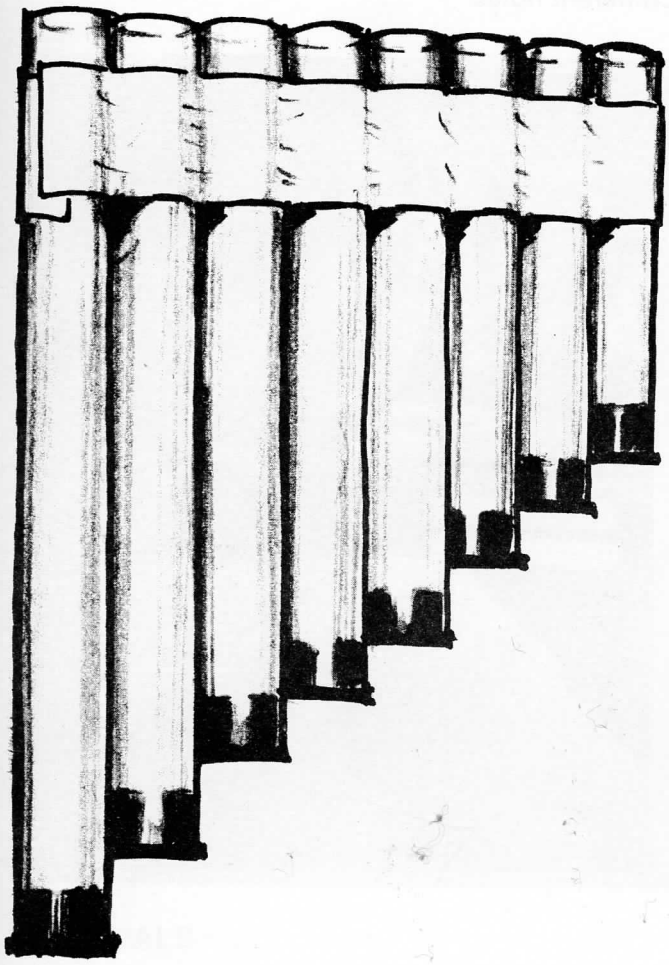
Make a slide from a longer or shorter straw to change the length of the tube and its pitch . . .

or . . .

Combine short straw reeds with longer pieces of tubing to make much longer horns and pipes.



PANPIPE



The panpipe, a very ancient instrument, has traditionally been made from reeds or bamboo. Here is a twentieth-century version.

MATERIALS

stiff plastic tubes from $\frac{3}{8}$″ to 1″ in diameter* (The set of pipes below takes about 5 feet of $\frac{5}{8}$-inch diameter tubing.)*

caps which fit snugly in the tubes* (one for each tube), or some other tight plug

masking tape

TOOLS

sharp scissors or utility knife

ruler

If you blow across the open end of a plastic tube which is closed at the other end, you get a clear sound of a definite pitch. The longer the tube, the lower the sound; the shorter, the higher.

Make a set of pipes from random lengths of tubing. Or, if you prefer, cut a set which plays a G major scale, by using the following dimensions (for plastic tubing $\frac{5}{8}$ inch in diameter).

Do $8\frac{3}{8}$″	Sol $5\frac{3}{8}$″
Re $7\frac{1}{2}$″	La $4\frac{3}{4}$″
Mi $6\frac{1}{2}$″	Ti $4\frac{1}{4}$″
Fa 6″	Do 4″

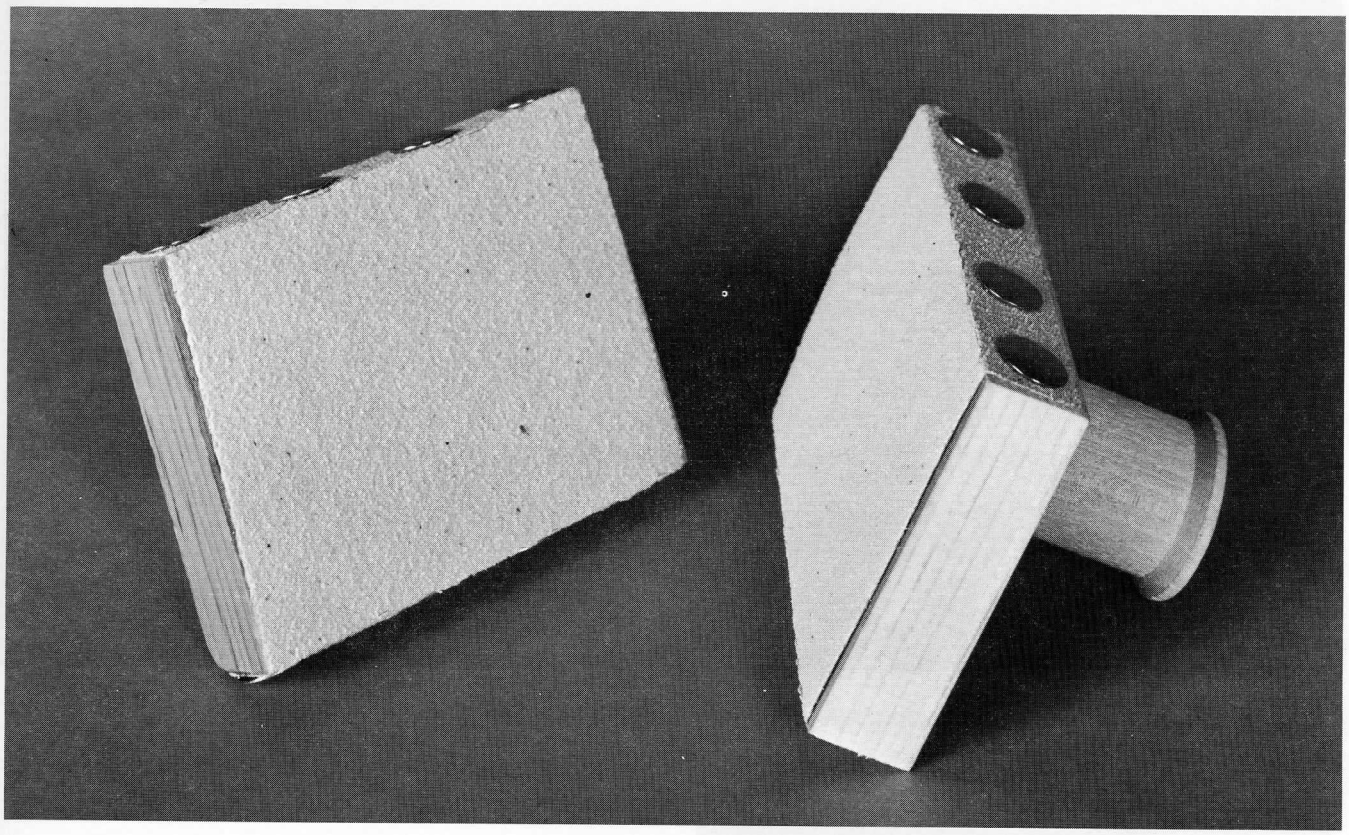
You may need to make some fine adjustments in length to tune the pipes exactly, so cut the tubes on the generous side to allow extra for trimming if you need it. Taping the pipes together with the open ends on the same level, makes them easy to play.

* For suppliers, see page 12.

OTHER POSSIBILITIES

Many kinds of stiff, thin tubing can be used for panpipes. Also, soda bottles or test tubes filled with water to different levels can be tuned to play different notes.

SAND BLOCKS



MATERIALS

2 small blocks of pine or other soft wood about 1″ x 4″ x 5″ (The exact size is not important.)

sandpaper or emery paper

thumbtacks

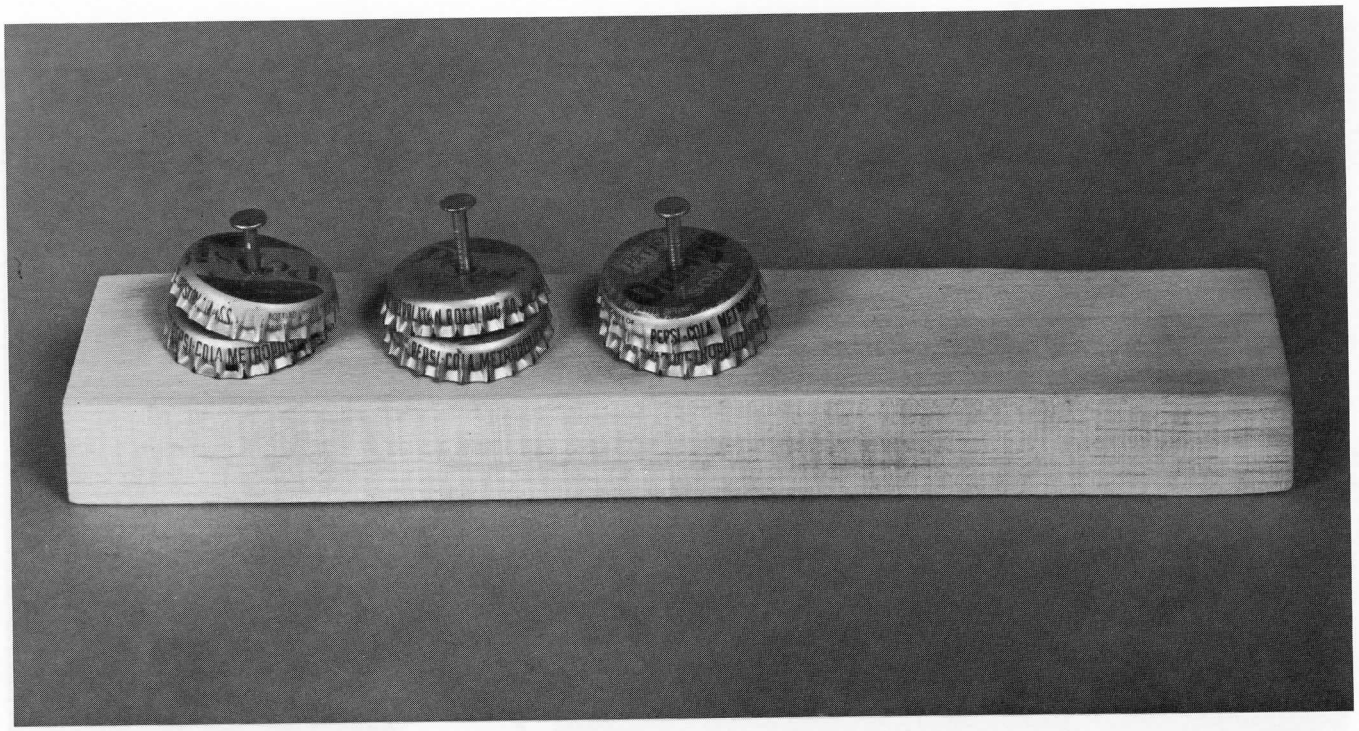
thread spools and glue, or knobs and screws

Cover one surface of each block with sandpaper, bring it up over the sides, and fasten it on with thumbtacks.

For handles, glue an old thread spool to the plain side of each block, or buy knobs at a hardware store and attach them with screws.

Note: Different grades of sandpaper and emery paper will make different sounds. You can test the sound by rubbing two bits of the paper together before you tack it to the wood. Make more than one kind of block for a variety of sounds!

WOOD-BLOCK TAMBOURINE



MATERIALS

6″ block of wood, about $\frac{3}{4}$″ x $1\frac{1}{2}$″ (called 1″ x 2″ at lumberyards)

bottle caps

nails with wide heads

TOOLS

hammer

sandpaper (to smooth rough edges)

Remove the cork from the bottle caps. Hammer a nail through the bottle caps partway into the wood block.

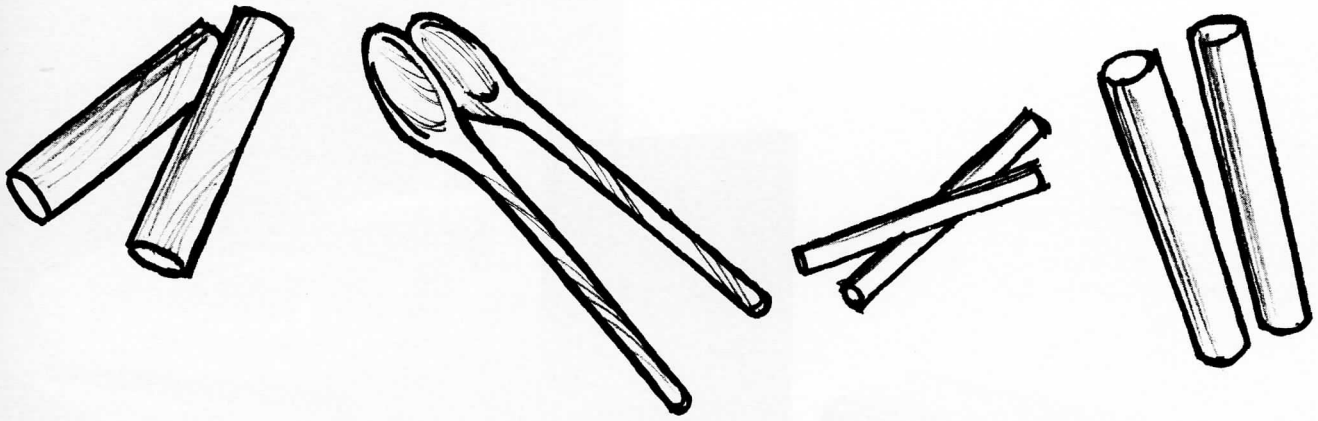
Make sure that the hole in the bottle cap is wide enough for the cap to slide freely along the nail.

Use as many nails and as many caps on each nail as you like.

Shake the tambourine or slap the wooden side against your hand or your knee to play it.

This tambourine is made of Tri-Wall cardboard covered with carpet scraps.

RHYTHM STICKS



MATERIALS

pieces of doweling

TOOLS

saw

sandpaper (to smooth rough edges)

Dowels make good rhythm sticks when hit together. Thin dowels make a different sound than thicker ones do. Short dowels don't sound the same as long ones.

Make pairs of rhythm sticks in different widths and lengths for a variety of sounds—8 to 10 inches is a good average length.

Decorate the sticks, if you wish, with paint or varnish.

OTHER POSSIBILITIES

wooden spoons

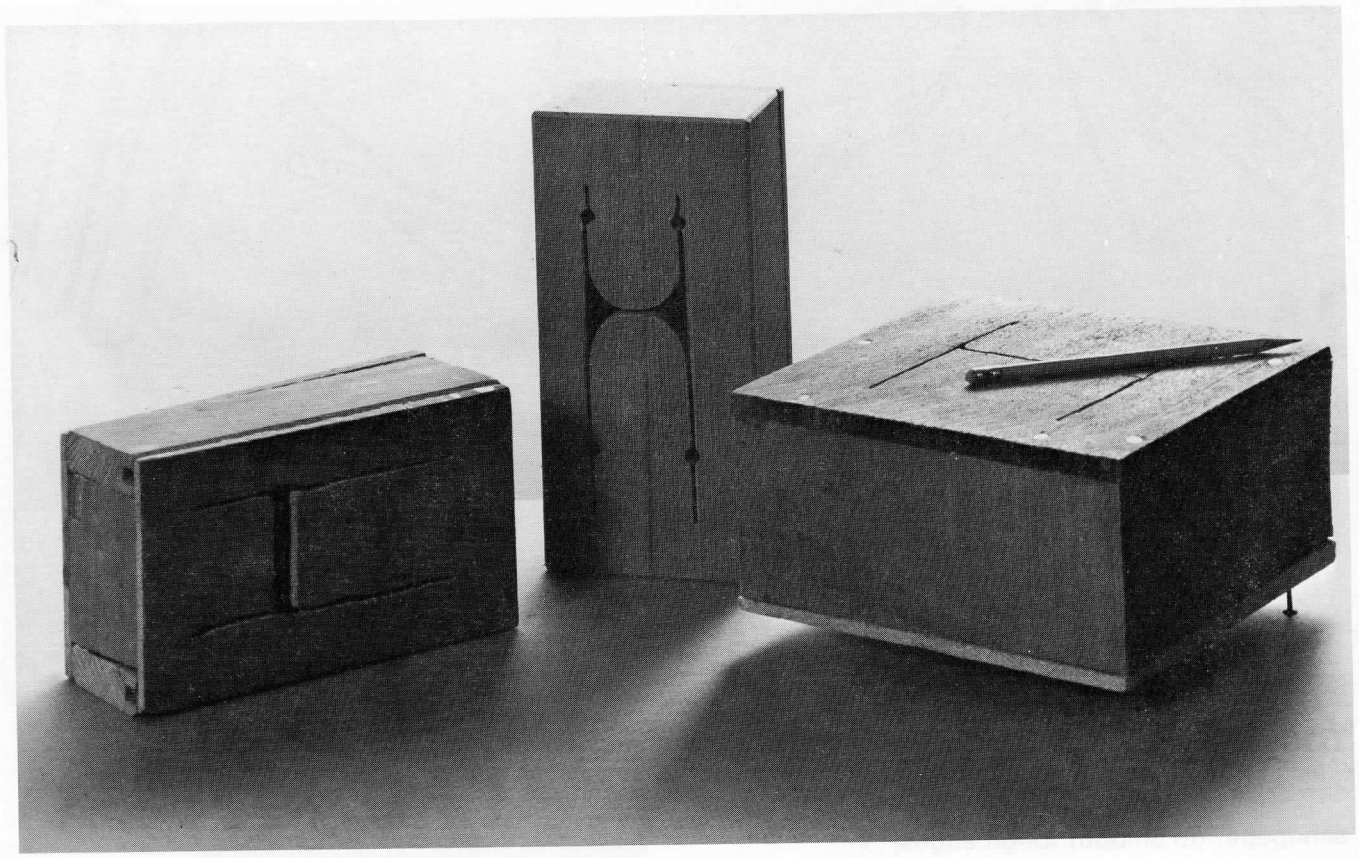
pieces of bamboo

sticks cut from broom handles

stiff plastic tubing

dried and smoothed rib bones (the kind that are left over after you've eaten short ribs or spare ribs)

SHINGLE-BOX DRUMS



MATERIALS

2 wooden roofing shingles (or other thin wood) for the top and bottom

wooden boards, about $\frac{3}{4}$" thick (Ask for 1" stock in the width and length you need for the sides of your box.)

nails

TOOLS

saw

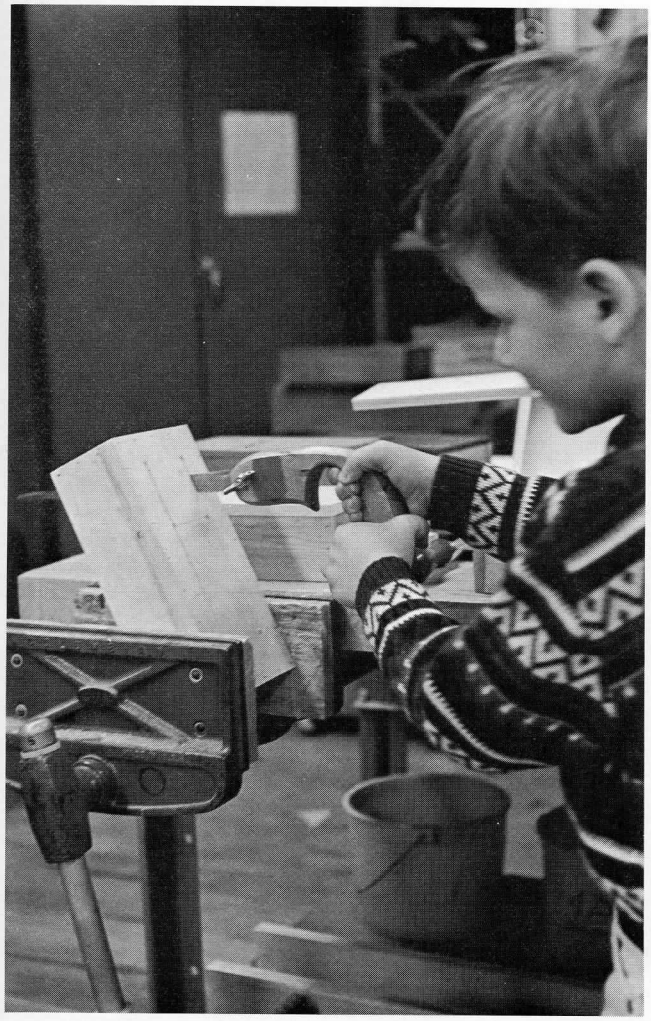
keyhole saw

Elmer's Glue-All

hammer

drill and $\frac{1}{4}$" bit

Make a box with pieces of shingle for the top and bottom, and $\frac{1}{2}$ to $\frac{3}{4}$ inch wide boards for the sides. (Some people have made box drums without bottoms which have good tone.) Then cut a fairly



large H shape into the top of the box with the keyhole saw. (Drill a hole or two in the top first for inserting the saw point.) The boxes in the photograph will give you an idea of how large an H to cut in your box.

Cut the crossbar of the H *off-center* to make two *unequal*-length flaps of wood for different tones.

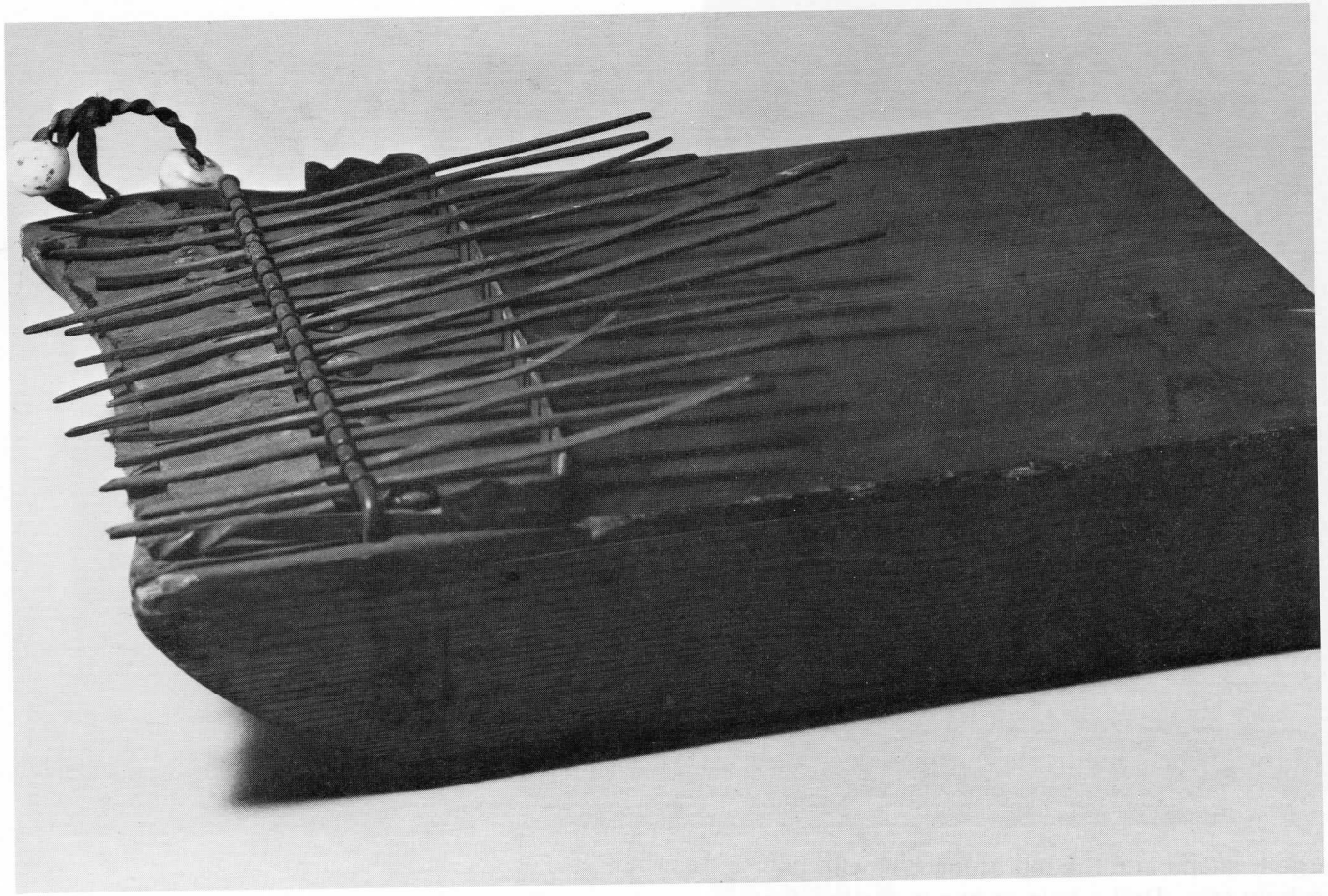
The eraser end of a pencil makes a good drumstick for hitting the flaps.

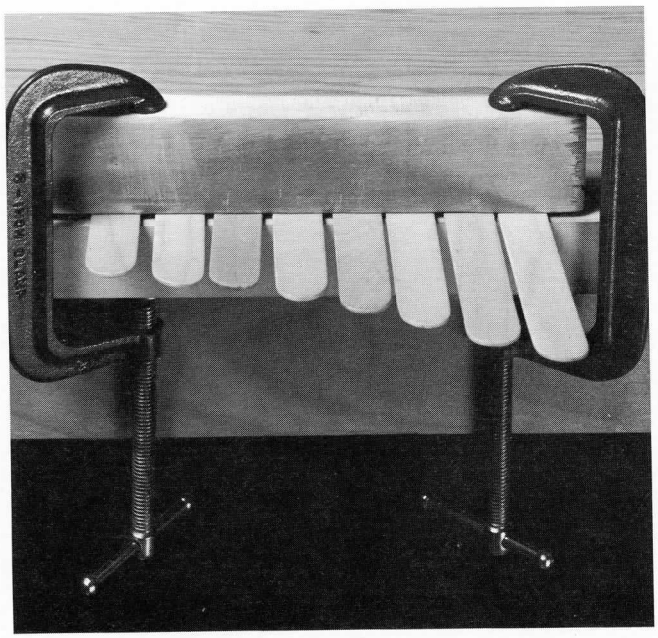
Insert thumbtacks or maptacks, or hammer nails partway into the bottom of the box in each corner. This raises the box off the table surface and allows it to make a richer sound.

The large box in the photograph is $8\frac{1}{2}$ inches square on the top and bottom. The sides are $\frac{3}{4}$ inch thick and $3\frac{1}{2}$ inches wide.

The smaller boxes are 8 inches long and $4\frac{1}{2}$ inches wide on top and bottom. The sides are $\frac{3}{4}$ inch thick and $2\frac{1}{2}$ inches wide.

TONGUE-DEPRESSOR FINGER PIANO





Above is an authentic African "thumb piano." Here's one version that is quite easy to make.

MATERIALS

6 or more tongue depressors

block of wood, about 8″ long

2 C-clamps (about 4″ size)

Arrange the tongue depressors across the edge of a table, so that each one sticks out to a different length.

Put the block of wood over the tongue depressors, and fasten it to the table with C-clamps.

Tighten the clamps until there is no rattle or buzz when the "piano" is played.

To change the sounds, loosen the clamps and alter the overhanging lengths.

VARIATIONS

You can make portable finger pianos, too.

Materials
wooden roofing shingles

or $\frac{1}{2}$ gal cardboard paint bucket

Elmer's Glue-All

5 tongue depressors

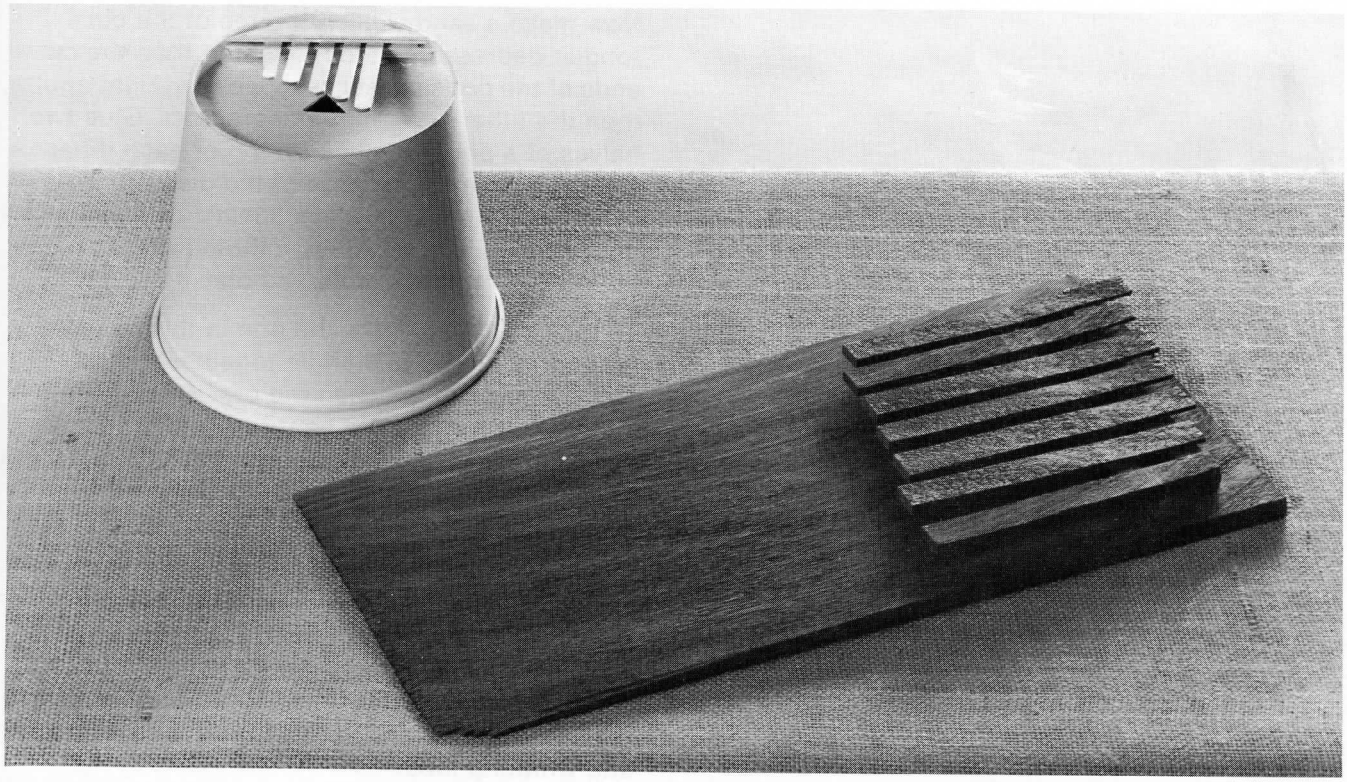
7 or 8 popsicle sticks

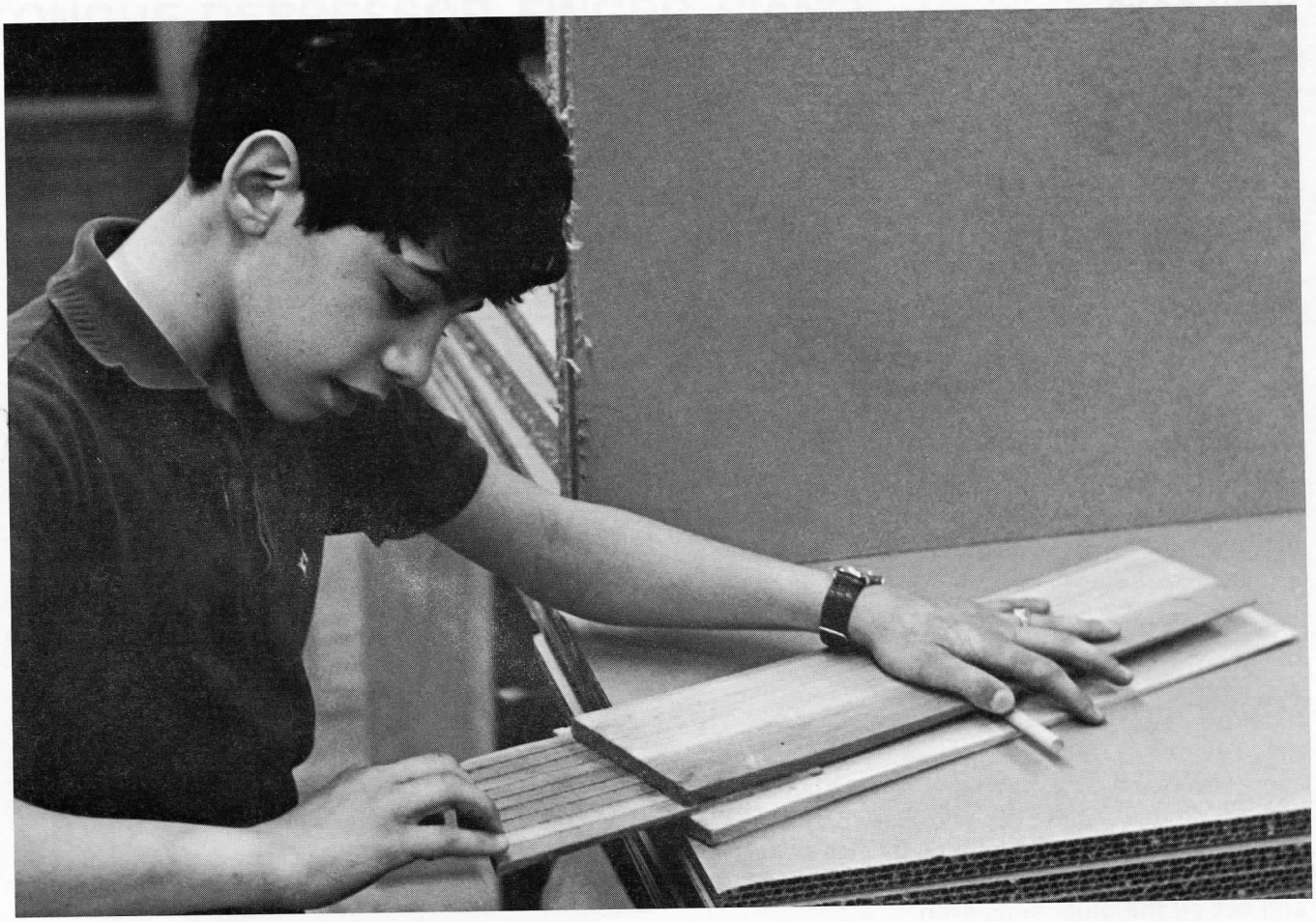
Tools
single-edge razor blade or utility knife

sandpaper

The "piano" on the right in the picture is made of strips of wooden roofing shingle glued onto other shingle strips. These are then glued together and glued onto a whole shingle as a base.

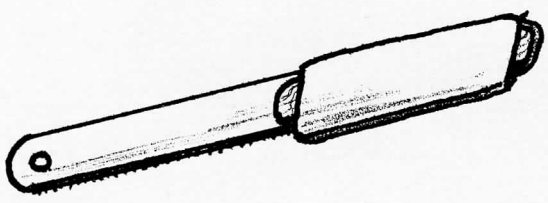
The one on the left uses an upside-down paint bucket, with a little hole cut in it, as a resonator and support. Cut one of the tongue depressors to fit across the bucket, just touching the inside rim. You can cut it with a knife or razor blade or score it top and bottom so that it will break off clean. Use this tongue depressor to mark the other four for cutting. Then line up five popsicle sticks so that they stick out different amounts, and cut off the other ends even.





Now make a sandwich with three of the cut tongue depressors glued together, then the cut ends of the popsicle sticks glued in at right angles, then the other two tongue depressors. Glue two halves of a popsicle stick on top of each other and under the finger edge of the piano to prop it up. Glue the piano in place against the rim of the bucket, tape it to the sides to hold it firm, and let it dry overnight before you play it.

To make a "piano" like the one in this picture, glue three pieces of shingle together with one sticking out between the other two. Then cut strips in the middle board to make the keys. The thin dowel between the two back pieces gives the instrument a richer tone.



You can tune all the finger pianos by trimming the wooden strips with a little hacksaw blade "minisaw." One end of the hacksaw blade is covered with tape wrapped around two popsicle sticks for a handle. This tool costs very little to make (an 8-inch hacksaw blade costs about 10 cents) and is good for all sorts of small-size sawing and whittling jobs.

RATTLES

Any container that can be sealed and easily shaken will make a rattle, and any material that will move freely inside the container completes the job.

Both the container (its size, shape, and the material from which it is made) and what is inside it will influence the sound that the rattle will make. Try the same contents in several different containers and, also, different contents in the same kind of container, to find the most appealing sound combination.

Since there are so many possibilities, try several combinations and make rattles for different tonal and rhythmic effects.

Here are some suggestions for materials:

CONTAINERS

paper cups (those with lids which are easy to close securely)

plastic detergent or bleach bottles

individual-serving cereal boxes

small plastic boxes or cans (available at variety and hardware stores)

wooden match boxes

adhesive-bandage cans

CONTENTS

any sort of dried beans, peas, or seeds

rice

table salt or sugar

rock salt

marbles

feathers

sand

TELEPHONES

Here are some devices that convey sounds over long distances.

STRING TELEPHONES

Thread each end of a long piece of string through a hole made in the bottom of a paper cup or tin can. Talk into one cup and listen through the other.

Plastic-coated paper coffee cups work very well. Tie paper clips to the string ends to keep them from slipping back through the cups. Pull the string tight.

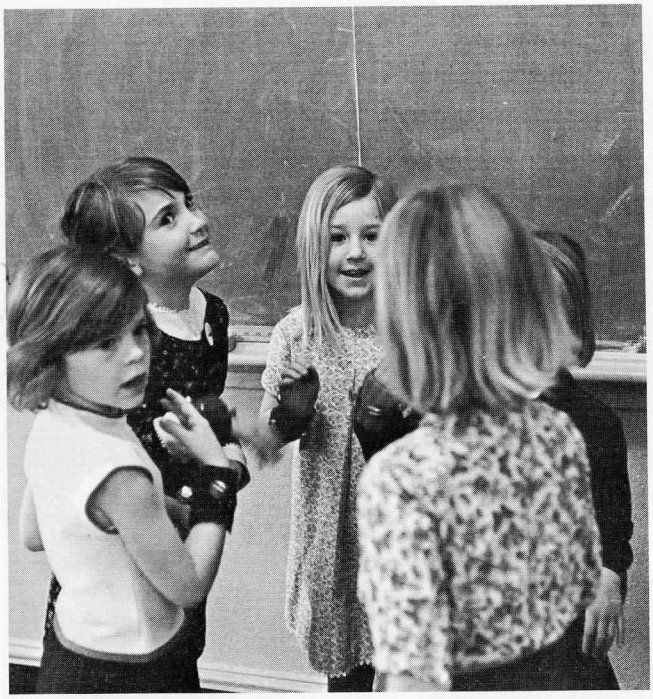
You can make a party line by tying other cups and strings into the main line.

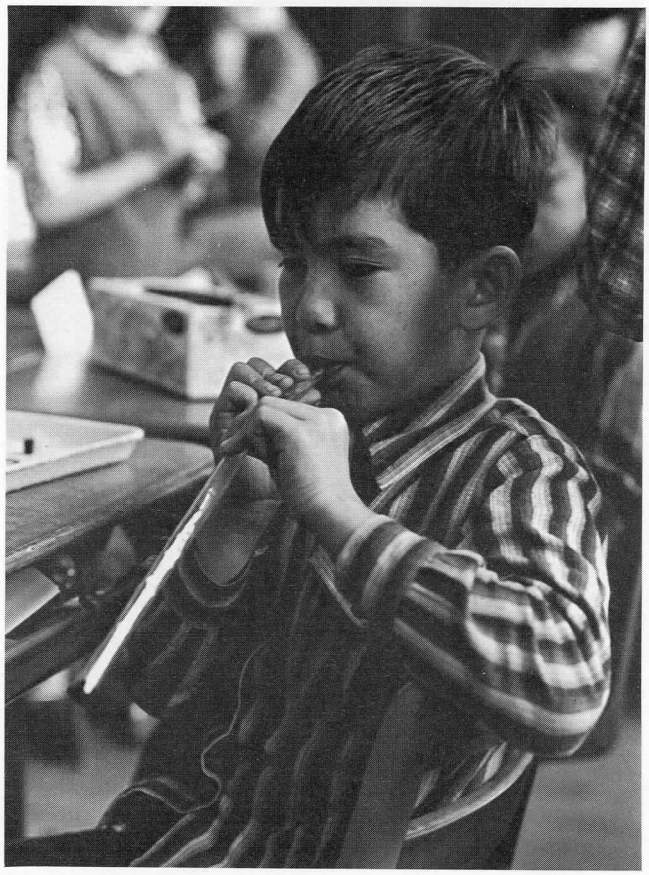
TALKING TUBES

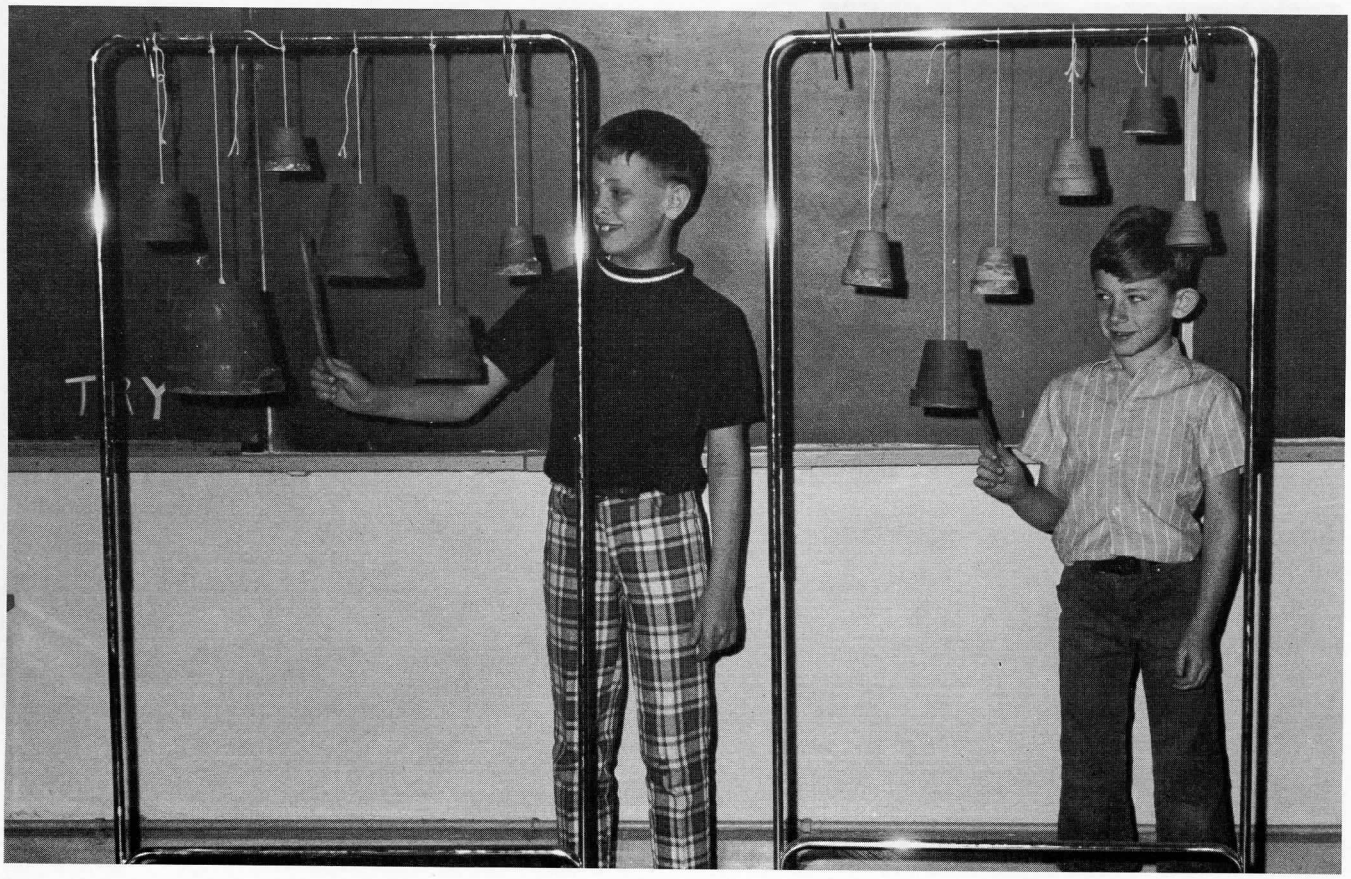
To make a talking tube, attach funnels to both ends of any piece of hose—a garden hose, the hose from a vacuum cleaner or portable hair dryer, or plastic golf tubes.

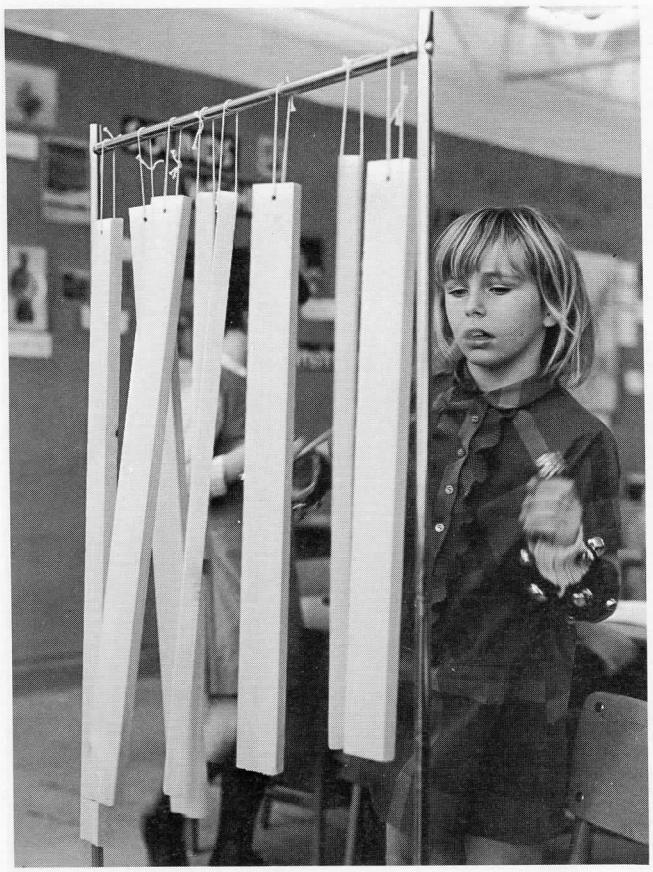

UNITED STATES

ONCE MORE WITH FEELING






TRY



12 EBEB 84