Sound-Activated KALEIDOSCOPE

Generate eye-catching patterns that change in cadence with an audio signal with this sound-activated kaleidoscope

BY DR. DON H. ANDERSON

Kaleidoscopes have been popular for ages, and over the years, a wide variety of kaleidoscopes have been developed. Most have depended on rotation of either the mirrors, or particles imaged in them, to provide a multiplicity of changing patterns.

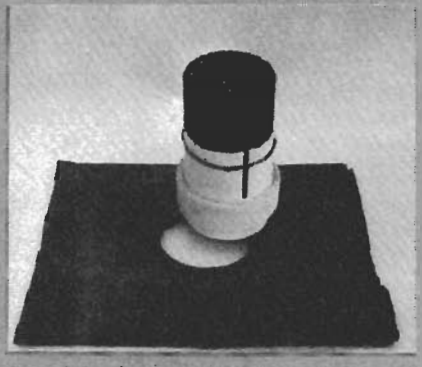
In the 1950's, a kaleidoscope in which the particles were caused to move in cadence with music was shown on television. The *Sound-Activated Kaleidoscope*, described in this article, accomplishes the same thing using readily available materials.

The kaleidoscope can be built to be viewed directly, and sound (be it from radio, tape recorder, or the human voice) can be used to move the particles. It can also be coupled to a musical instrument through a contact microphone.

I've had the greatest success when I coupled the kaleidoscope to an electric organ and projected the image of the moving particles on a screen in front of the organist. The heart of that unit was a small speaker.

Getting Started. For your first experiment, I suggest that you use a 4-inch speaker that has a well suspended cone. The speaker cone is expected to bear the weight of the mirrors and the mount, which may result in severe distortion if the speaker cone is not rugged enough.

The mirrors are, ideally, of front surfaced thin glass or plastic. Front surfaced mirrors are available in a variety of sizes and thicknesses. To help determine mirror size, it is suggest that you build an experimental unit using reflective foil. Many art stores sell reflective foil by the foot. It is easily peeled from its substrate and transferred to a piece of very smooth cardboard or plastic sheeting. The surface that holds the reflective foil should be as free from defects as possible because the film will bring out any the defects in the surface.



Shown here is the projection lens mounted in a cardboard tube ready for installation on a cloth-covered cardboard base.

Because the unit is to be experimental, its assembly need not be super critical. The mirrors, angled at 60°, are mounted on a thin aluminum plate, which is then mounted on a small paper cylinder. That assembly is then glued to the cone of the speaker.

For particles, crumpled bits of aluminum foil—either plain or colored (like florists use)—works well. Bits of plastic insulation from some brightly colored wire can be used. Another alternative, provided you are located in an area of low humidity, is to use the brightly colored particles (sprinkles) that are used as cake and cookie decorations (high humidity would cause the sprinkles to bond together).

Construction. Begin construction by cutting two pieces of cardboard or plastic to about 2-by-3¼ inches. Be sure they are the same length and width; they'll be used to form the reflecting surfaces in the kaleidoscope. Apply the foil to the cardboard or plastic.

Use thin transparent plastic film to provide the window area. Be sure that the film is stiff enough to hold the mirrors in position after cementing, without buckling. The clear film is the window through which the display will be photographed if you use a video camera. If you make a projection unit, the window will be used to illuminate the particles.

For assembly, a support can be made by gluing two pieces of corrugated cardboard together with the corrugations at right angles. The window material is cut about ⅞-inch wider than the mirror panels, but of equal length.

Refer to Fig. 1. As shown, one of the mirror panels is pinned to establish the spacing of the parts during cementing. Pinning the window material down (as shown in Fig. 2.) allows the two mirror panels to be properly arranged. Two pieces of masking tape placed along the bottom and top edges serve as a temporary support during the cementing process.

Place a small amount of five-minute epoxy cement along the joints. Be careful that the cement does not get on the mirrored surfaces. The first coat must be solid and completely dry before the second coat is applied. Doing

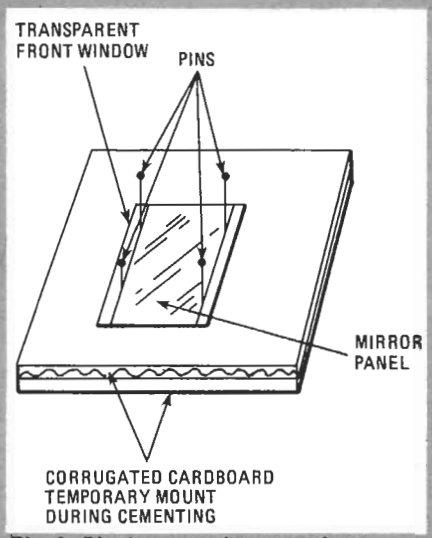


Fig. 1. Pinning one mirror panel to a temporary mount helps to establish the spacing of the parts.

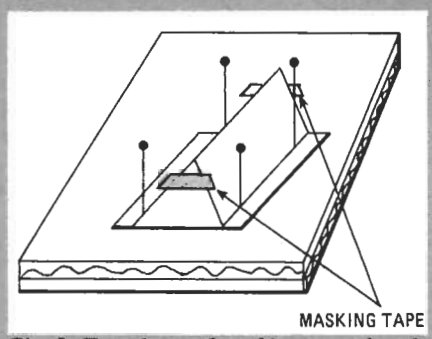


Fig. 2. Two pieces of masking tape placed along the bottom and top edges of the mirror panels serve as a temporary support during the cementing process.

MATERIALS FOR THE SOUND-ACTIVATED KALEIDOSCOPE

Small speaker (size not critical)
Front surfaced mirrors or reflective foil
Plastic sheeting or smooth cardboard (⅛-inch thick)
Clear plastic, rigid (thickness not critical)
White glue
5-minute epoxy cement
Flat black spray paint
Stereo amplifier (optional, see text)
A small slide projector or halogen flashlight
Projector lens or simple lens (4- to 6-inch focal length)
Video camera extension microphone

Note: Front surfaced mirrors are available from Edmund Scientific Company, 101 East Gloucester Pike, Barrington, NJ 08007.

so ensures that the second coat won't run inside the unit. Make sure that the second coat is thick enough to provide good mechanical stability with very rigid joints.

Be particularly careful around the apex of the unit. Any cement that runs inside will forever be a part of image of the kaleidoscope's display.

For the base plate, use aluminum sheeting. You can, if you wish, substitute cardboard if all you are building is an experimental unit. Don't use plastic since it can build up static charges that interfere with the free movement of the particles.

Cut the base plate about ⅞-inch larger than the kaleidoscope and give it a coat of flat black spray paint.

The kaleidoscope is cemented to the painted surface of the plate. The bottom is glued to the paper cylinder. Since white glue and aluminum are not compatible, a self-sticking label was placed on the bottom of the aluminum plate to provide a surface to which the glue would adhere.

Make the cardboard cylinder from card stock. A 5- by 7-inch index card works well. The cylinder is made by gluing 3 or 4 layers together to form a cylinder that's about 2 inches larger than the center of the speaker cone and long enough to extend about ½ inch above the edge of the speaker frame.

While that is drying, mount the kaleidoscope to the top of the base plate. I suggest that you use some cellophane tape for the initial trials. You can cement the assembly in its final position later.

After the paper cylinder is dry, find the balance point of the kaleidoscope by placing it on a finger and moving it around. Glue the paper cylinder at that point. When the joint is thoroughly dry, glue the assembly to the speaker cone. If you ever wish to remove the unit, you'll find that a razor blade or very sharp knife allows you to break

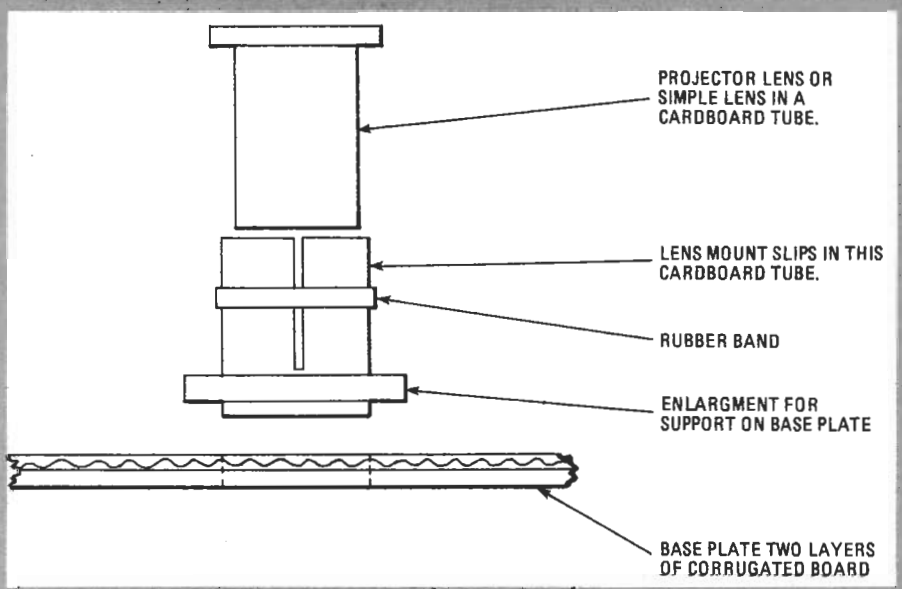


Fig. 3. A lens from a slide projector can be held in place by a cardboard tube wound tightly around the lens. That assembly is placed inside another cardboard tube and held in place by friction, supplied by a rubber band.

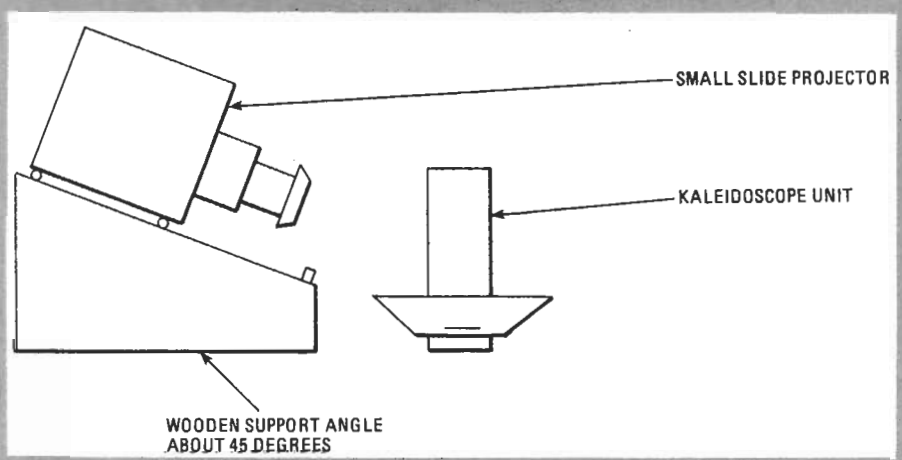


Fig. 4. A slide projector can be mounted on a rack in such a way that the light is emitted at a 45-degree angle into the apex of the kaleidoscope.

the joint between the base plate and the cylinder.

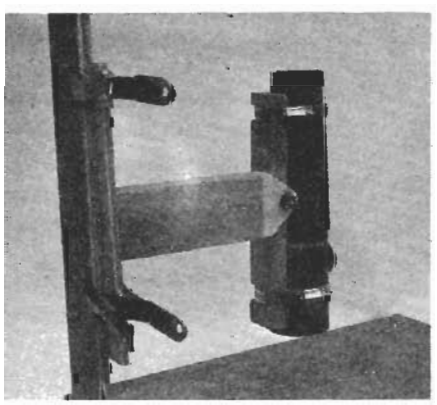
When all joints are set, you can put particles into the kaleidoscope unit and test it with a small radio. You'll find that the load of the kaleidoscope results in some audio distortion. With some speakers, the distortion is so small that it is of no concern.

Optics. The projection lens need not have all the optical quality of a typical slide projector lens. Since the kaleidoscope particles are in motion and at times are flying above the surface, the image is constantly changing in and out of focus. You might try using a simple double convex lens as a start.

Depending on the size of your kaleidoscope, you will need to use a lens with a focal length of 4 to 6 inches. You can try lenses from small hand magnifiers or the so-called close up lenses used with cameras. They usually have the focal length marked on them. A quick way to check your lens is to focus the image of a distant object on a white card. If the distance from the lens to the card is about 4 to 6 inches, it's worth a try.

Some ingenuity may be required to mount the lens. If it is a loose lens, mount it in a cylinder made from several layers of card stock. A ring of cardboard glued on each side of the lens will hold it securely in place. It is suggested that you build a model before building the final carrier. Your final unit can be as professionally finished as your time and talent allow.

If you are using a projection lens from a small slide projector, it can be held in place using the method illustrated in Fig. 3. The cardboard tube is wound tightly around the lens, glued securely in place, a collar mounted to the assembly, and the whole thing glued to a corrugated cardboard panel. When thoroughly dry, one or two slits are cut and a rubber band provides the friction to hold the lens.



This simple mount can be used to hold a flashlight at almost any angle for video taping or projecting the images.

Details of the best way to hold the panel above the kaleidoscope are difficult to give. I frequently use corrugated cardboard for the box. Try using a small slide projector as the light source. The slide projector is mounted on a rack, as shown in Fig. 4, so that the light is emitted at a 45 degree angle into the apex of the kaleidoscope.

Trial and error with the lens at several positions and angles may be needed to optimize the conditions. For short projection distances, I have used a flashlight containing a high-intensity halogen bulb with satisfactory results. A typical experimental mount is shown in Fig. 5. That mount or a similar arrangement of your own design allows the flashlight to be used with either the projection unit or for video taping.

If you wish to project the image onto a wall screen (see Fig. 6), the tube is used to hold a simple mirror (taken from an old purse) at a 45 degree angle. When video taping, only a relatively small amount of light is needed. It

(Continued on page 99)

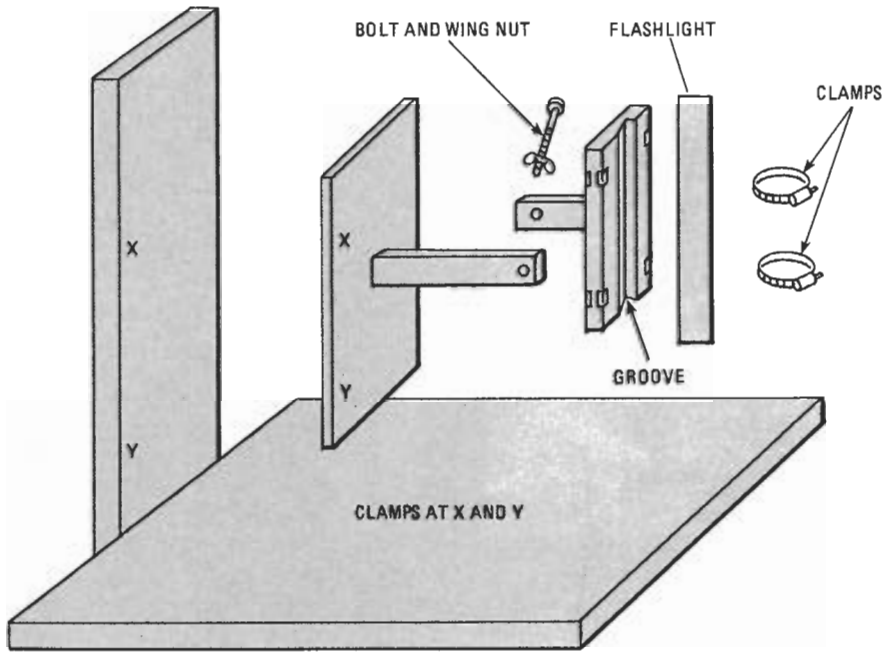


Fig. 5. Shown here are construction details for a typical experimental mount for a flashlight. Such an arrangement allows a flashlight to be used with either a projection unit or a video camera.

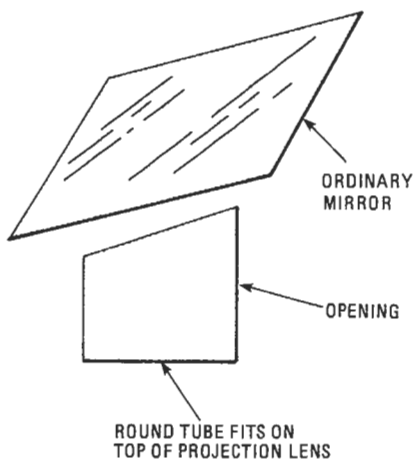


Fig. 6. When projecting the image onto a wall screen, the tube is used to hold a mirror at a 45-degree angle.

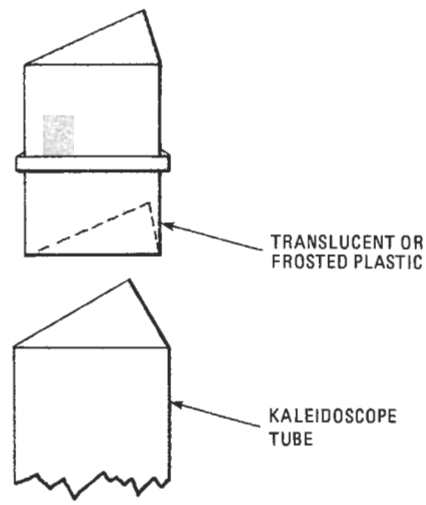


Fig. 7. When video taping, only a relatively small amount of light is required. The light should be diffused. That can be accomplished by placing a piece of frosted plastic between the flashlight and the particles in the tube.