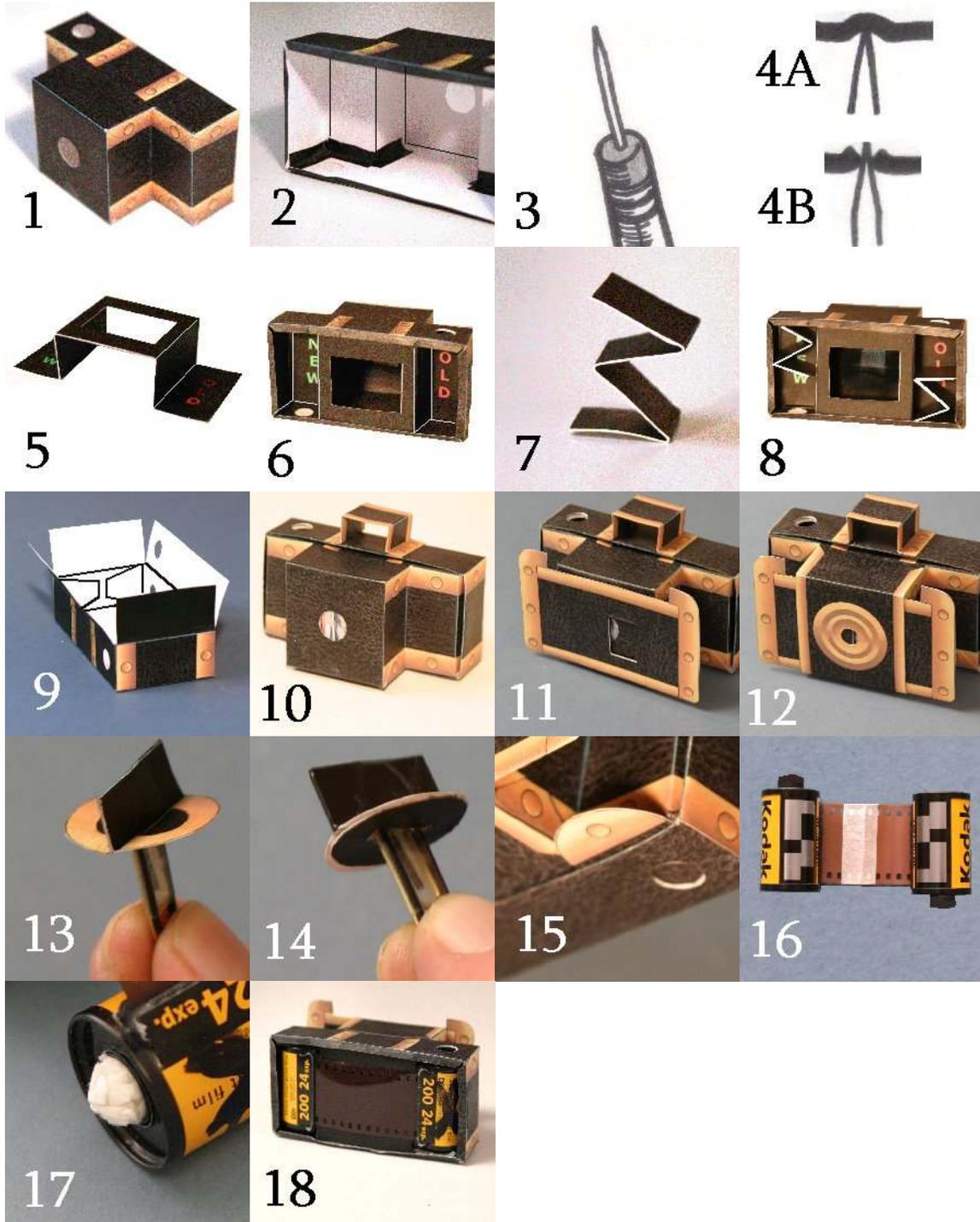


THE PINHOLE CAMERA – ASSEMBLY, LOADING, SHOOTING - page 1.



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THE PINHOLE CAMERA – ASSEMBLY, LOADING, SHOOTING - page 2.

WHAT YOU'LL NEED: Scissors, an X-acto knife, Elmer's glue (or a glue stick), black electrical tape, transparent tape, an aluminum soft drink can, an emery board, a black marker, a pencil with an eraser, a small needle, two rolls of 35mm film (200 film speed), two standard sized paper clips (1"x.25"), a 2" square of tissue paper, and a ruler or other straightedge.

(This model should be printed on heavy card stock)

NOTE: Assembling this project requires cutting an aluminum can, and the edges of the aluminum can be VERY sharp, so this step (as well as using the X-acto knife) should only be performed by adults.

ASSEMBLY:

We'll begin by cutting out the FRONT SECTION on parts page 1. Use the X-acto knife to remove the three white circles. Cut along the four red lines to separate the brass tabs. The FRONT SECTION has four long narrow outer flaps. Fold these four flaps DOWNWARD along the blue lines, and then fold all twelve brass tabs DOWNWARD. Fold the top and bottom panels DOWNWARD along the blue lines (the top panel is the one with two brass brackets). For the side panels, fold DOWNWARD along the four blue lines and fold UPWARD along the two green lines.

Now glue the brass tabs over the brass strips on the side panels, forming a camera body like the one shown in Figure 1. The four narrow black flaps don't connect to anything; they're just there to help block light.

Next cut out the FRONT SECTION LINER on parts page 2. Use the X-acto knife to cut out the three white circles. Don't cut along the four grey lines, they're just guide lines we'll be using later. Fold the top and bottom panels UPWARD along the green lines. For the side panels, fold UPWARD along the four green lined and fold DOWNWARD along the two blue lines.

Smear some glue on the back of the FRONT SECTION LINER and glue it to the inside of the FRONT SECTION. The LINER will fit very snugly inside the camera, so press it gently into place and then press with your fingernails along the edges. When the liner is correctly inserted, the four FRONT SECTION flaps should still fold downward.

It's important that your finished camera not let any light inside, so we'll seal the camera body with black electrical tape. Cut pieces of tape about an inch long and then cut them down the center (so they're about an inch by three eighths of an inch). Place the tape inside the camera, along the top and bottom edges of the side panels as shown in Figure 2. (Figure 2 shows a white interior for clarity.) Cover all twelve edges. If you have trouble getting your fingers inside the camera, you can stick the tape to the tip of a toothpick and use the toothpick to position the tape before pressing it into place. After taping along the edges, hold the camera body up to a bare light bulb and look into the back of the camera body. Be sure no light is getting in through the taped edges.

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THE PINHOLE CAMERA – ASSEMBLY, LOADING, SHOOTING - page 3.

Now it's time to create the pinhole. Carefully cut a two or three inch square piece of aluminum from the side of the soft drink can. Gently rub the aluminum back and forth over the edge of a table to straighten out the curve and flatten the metal. Cut out the PINHOLE TEMPLATE on parts page 3. Use the template to cut out a 1" square from the aluminum. Use a marker and straight edge to draw lines from corner to corner on the aluminum, as shown on the template.

Next poke the top end of the needle into the eraser on the pencil, forming a tool like the one shown in Figure 3. Place the point of the needle against the center of the metal (where the lines cross) and begin to push gently. We don't want to just push the needle through, since that would make too large of a hole (resulting in overly fuzzy images). Instead, we want to make the smallest hole possible. So push gently and rotate the tool while doing so. Stop pushing the moment you can feel a slight bump on the back of the metal (as shown in Figure 4A). Use the emery board to sand the back of the metal smooth. Push the needle gently into the front once more, and then sand the back again. Finally, push the needle into the front until the needle pokes through the metal (not the entire needle, just the tip, as shown in Figure 4B). There should now be a hole in the metal, but it may be too small to see. Hold the metal up to a bare light bulb. If you can see light through the hole then it is probably large enough. Sand the back and front smooth with the emery board a final time.

Place the finished metal piece inside the camera body, line up the lines on the metal with the grey guide lines inside the camera, and tape the metal in place. Be sure all edges of the metal are covered so no light can leak in around the edges.

Next cut out the FRAME on parts page 3. Fold DOWNWARD along the long blue center line and glue the two sides together. Use the X-acto knife to remove the white rectangle. Fold UPWARD along the green lines and fold DOWNWARD along the blue lines to form a piece like the one shown in Figure 5. Position the FRAME inside the camera as shown in Figure 6, with the camera body upright (two brass brackets on top) and the FRAME upright (with NEW on the left and OLD on the right, when viewed from the back of the camera). Put glue behind the NEW and OLD panels and glue the FRAME into place inside the camera. We now have chambers for the two rolls of film we'll be using.

We'll be using paper 'springs' to keep the film rolls properly positioned. Cut out the two SPRINGS on parts page 3. For each spring, fold DOWNWARD along the long blue center line. Glue the two sides of each spring together. Fold UPWARD along the green lines and DOWNWARD along the blue lines, forming springs like the one shown in Figure 7. Glue the end panel of one spring to the TOP of the NEW chamber, and glue the end panel of the other spring to the BOTTOM of the OLD chamber, as shown in Figure 8.

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Now cut out the BACK SECTION LINER on parts page 3 and set it aside.

Cut out the BACK SECTION on parts page 4. Use the X-acto knife to remove the four white circles. Fold the four black panels and the four black tabs DOWNWARD. Then fold the two side panels and the top and bottom panels DOWNWARD. Glue the small black tabs to the insides of the adjacent side panels, as shown in Figure 9. Then fold the four black panels down and glue them to the backs of the side, top and bottom panels. Lay the piece sideways and rub the black panels with a marker or similar object to be sure the black panels are glued down completely flat. Glue the BACK SECTION LINER (from parts page 3) to the inside of the BACK SECTION.

You can trace along the inside edges of the BACK SECTION with a black marker to cover any white areas.

The BACK SECTION should now fit very tightly onto the FRONT SECTION. We want it tight to prevent light from leaking into the camera (but it'll get a bit easier to slide on and off after you've used it a few times).

Cut out the VIEW FINDER on parts page 4. Fold DOWNWARD along the blue center line and glue the two sides together. Fold the two brass end tabs UPWARD and then fold the two side panels DOWNWARD along the blue lines. Attach the VIEW FINDER to the top of the BACK SECTION, gluing the end tabs directly over the two brackets on the top of the BACK SECTION as shown in Figure 10.

Now cut out the SHUTTER on parts page 5. Fold DOWNWARD along the blue center line and glue the two sides together. Trim as needed. Use the X-acto knife to remove the white rectangle. Position the SHUTTER over the front of the camera, with the rectangular hole to the right of center, as shown in Figure 11, with the two prongs pointing upward (but don't glue the SHUTTER to anything).

Cut out the SHUTTER GUIDE on parts page 5. Use the X-acto knife to remove the white center hole. Fold the top and bottom panels DOWNWARD along the blue lines. Position the SHUTTER GUIDE over the SHUTTER as shown in Figure 12 and glue the top and bottom panels of the SHUTTER GUIDE to the FRONT SECTION of the camera. The SHUTTER GUIDE should be just loose enough for you to be able to gently pull the SHUTTER from side to side to open and close it.

Remove the camera's BACK SECTION, point the camera at a light and look through the open back of the camera. You should now see the pinhole open and close when you operate the shutter.

Put the BACK SECTION back on the camera.

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THE PINHOLE CAMERA – ASSEMBLY, LOADING, SHOOTING- page 5.

Next we'll construct a sturdy little winder to advance our film. Place the two paper clips directly over each other and tape them tightly together with a couple of wraps of transparent tape. This will serve as the winder's stem. Cut out the WINDER KNOB on parts page 5. Fold the two brass tabs UPWARD and then fold DOWNWARD along the blue center line. Place the WINDER KNOB over the end of the paper clips, as shown in Figure 13, and glue the black panels together. Then cut out a piece of black electrical tape about three inches long and slice it down the middle (so it's three inches by three eighths of an inch) and wrap the black panels to firmly connect them around the paper clips. Trim if needed. Cut out the WINDER BASE on parts page 5 and use the X-acto knife to remove the white rectangle. Slide the WINDER BASE over the paper clips and glue the WINDER BASE to the bottom of the WINDER KNOB as shown in Figure 14.

This camera is designed to work with KODAK 35mm film. The winder should fit into the top of the film canister and allow you to wind the film. Also, the winder should sit flat on top of the camera once the film is loaded (to prevent light leakage). I've noticed some brands of film, such as FUGI, have canisters with shallower openings, so you may need to shorten the winder stem so the winder will sit flat on top of the camera when using brands other than KODAK. The stem can be shortened by bending back the ends of the paper clips, or by pushing the paper clips up through the top of the WINDER KNOB to shorten the stem. After completing the winder, set it aside until we're ready to take pictures.

We'll need light stoppers to cover the winder hole in the bottom on the camera, and to cover the winder hole in the top of the camera when transporting the camera from place to place (since the winder knob can fall out when moving the camera around). Cut out the two LIGHT STOPPERS on parts page 5. For each, fold DOWNWARD along the blue center line and glue the two sides together. Trim if needed. Slide a light stopper into the gap between the camera's front and back sections to cover the winder hole in the camera's bottom panel, as shown in Figure 15. Use the other light stopper to cover the top winder hole in the same manner.

Your camera is now assembled and ready to load with film! For loading instructions and shooting tips, read on...

LOADING FILM:

This camera is designed to use 35mm film canisters. 200 is the recommended film speed. You'll need one new roll of film, and also a second roll to use as a 'take up' reel. This second roll can be a used roll (your local film processor throws these away and will probably be happy to give you a few) or you can remove the film from a new roll and use that.

The take up reel should have about one inch of film remaining. Be sure the end is cut off squarely. Mark a large black X on the take up roll with a marker (this will save lots of confusion later). Cut off the end of the new roll so its square, with about an inch of film pulled out.

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THE PINHOLE CAMERA – ASSEMBLY, LOADING, SHOOTING- page 6.

Position the two film rolls as shown in Figure 16 (with the dull side of the film facing upwards on both rolls) and tape the two film ends together with transparent tape (masking tape is shown in the illustration for clarity). You don't have to worry about the spacing of the sprocket holes, just be sure the top and bottom edges of the film are straight. Flatten the tape completely on both sides of the film.

Take a two inch square of tissue paper and wad it up into a small ball. Place this ball of tissue halfway into the bottom (flat end) of the take up reel, as shown in Figure 17. This will cause a little resistance in the take up reel so the film won't try to unwind back onto the new roll when we advance the film later.

Remove the shutter and light stoppers from your camera. Pull off the back section. Carefully push down the springs and insert the film as shown in Figure 18. Be sure the new roll of film is in the NEW chamber on the left, the take up roll is in the OLD chamber on the right, the dull side of the film is facing the front of the camera and the shiny side of the film is facing the back of the camera. Also, be sure the narrow flaps on the front section aren't caught under anything. Insert the winder and turn counter-clockwise until the taped area has been wound into the take up reel canister.

Remove the winder and replace the camera's back section. Replace the light stopper over the hole in the bottom of the camera, and put the winder back into the top hole. Check to be sure the shutter is closed. Wind the winder two complete turns counter-clockwise. Your camera is now ready to use (see below for shooting tips).

Camera Operation:

The camera must be braced against a tabletop, wall, stack of books, or other stable object. Gently slide the shutter from side to side to open and close the pinhole. Turn the winder one complete turn after each shot to advance the film.

After shooting your film, remove the winder and cover the top hole with a light stopper. Remove the bottom light stopper and place the winder into the bottom hole. Wind counter-clockwise until all the film has been wound back onto the 'new' reel. Remove the winder and stoppers. Open the camera and cut or tear the film a little to the left of the tape (you can then remove the tape and re-use the take up reel next time). Place the 'new' roll into its original container (if you have one) and take it to your local film processor for developing.

Be sure to tell your film processor that the shots will be spaced irregularly (they won't mind but knowing in advance helps them set up their equipment).

SHOOTING TIPS:

The main challenge to pinhole photography is finding a good exposure time. This will vary depending upon the amount of light and the size of the pinhole. Here are a few general exposure times to try:

1 second or less - daylight

2 seconds - cloudy

5 to 15 seconds - indoors at night, small objects a few feet from a light source.

1 minute to 2 minutes – indoors at night, larger objects in a room.

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You can simply count to yourself “one thousand one, one thousand two” and so on, or you can use an egg timer or stopwatch to help time your shots.

The best way to get a good exposure is to use a technique called ‘bracketing’. If you think a shot might require a 2 second exposure, for instance, you would ‘bracket’ the shot by shooting a 1 second exposure, a 2 second exposure, and a 3 second exposure. This will greatly increase your chances of getting a good exposure time. Another trick is to look for chances to have the same lighting on more than one day, so if you miss the exposure time you can go back and try again.

Because there’s no mechanical winder, a 24 exposure roll of film usually yields around 18 shots. So if you’re bracketing, you should plan to shoot no more than 6 subjects per roll (shooting each subject 3 times at different exposure lengths). And there’s nothing wrong with shooting a whole roll of just one subject, using a wider variety of exposure times. The goal isn’t to get a lot of photos, but rather to catch that one really amazing shot. And with practice you’ll probably find yourself getting several good shots per roll.

Keep in mind that an under-exposed or over-exposed shot sometimes works out great. Part of the fun of a pinhole camera is that it’s a bit unpredictable. It helps to keep notes of your exposure times so you can compare results from one time to the next. After a while you’ll probably start getting a feel for what general exposure times your camera will need (although you’ll want to continue bracketing).

It’s a good idea to get in the habit of advancing the film immediately after each shot. If you forget to advance the film, you’ll get a double exposure (although sometimes this can be done intentionally with amazing results).

Since pinhole cameras use comparatively long exposure times, it’s very important to make sure the camera doesn’t move while the shutter is open. The camera can be braced on a tabletop, a stack of books, a wall or any other stationary object. You might even try connecting the camera to a tripod with rubber bands.

When operating the shutter, don’t jerk it open or closed quickly (since this will shake the camera and ruin the shot). Instead, always move the shutter gently.

The view finder isn’t as accurate as a factory-made camera, but it will help you see if your subjects are centered in the shot. If you’re very close to the subject (less than a few feet), remember to tilt upward slightly to compensate for the difference in position of the viewfinder and pinhole.

I recommend 200 speed film, but you may want to try other speeds as well. Lower film speeds are slower and will require longer exposure times (handy for daylight). Higher film speeds are faster and will require shorter exposure times (handy for night shots).

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You can usually tell if a shot is over or under exposed by looking at your negatives. An under-exposed shot means not enough light hit the film, so the negative will usually only show a trace of the image. If the shot's over-exposed then too much light hit the film, and the negatives will usually show a dark rectangular frame. If you aren't sure if the shots are under or over exposed, ask your film processor. They won't be able to recommend exact exposure times but they can tell you if a particular shot is under or over exposed.

If your shots are under-exposed, try taking the same shot with a longer exposure time. If the shots are over-exposed, try a shorter exposure time. If the shots are blurred, the camera may have been shaken while the shutter was open. If the shots are excessively fuzzy, you may have too large of a pinhole (in which case you can always make another camera).

A Final Note:

This is a soft focus camera. The images it creates will have a unique look that's unlike ordinary lens cameras. You may need to shoot two or three rolls of film to get the hang of it, but with a little practice and experimentation you'll be amazed (and delighted) with the images you can create.