MAKING AN INEXPENSIVE TELESCOPE

By K.E.Chilton
93 Currie St.,
Hamilton,Ont.

1. K.E.Chilton

Making An Inexpensive Telescope

The craters and mountains of the moon, the rings of Saturn and the moons and belts of Jupiter can easily be seen with a simple, inexpensive telescope of your own making. Making a telescope does not need to be an expensive or time-consuming project, although if you are interested in making serious scientific observations, then, of course, it is better to build a more costly reflecting telescope. However, if you want a simple telescope for gazing at the Moon or other celestial objects, just for the fun of it, then what follows is for you!

There are two types of telescopes, refractors and reflectors. A refractor employs lenses at both ends while a reflector uses a curved mirror at one end and a flat mirror at the other.

It is virtually impossible for an ordinary person to make his own lenses for a refracting telescope; but if you can get some lenses, perhaps from a war-surplus store, you can make a small telescope.

(FIGURE 1)

In Figure 1, we have the layout for making a refractor. As you can see, this type of telescope is nothing more than a spyglass such as was used in olden times by sailors and other mariners. The best type of lens would be about two or three inches across. Once you get one, then you have to determine its focal length. This is done by taking your lens outside on a sunny day. Let the light from the sun pass through the lens on to a sheet of paper. Move the lens up and down with respect to the paper until the sunlight makes a very small intensely white dot on the paper. (In fact, it may actually set fire to your paper, so be careful!) Have a friend measure the distance between the paper and the lens. This distance is the focal length of the lens.

Next, you will need a smaller lens for an eyepiece. I have managed to take apart an old broken camera and use the lens from it for an eyepiece lens. The lenses should be mounted in tubes as is shown in Figure 1. When the distance between the lenses is slightly more than the focal

length of the large lens, then things should be in focus. At any rate, you can focus the telescope easily by sliding the tube in an out until things look very clear.

A reflecting telescope is a bit more difficult to make, but still can be done without much trouble at all. The main ingredient in a reflector is a curved mirror. The best way to get one all ready-made is to buy a shaving mirror from a ten-cent store or from a department store. These mirrors ususally have a curved mirror on one side and a flat mirror on the other. When you look in the curved mirror it magnifies your face, and supposedly, this makes it easier to shave! It is this curved mirror that makes your telescope work. (FIGURE 2)

Probably the mirror will be about six inches in diameter, so you will need a tube that large in which to mount your mirror. The best place to locate one of these tubes is at a store that sells rugs and carpets, since these floor-coverings usually come rolled on six-inchetubes.

Since your mirror is much larger than the lens that we mentioned while discussing refractors, it would be foolish to find the focal length in the same way. The increased heat and light from the sun would certainly set fire to your paper, and perhaps burn you severely at the same time. The safest way to find the focal length of your mirror is to go into a dark room and use a lamp in place of the sun, as we show in Figure 2. The distance between the mirror and the upside-down picture on the white paper is the focal length of your mirror. (Why the picture is upside-down is another matter, and we need not go into it here. However, when you use your telescope to look at the Moon,or any other object, for that matter, you will see that what you are observing is upside-down.)

After you have determined the focal length of your mirror, you should make a scale drawing as we show in figure 3. This is necessary to put your flat mirror in the right place.

You will need a flat mirror to reflect the light out the side of the telescope tube, because if you put your eyepiece in the location just past the focus, as we did with our refractor, then, obviously, your head would be in the way of the light getting to your mirror. In order to get

your head out of the way, we have to bend the light-path, using a flat mirror. These mirrors can be obtained at your local dime-store. Try to get one that is reasonably flat. Flatness can be determined by looking at a long fluorescent light. If the light-tube looks reasonably straight when you look at it with your mirror, then the mirror is reasonably flat.

(FIGURE 3)

Positioning this flat mirror is a matter of great imporatance. That is why you should employ a scale diagram. If your tube is 6 inches in diameter, then your mirror should be about 3½ inches down from the tip of the drawing. In other words the distance of the middle of the flat mirror from the focal point should be equal to half of the diameter of the tube, plus half an inch or an inch for focussing purposes.

You will have to construct a mirror holder. If you have a Meccano set, then you are in luck, as it is relatively simple to make a mirror-holder with Meccano pieces. Otherwise, you will have to visit your local hardware store and buy some corner brackets and other pieces.

Make a hole in the tube at the correct position as determined from your scale drawing. Then mount your mirror holder on the opposite side of the tube. When you adjust your mirror to 45 degrees, as shown in the diagram, then everything is ready. All that you have to do is insert your home-made eyepiece and point the telescope at the object you want to see. The same eyepiece that you made for your refractor can also be used in your reflector.

You might want to know the magnifying power of your telescope. For both kinds, the magnification can be found by dividing the focal length of the large lens, or the mirror, bythe focal length of your eyepiece. For example, if the focal length of your mirror is 24 inches and the focal length of the eyepiece is 2 inches, then you are operating at a magnification of 12. It may easily be seen that the shorter the focal length of your eyepiece, then the higher the power of your telescope.

The telescopes that we have described can be used satisfactorily by holding them by hand, but for a steadier view, you will want to make some sort of mounting for it.

4. K.E.Chilton

There is a mounting for a small telescope that is known as "The Plumber's Nightmare"! It is made from parts available from a hardware store or from a plumbing supply store. For the small telescopes that we have described you should operate with inch or inch-and-a-half pipes.

(FIGURE 4)

Once you have constructed your mount, as shown in figure 4, you can imbed it in concrete (that is, if you want it in a permanent location) or build some sort of wooden platform for it.

Attach your telescope securely to the board, perhaps with bolts and wing-nuts, and you are in business as an amateur astronomer.

The whole Universe will be open to you. However, I would like to add a word of caution.....NEVER point your telescope at the sun. Remember that when giving the directions for making the telescope, we mentioned that the telescope also gathers the heat from the sun. If you point your telescope at the sun, and then look in the eyepiece, instant blindness will result. I cannot emphasize this point enough; that to look at the sun is suicidal!

There is a safe way of looking at the sun, and that is to hold a piece of paper about six inches from the eyepiece. When the telescope is pointed at the sun, then a picture of the sun will appear on the paper. In this way, you will not be blinded.

Of course, these have been the simplest directions that I can give for making a telescope. However, with a little ingenuity, you may be able to improve on my design. I know, however, that even with a simple telescope such as been described here, you will enjoy looking at the skies and the splendours of the heavens, and with the pride of having a telescope of your own making.

1504 words

FIGURE 1

FIGURE 2

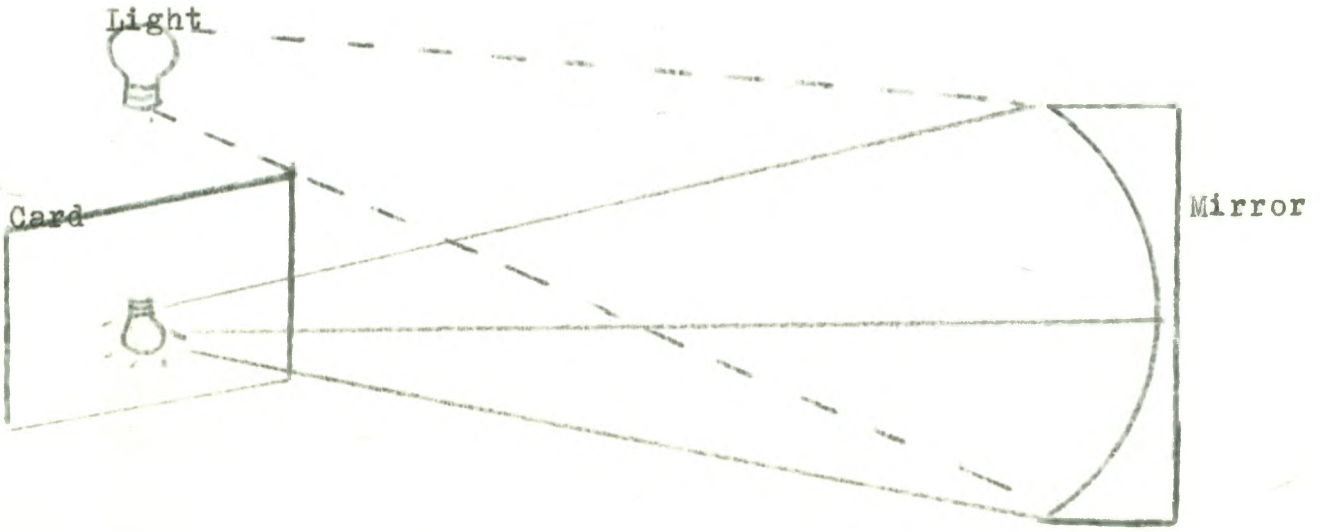

Figure 3

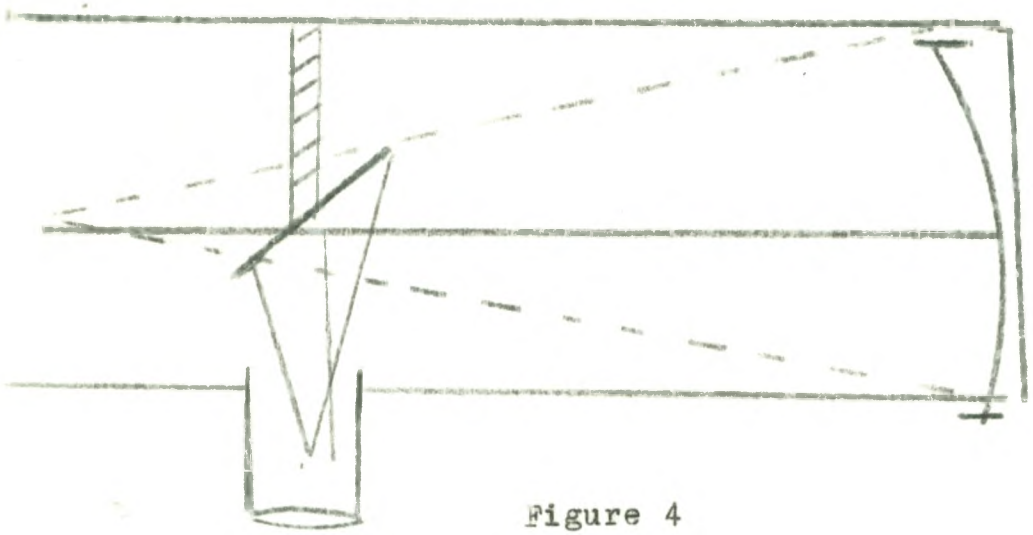

Figure 4