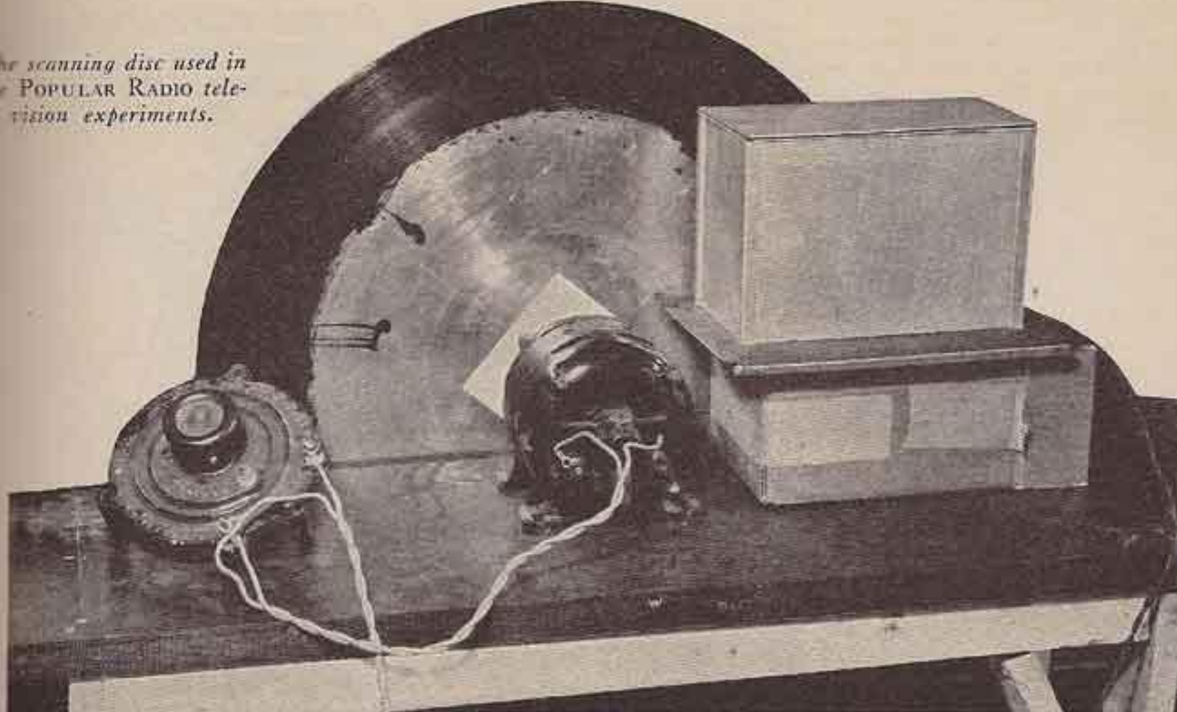


The scanning disc used in the POPULAR RADIO *television experiments.*

SCANNING DEVICES

What They Do *and* How to Make Them

The scanning device may be considered the nerve center of any television system, for it acts as a means of directing and disposing of the light impulses that make up the transmitted image. With reasonable care the home experimenter may construct a simple scanning disc which will satisfy all the needs of home experiments in this fascinating new art.

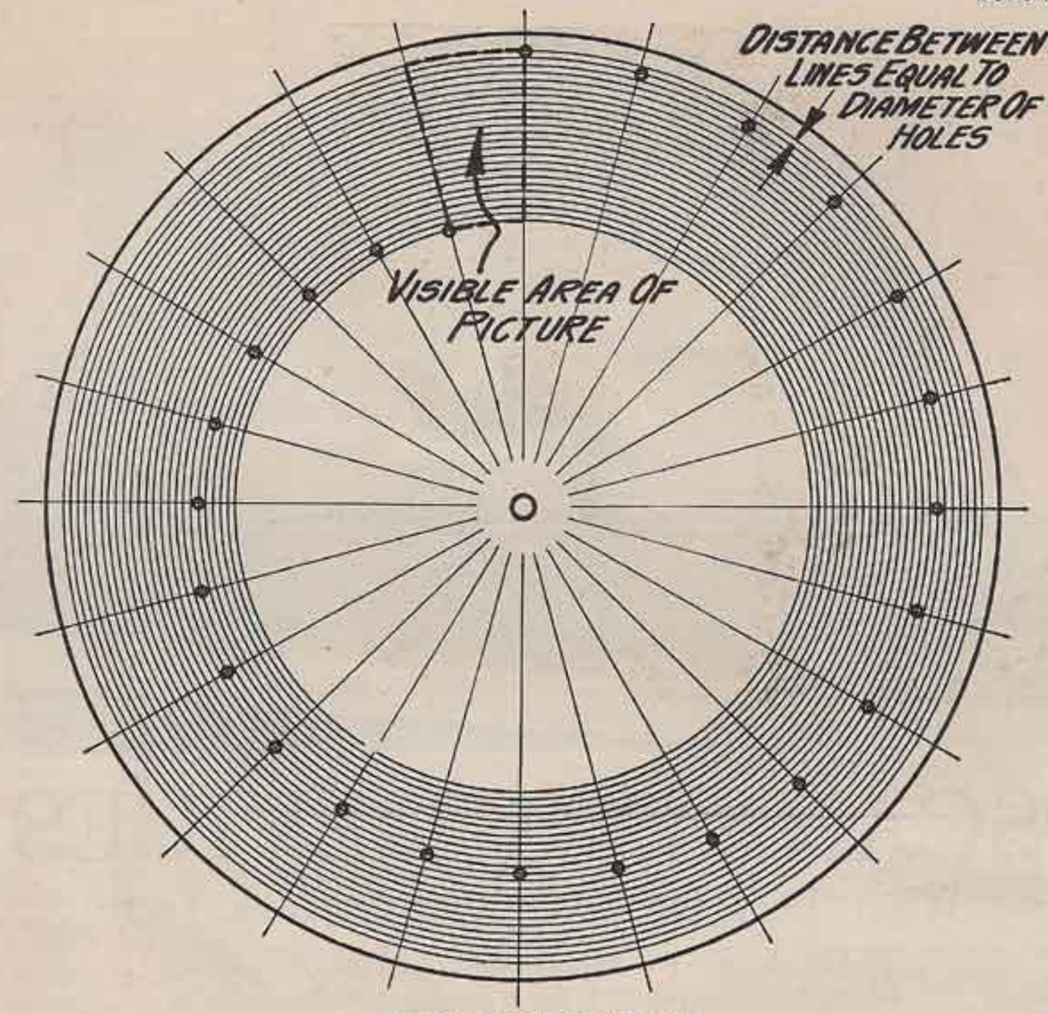
By IRVIN HARRIS

THE scanning device is one of the key components of a television transmitter and receiver. Although simple and inexpensive to construct, it calls for a high degree of accuracy if distortion of the transmitter picture is to be minimized. It is the scanning device that causes the beam of light to explore the picture or object to be transmitted. This is done by a succession of holes which pass before the light source, each hole being so arranged as to cause the exploring beam to sweep across the object, each time at a lower level.

Although various types of scanning devices have been developed, the most simple one is that developed by Nipkow in 1884. Nipkow simply used a revolving metal disc with holes arranged in a spiral. Inasmuch as this spiral must be accurately traced, if the exploring beam is to catch every detail of the object being transmitted, it behooves the experimenter to find some simple way of laying out the disc for the drilling operation. It is obvious that the average workshop is not equipped to trace these spirals with a machine method.

In Figure 1 there is shown a simple and very effective way of developing the spiral which will be sufficiently accurate for all amateur work. Having determined upon the diameter of the scanning disc used, the experimenter makes sure that the sheet metal that he is using is not perceptibly warped and that the exact center of the circle is found. Having done this, one line is drawn through the exact center of the disc. Next, a protractor is set so that its central point rests on the center of the disc. For purposes of illustration, we shall assume that the scanning disc under discussion is to be provided with 36 holes, inasmuch as 36 is a divisor of 360, which is the number of degrees in a circle. This permits the holes to be laid out 10 degrees apart. In marking off the disc, care should be taken that the protractor will not move and, having assured himself of this, the experimenter may proceed by the aid of a sharp prick punch to mark the disc off. In doing this it will be found advisable to lay the disc on a solid metal surface, perfectly flat, so that there will be no danger of springing the metal under the impact of the hammer blows which, although light, may cause damage.

Having laid out the 36 holes, the workman proceeds to draw 36 lines so



HOW THE DISC IS LAID OUT

FIGURE 1: *This drawing is diagrammatic only, and cannot be used for the exact layout of a disc. The visible area of the picture is defined by the radii through two consecutive holes and arcs of circles through the inner and outer holes. Hence, to make the area as nearly square as possible, a large disc should be used, with the arrangement of the holes near the edge of the disc.*

that each line will go through the center of the disc and through each one of the prick punch markings. These markings should be made with a scriber and a straight edge, and patience and care should be exercised to make them as accurate as possible.

The next operation is that of drawing 36 concentric circles with a special compass sufficiently large to accommodate the work in hand. If this compass is not available in the workshop kit, a splendid substitute can be made readily with two wooden strips screwed together at one end so that they will move freely, the opposite ends each being provided with a phonograph needle. The outermost circle is drawn first, and the distance between this circle and subsequent circles will be determined by the size of the holes to be used in the scanning disc. This, as we shall see later, depends upon the demands to be made upon the apparatus, the degree of quality desired, the speed of the disc, and the size of the picture to be handled. In this case, let us assume that a hole made by a No. 48 drill is chosen. A No. 48 drill has an actual diameter of .036 inch. It is this dimension that determines the distance between the concentric circles.

From a drawing in Figure 1 it is obvious that the matter of laying out the holes so that they will conform to a spiral is comparatively easy. The first hole is placed at any one of the indicated lines that were drawn. The next hole is placed on the intersection where the line of the second circle passes through the line indicating the next 10 degrees. The next hole is placed on the third line down, and so on, until the mark for the last hole is completed. Each hole should be carefully marked at the intersection line with a prick punch *before* the drilling operation is undertaken.

The drilling will have to be done with some care, for it is essential that the holes shall not overlap to any perceptible degree, although a trifle will not do any harm—in fact, it is beneficial. When the drilling has been completed, the holes are then lightly countersunk so as to effectively remove all burrs that may have been developed during the drilling. If the burrs are not removed the definition of the scanning beam will be partially destroyed and will lack the sharpness necessary for good reproduction.

Perhaps it might be advisable at this point to consider the various metals that are available for use in scanning discs. It is obvious that the metal must be thick enough to hold its shape, and that it will exhibit no tendency to warp. Aluminum, due to its light weight and its desirable physical properties, is perhaps the most acceptable of all the

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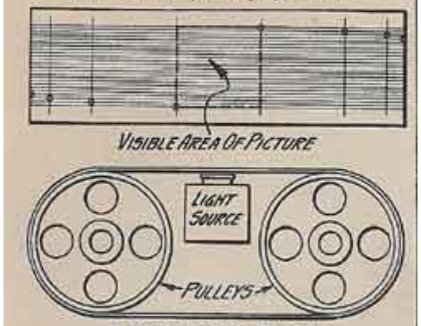
Scanning Devices

(*Continued from page 390*)



A SCANNING BELT

FIGURE 2: *In this sort of scanning device the holes are arranged diagonally on a belt which passes over two wheels, one of which supplies the drinking force. The image is defined by the distance between holes, and the combined width of the holes.*

metals that could be used. It is easy to drill and machine and, owing to its light weight, it is least affected by the high speeds necessary in scanning work. Thin sheets of metal with a slight warp in them will have a tendency to flatten out when revolving at high speed.

Having acquainted ourselves with the mechanical operations necessary for the production of the scanning disc, we are now ready to review the factors determining the physical dimensions of the disc and the laying out of the holes. It is evident that the larger the number of holes on the disc, the greater the tendency toward better reproduction. The number of holes in the disc determine the number of sections or lines into which the picture is divided. Thirty-six holes would simply mean that the picture was divided in to 36 sections or lines.

What actually determines the size of the picture that can be transmitted is the distance between the holes, as well as the size and number of the holes. This becomes clear upon reference to Figure 1. From this diagram it will also be plain that the size of the picture must be adjusted so that only one hole is sweeping across it at one time. Simple arithmetic will show that the scanning disc is more or less limited in its application, and that home experimenters cannot hope to transmit very large pictures with great detail.

Although scanning wheels or discs provide what is perhaps the best known method of illuminating objects to be transmitted, there are several other methods that have been applied successfully and which lend themselves to experimental research. Figure 2 shows how a moving belt, which may be of very thin metal, can be applied to the problem of scanning. Here the holes are arranged diagonally, producing the equivalent of a spiral. In this instance, the size of the picture is determined by the distance between two successive holes and the width of the belt.