4

ANIMATION WITHOUT FILM

Anxious as you may be to start making and projecting animated films, first take a step back into history for a short session of basic training. By actually making and operating some of the "ancient" animation devices mentioned in Chapter 2, you will get a practical demonstration of persistence of vision and a better understanding of how the animation process works. You will also get a chance to put your drawing, lettering, and other practical skills to use. What's more, you'll have fun.

THAUMATROPE

Start with the easiest animation invention, the Thaumatrope (Figure 9 on page 16). Dr. John Paris, an Englishman, made the first ones back in the 1820s using a bit of cardboard and two pieces of string.

You'll need:

- A small piece of cardboard or illustration board, white on both sides.
- Two pieces of string, each about 4 inches (10cm) long.

Draw a circular disc about 2 inches (5cm) in diameter on the cardboard and cut it out. Punch small holes at the left and right sides of the disc near the edge. With pen and ink or a felt marker, letter the words I and YOU on the disc as shown in Figure 22. Turn the disc over and draw a heart in the center. Now, insert and tie the two strings in holes in the disc. (You can add a modern touch by substituting rubber bands, if you wish.)

Congratulations! You have just made a Thaumatrope as good as the one the good doctor devised. Hold the strings as shown in Figure 9 and roll them between thumbs and forefingers. The disc will whirl, and your persistence of vision will blend the lettering and heart into a single message: "I LOVE YOU."

Don't fret if you don't have a piece of cardboard that is white on

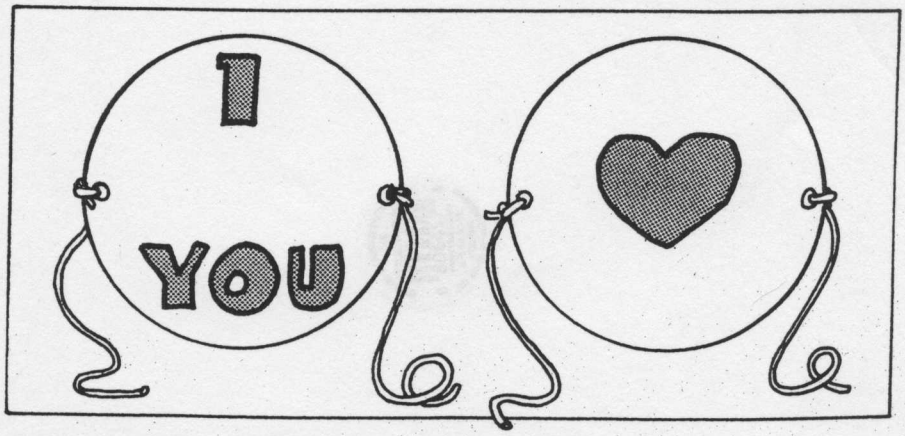


Fig. 22 An easy-to-make Thaumatrope.

both sides. If one side is gray, tan, or some other pale color, note the interesting color variation that results when the disc whirls. You may wish to experiment further with various color combinations on discs.

Also create some interesting visual combinations with lettering and drawings. For example, draw combinations on discs that will result in a monkey in a cage (Figure 9), a man holding a sign, a man and woman facing each other in conversation, and a seal balancing a ball on its nose. Note that you must be careful in positioning the components so that they will combine correctly when the disc is spun. This care will help you when you get into film animation.

FLIP BOOK

You have already experienced an example of flip book animation in the margins of this book. But if you make one of your own, you'll get some practice drawing and positioning material to give the illusion of movement. What's more, you will quickly learn the value of simplifying your drawings to the fewest possible lines to express what you wish to portray.

You'll need:

- A small pad of paper about 3" x 5" (7.5 x 13 cm) in size. The paper should be stiff enough to spring back into position when bent and released (Figure 23). Good quality drawing paper usually will do. Thin, limp paper such as cheap typing paper won't work.

If you can't obtain a ready-made pad with the right amount of springiness in the paper, find, instead, the right sort of paper and cut and staple it together. It may even work to your advantage, because it is easier to draw or trace a series of drawings on individual sheets of paper before stapling than on an assembled pad. You

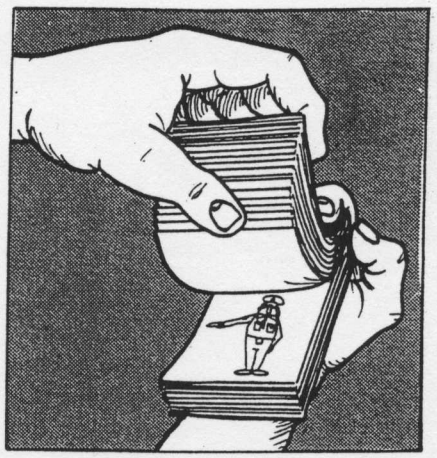


Fig. 23 One way to hold a flip book.

Fig. 24

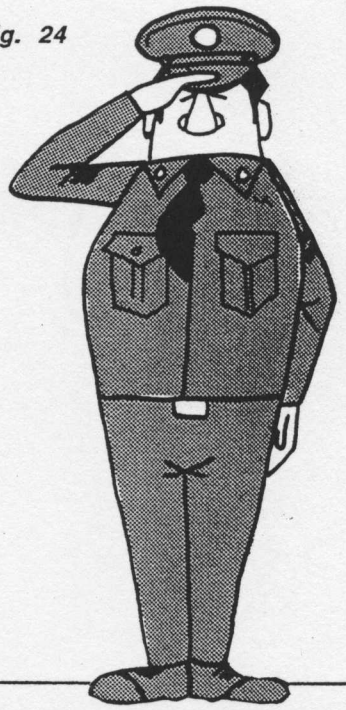
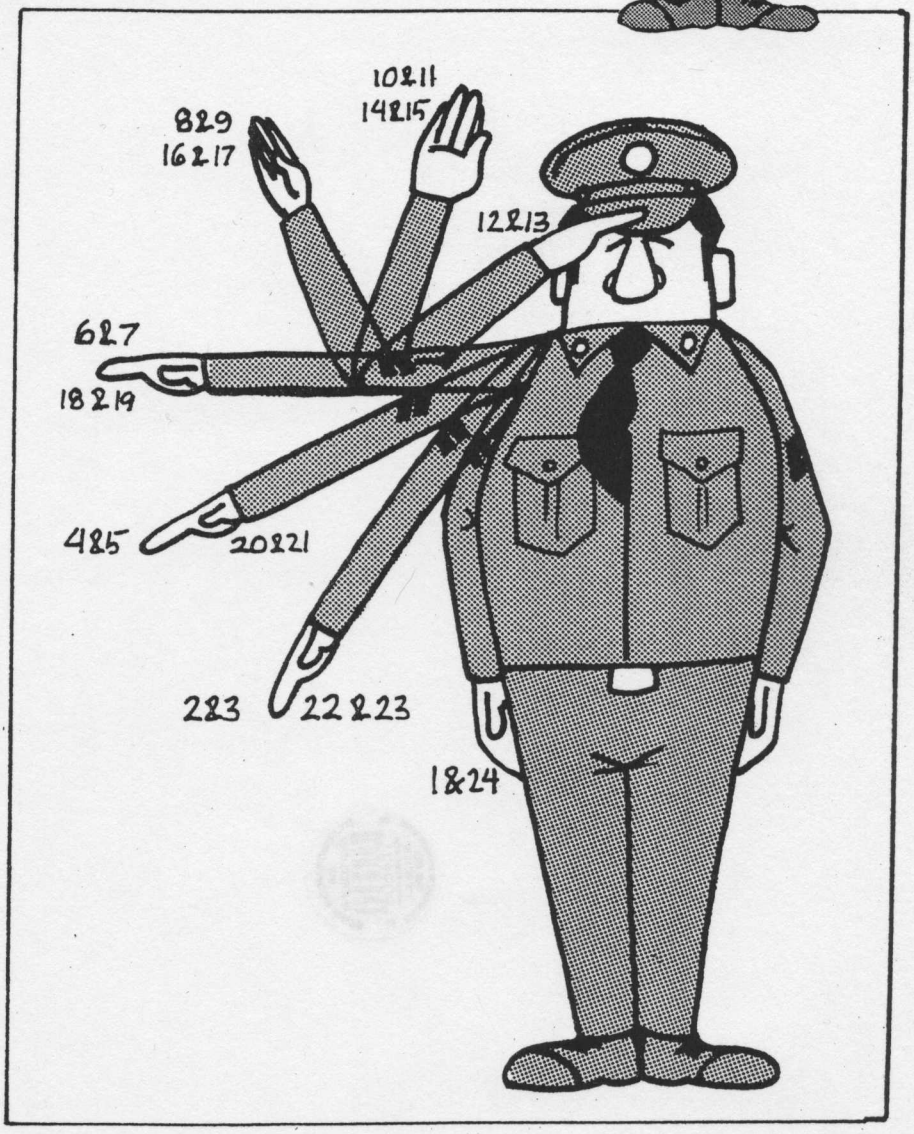


Fig. 25 A diagram of the soldier's arm movements.



can also decide whether it is easier for you to flip the pages from front to back or back to front, as a southpaw would, and assemble your pad accordingly.

Choose a simple subject for your flip book animation — a fluttering leaf, a girl on a pogo stick, a hopping frog. Make a few trial drawings to establish a correct size and sequence before tracing them on your pad.

Start now to think habitually in one-second segments. (We're making a flip book to get to know basic animation methods, remember.) That means you think in terms of movements expressed in either 18 or 24 drawings for each second to be shown. The reason for this is that silent films are projected at a speed of 18 frames per second (*fps*) and films with sound are shown at a rate of 24 fps. Since an animated film with sound is more desirable and, we hope, your ultimate goal, plan your flip book on the basis of 24-frame sequences.

The most practical way to draw an animated movement in 24 steps is to start at the two ends and fill in the middle. Say, for example, you are to draw in your flip book a soldier saluting (Figure 24).

1. You first decide the limits of the action, that is the start and finish, and establish your *key drawings*. In this case you're in luck, because the limits of the soldier's salute are identical. He is standing at attention with his arms at his sides both before and after the saluting motion. One drawing will suffice (Figure 25) for both start and finish.
2. Next, determine where his arm and hand will be halfway through the sequence and draw them in that position. In our example, the hand is at the soldier's forehead in the salute position.

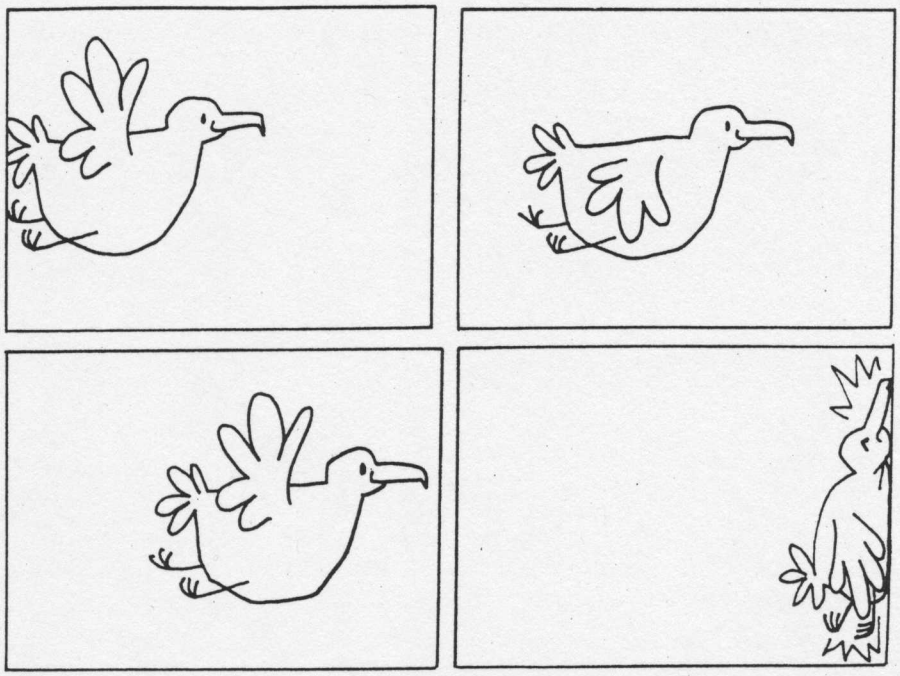


Fig. 26 Professionals "flip" their drawings to check the effectiveness of the action they're portraying. An example of this is the "squash" at the end of this bird's flight.

3. Now draw the position halfway between standing at attention and the full salute. As you can see, the arm is extended straight out from the shoulder in a horizontal position. This is called an *in-between* in animation parlance, because it is a drawing of a stage of the motion in between key drawings.
4. Next, draw additional in-betweens showing the intervening stages of the salute. Note that, above the level of the shoulder, only the forearm moves and the hand turns 90 degrees at the wrist.

But, hold on, you say. We were intending a sequence of 24 frames and have made only seven drawings. Somebody must have flunked math.

Not so. You've just had another lesson in the application of persistence of vision. Since the eye retains an image for a fraction of a second, you don't have to change your drawings for every frame. It is common practice when photographing animation to *double frame* or shoot *on twos*; that is, to shoot two frames on each drawing. We're doing the same in your flip book.

Your next task is to trace the seven basic drawings onto the pages of the flip book in the proper sequence, double framing as you go. The numbered sequence is shown in Figure 25, starting with the soldier at attention as Position 1. The figure is then traced with the arm at Position 2, and an identical drawing is traced on the succeeding page to represent Position 3. Repeat this for Positions 4 and 5, 6 and 7, and so on, up and back, until your soldier is at attention again in Frame 24.

You have also just been introduced to something called *limited animation*, a very common technique used in the mass production of animation cartoons for Saturday's children's shows on television. After a key drawing is established (in your case the soldier standing at attention), only the moving portion is redrawn.

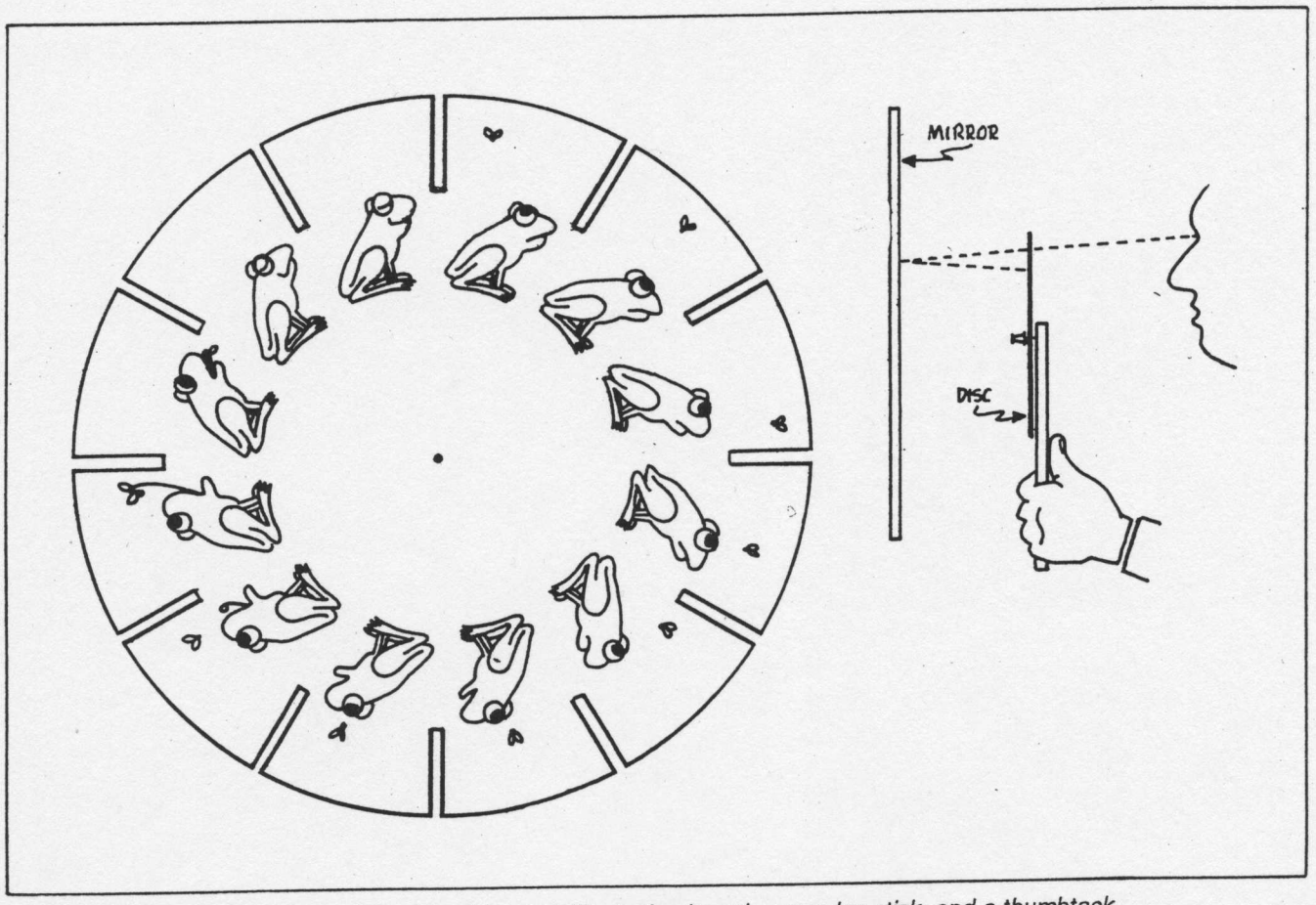


Fig. 27 A Phenakistoscope can be made with some illustration board, a wooden stick, and a thumbtack.

We will go into limited animation more thoroughly later on when discussing cutouts and cel animation, because it is a great timesaver. However, to make a flip book, you will have to trace or redraw the full figure of the soldier on each page.

If all this flipping business seems a bit rudimentary, don't make the mistake of discounting the importance of the flip book in the production of animation. The *flipping* technique has practical, time-saving applications, which are used as a matter of course by professionals as a quick way of visually testing proposed action sequences.

Take, for example, a flying bird (Figure 26). At the end of the flight, note how the impact is exaggerated by squashing the bird almost flat. If an animator making a film of the bird wanted to check the effectiveness of the *squash*, he or she would hold the original drawings together like a flip book and flip them. Thus, the action can be checked before expending the time and effort painting it on cels. Later on, when you are doing your own cel animation, you'll find trial sketches viewed in flip book fashion a handy way of pre-testing your work — if not an occasional lifesaver.

PHENAKISTOSCOPE

Transfer your flip book drawings to a cardboard disc to make a simplified version of another pioneering animation device, Joseph Plateau's famous Phenakistoscope. It will provide you with a practical demonstration of persistence of vision, on which animation rests.

You'll need:

- Heavy illustration board at least 10 inches (25cm) square.
- A wooden stick about 14 inches long and 1 inch thick (25 x 25 x 2.5 cm).
- A thumbtack or pushpin.
- A mirror.

Draw a circle with a 10-inch (25cm) diameter on the illustration board. Cut out this disc. Divide the circumference of the disc into 12 equal parts and cut a slot at each point that you mark (Figure 27). The slots should be 1/4 inch (.63cm) wide and approximately 1 inch (2.5cm) deep. Draw a 12-part animated sequence around the disc. Each drawing should be immediately below one of the slots. Insert the thumbtack

through the center of the disc and fasten it to the wooden handle. Turn the disc several times on its thumbtack "axle" so that it will spin easily.

Now, on with the show! Grasp the handle in one hand and hold the disc up before a mirror with the animation drawings facing toward the mirror (Figure 27). Spin the disc with your other hand and peer through the slots at the image in the mirror. The separate drawings will merge into a single one with the illusion of movement.

Experiment to find the best speed for the disc to get the clearest image. You can also strengthen the image by painting the back of the disc solid black.

ZOETROPE

If you had been a kid back before the turn of the century, you might have found this one under your Christmas tree. In addition to being the subject of much scientific study, the Zoetrope proved to be a popular toy, occupying a place in homes much as video games do today. It is a revolving drum-like cylinder with animation drawings around the inner circumference. With a little ingenuity you, too, can enjoy this bit of animated nostalgia.

You'll need:

- A smooth board or piece of plywood 9 inches (23cm) square.
- Flexible illustration board 6 inches (15cm) wide and at least 30 inches (76cm) long. This board must bend around a wooden disc.
- White drawing paper or thin Bristol board, 30 inches (76cm) long.
- Two dozen small tacks.
- Rubber cement.
- Matte black poster paint.

Optional base:

- Wooden spool (sewing).
- Smooth board about 6 inches (15cm) square or larger.
- Small-diameter dowel or bolt about 3 inches (7.6cm) long, with washer.
- Wood glue.

Draw a disc with a 9-inch (23cm) diameter on the board or plywood and cut it out. Drill a hole in the center of the disc large enough to fit over the center shaft of a record player turntable.

Cut a strip from the illustration board 6 inches (15cm) wide and long enough to go around the outer edge of the wooden disc. Allow about 1 inch (2.5cm) extra for overlapping. Mark equidistant spaces for twelve slots to be cut in this strip (Figure 28). The slots should be ½ inch (1.27cm) from one edge of the strip. Each slot should be ¼ inch (.63cm) wide and about 1 inch (2.5cm) long. Cut out the slots with a razor blade or mat-cutting knife.

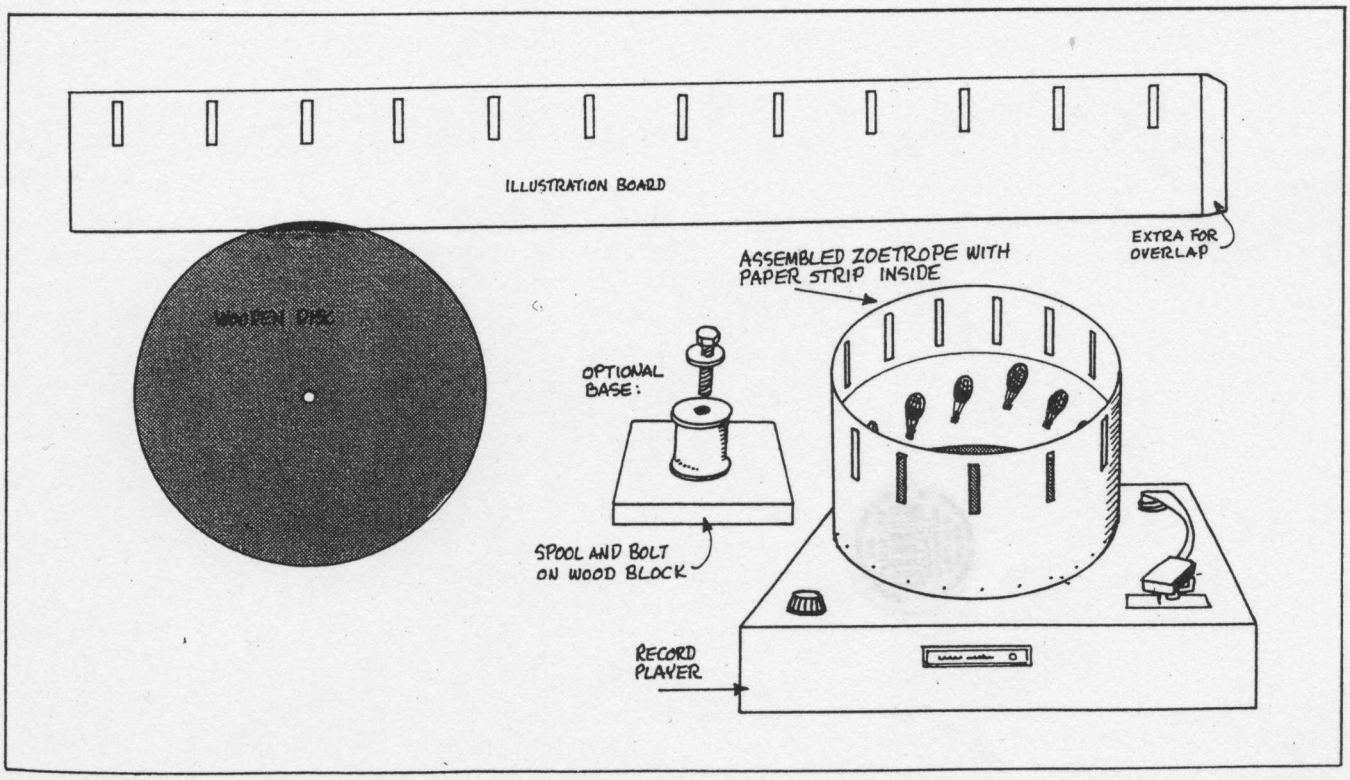


Fig. 28 A Zoetrope is harder to make but lots more fun.

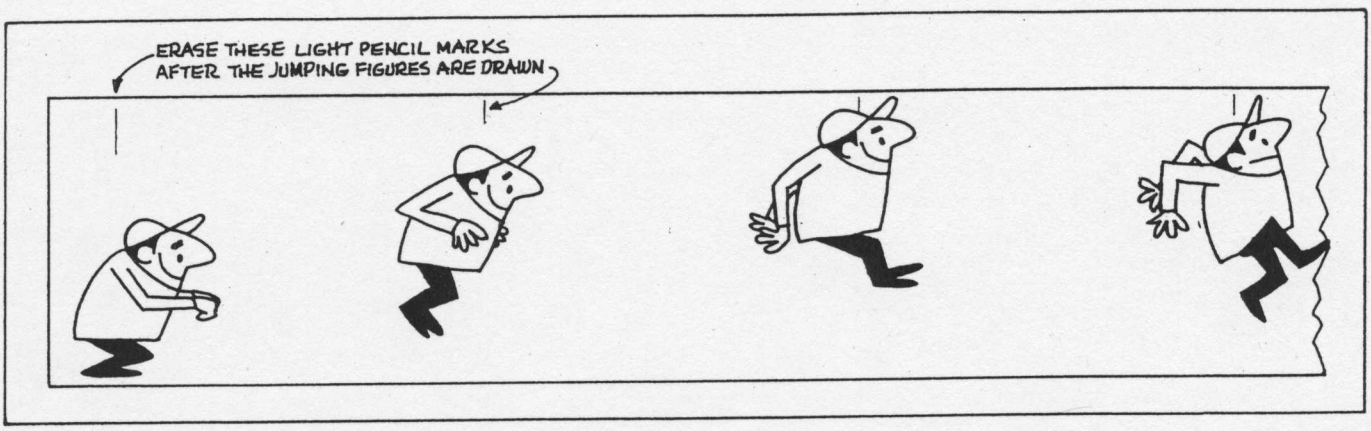


Fig. 29 A portion of an animated strip drawn for a Zoetrope.

Assembling the drum:

Place the wooden disc on a flat surface and bend the illustration board strip around it, with the twelve slots nearest the top. Secure the illustration board to the disc with tacks. With rubber cement, fasten the overlapping portion of the illustration board together. You now have a firm cylinder open at the top and with a closed wooden base. Paint the outside of the cylinder black, being careful to keep paint from running through the slots to the inside.

Next, on drawing paper, mark a rectangle 3 ½ inches (8.9cm) high and long enough to go exactly around the inner circumference of the cylinder you have assembled. Cut out the rectangle and bend it around the inside wall of the cylinder. The paper should rest on the wooden base and go up almost to the bottom of the row of slots in the cylinder wall. With a pencil, put a very faint mark on the paper just below each of the 12 slots. These marks will help you position your animation.

Remove the paper from the cylinder and draw an animation sequence on it, positioning one component at each of the pencil marks you have made (Figure 29). Put this completed "animation strip" back into the cylinder as before, making sure that each drawing is directly opposite a slot in the cylinder wall. A spot or two of rubber cement on the back of the strip will keep it in position against the cylinder.

Place your assembled Zoetrope on a record player turntable and watch the action through the slots as the cylinder revolves. The viewing principle, based on persistence of vision, is the same as that you experience while viewing animation with a Thaumatrope, flip book, or Phenakistoscope.

In case you haven't a record player handy, perhaps there is a lazy susan in the pantry that you can borrow. Or make a base for your Zoetrope with the optional materials listed earlier. Glue the spool upright in the center of the wooden board. Insert the dowel in the center hole of the spool and glue it in place with approximately 1 inch (2.5cm) extending above the spool. Center your animation cylinder on the dowel and rotate. A bit of candle wax on the top of the spool will help the cylinder spin.

This do-it-yourself Zoetrope is great for exercising your imaginative skills, because you can draw and view as many animation strips as you like. Use the gadget for experimenting — especially with animated abstract forms and color combinations. You'll find the knowledge useful in the next chapter.