LANTERN SLIDES.

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Lantern slides are now considered as necessary educational material as maps and natural history specimens. They serve the same purpose as the illustrations in our text books, but being larger and brighter than these they are of greater interest to students and can be better studied and interpreted. A series of lantern slides on particular topics such as erosion, mountain structure, seed dispersal, development of the algae, insects, birds, historic scenes, etc. are excellent for summaries and general reviews, and they give more pleasure than the ordinary reviews.

Every teacher in geography, history, geology, botany, zoology, and the physical sciences ought to own a hand camera to take local views to illustrate his subject or to bring back pictures from his travels. The school should supply him with the plates, chemicals and other accessories for such work.

I prize above all others the lantern slides made from original photographs, and students also appreciate these more because of the personal element and local flavor.

Personally I like a 4x5 plate camera the best for general outdoor work. With a Kodak roll of films or a Premo film pack attachment such a camera is a useful accessory in one's travels and rambles about home. But a $3\frac{1}{4} \times 4\frac{1}{4}$ hand camera has perhaps an advantage over the larger sizes for lantern slide work, because its pictures may be readily reproduced by the contact method without any reduction, or cutting out. The contact method of making lantern slides is very similar to that of making ordinary prints. The negative is placed in the printing frame with the film side up. It should be previously well cleaned on the other side, and dusted with a soft camel's hair brush. The lantern slide plate is then brushed and placed film side down on the negative. The film side can be readily distinguished. It does not reflect the light as well as the other side. On looking at the edge of the plate light will be seen refracted through to the glass side from the end, but not on the film side. By slightly moistening the finger and pressing on a corner of the plate the film side is distinguished by its stickiness.

The exposure is made as with prints, but the lantern slide plate

is very sensitive as compared with ordinary sensitized papers, and the exposure should be carefully tested for the brand of plates used. I use Seed lantern slide plates and expose from one-half to two seconds at a distance of three feet from a 16—c. p. electric lamp. Other artificial lights and of course daylight may be employed. Daylight, however, is more variable than artificial. Test for exposure by holding an opaque paper over about three-fourths of the plate and expose for, say, half a second. Then draw the paper back so as to expose one-half the plate and again expose half a second, and so on for the rest of the plate. In this way the four parts of the plate have been given varying exposures of from two to one-half seconds. On developing the plate it can then be seen which exposure gave the best results. In this way the plates are not wasted so much. It must be remembered that the denser negatives require a longer exposure than the thinner. In exposing different plates use the same distance from the light as the intensity of this varies inversely as the square of the distance. In timing exposures a metronome is convenient. I sometimes use a seconds pendulum made of a cord and a bright bob.

If 4x5 plates or larger are to be used for contact printing, a part of the plate must necessarily be sacrificed and cut out, the lantern slide plate being placed simply over the part most desired. The standard lantern slide size is two and three-fourths inches square, the rest being covered by the mat.

The reduction method is necessary where we desire to retain all that is in a 4x5 (and even in the $3\frac{1}{4}\times 4\frac{1}{4}$) plate and the larger sizes. This consists essentially of taking a photograph with the camera of the desired negative and reducing it to the necessary size. This method gives better results generally than the contact method.

A simple method for reducing is to place the negative to be copied in a vertical frame or kit against a white background or better against a north sky, with the film side toward the camera. The negative is then copied upon a lantern slide plate in the camera. Care should however be taken to exclude all stray light and reflections on the lens in order to prevent the fogging of the plate. This can be done by laying sticks across the top of the negative frame and the camera and covering the whole with a dark cloth. A better way is to make a box with a kit at one end capable of being reversed and of holding plates of various sizes,

Fig. I. The hand camera is placed in a guide at the other end of the box and should be centered on the negative holder. There should be a long door on the focusing side of the camera, and the box should be painted a flat black inside. By sliding the camera along the guide different reductions can be made. The box should be about four feet long. It should be turned up to a north sky.

Fig. 1

Great care should be exercised in getting a perfect focus. The exposure should be tested in a manner similar as for the contact method. It should be varied for density of negative and for variations in the intensity of the light.

Many lantern slides may be made from line drawings, woodcuts, half-tones and colored prints in books and magazines. Though most of these are copyrighted there is probably no objection to their being copied without express permission for lantern slides to be used in class room instruction, especially if due credit be given. If such slides are to be copied for commercial purposes, however, permission should first be obtained.

Copying pictures presents no serious difficulty providing a few simple rules are followed. The ordinary outdoor plates are not suitable for such work. They give very disappointing results when tried on line drawings and half-tones. I use Seed's process plates for such work which are especially excellent for fine line work. And it is surprising what brilliant negatives may be made with such plates from very dull and flat half-tones. It is well to consider however that the half lights are lost more or less with process plates. Very slow outdoor plates probably give better gradations of light. Again the ordinary plates and the process

plates also give disappointing results with pictures in colors. The proper light values cannot be brought out by means of these plates. Orthochromatic and other color sensitive plates should be used for such work. These are also necessary for the best results with the direct photography of flowers, insects, etc.

The simplest and crudest way to copy is to use the hand camera on the tripod, the picture or book being placed before it. This however is very troublesome as it requires much shifting about with the camera in order to secure size and alignment. It is somewhat better to set the tripod upon a triangular base with castors. Then the legs of the tripod need not be disturbed and the whole thing can be more easily moved.

It is best, however, to make some kind of a copying frame or stand. The camera should be placed upon a special base capable of back and forward motion along a board at the other end of which is placed an easel on which the book or picture can be placed, Fig. II. The axis of the camera and the plane of the

Fig. 2

picture should be at right angles to prevent the distortion of the image. If the camera base is so made as to give also vertical, lateral and swing adjustment so much the better. The rising and falling and sliding front of the camera itself is useful for such alignment, and so is the reversible and swing back if these conveniences are provided in the camera. In the last October number of *SCHOOL SCIENCE AND MATHEMATICS* I have described a very simple and convenient form of copying stand. Some sort of a copying stand is almost absolutely necessary for anyone who intends to make lantern slide work a regular practice. For all-

around usefulness in indoor photographic work a regular copyist's camera for enlarging, reducing and copying is a profitable investment, at least for the larger schools. The Climax camera is such an apparatus. I have one with a Benster plate holder for plates of different sizes, the largest, 8x10. I had a lantern slide attachment put on with reversible back, with lateral, vertical and swing adjustment. This camera together with a strong adjustable stand and easel makes lantern slide work a pleasure indeed.

A good side light is necessary for copying, that from a north sky being most satisfactory as it is less changeable. Be careful that no shadows of window sash and also no sunbeams fall upon the picture to be copied. Keep all reflections off the lens.

It is well for uniformity to make the lantern slide pictures all of standard size. There are, however, exceptions. Small objects such as details of plants, insects, and also portraits look better on the screen if not made too large, and need not be made standard size.

To reduce a picture increase the distance between the picture and the camera and shorten the bellows. To enlarge, do the reverse. Most hand cameras are not made with bellows long enough for enlarging. In selecting a camera with the intention of doing lantern slide work with it, choose one with extra long bellows as this enables one to copy small pictures better. A short bellows may be lengthened by putting a light tight extension on the lens front and inserting the lens in the front end. In enlarging remember that as the light rays are diffused more the exposure must be lengthened.

Great care should be taken in focusing. It is best to focus on some line or printed words that may be on it, than upon the picture in general. In focusing use the largest aperture, but in exposing reduce aperture to small size. I generally use No. 32. A small aperture gives better definition, but requires longer exposure. It is best to use one particular size of aperture for all copying and thus become accustomed to the necessary variations in exposure for that stop.

Lantern slide plates are developed in the same manner as ordinary plates, only the developer is stronger and the image comes up rapidly. Experience soon teaches how far the development should be carried. The slide should not be too dense and the high lights should be clear and white. Hold the slide up frequently and when the definiteness and contrast are sufficient put

the slide in the hypo. A white plate or developing tray is very useful in judging when the development is sufficient. It is well to try a few slides of different intensities on the screen to see which is the most satisfactory. Over-developed slides may be easily reduced by the usual methods. Use the developer recommended by the makers of the plate used,

Many lantern slides can be made more beautiful and their value as illustrations improved by coloring them. Colored slides of landscapes, birds, mammals, insects, plants and diagrams colored for contrast are more desirable and effective than the black and white. This coloring is not difficult. Use *transparent* water colors sold by dealers for this purpose. To avoid the formation of water lines first moisten the plate slightly with a wet brush and let the water soak in a little before applying the colors. Though a slide may at close sight seem too crude and gorgeous, it may nevertheless be very presentable on the screen.

The slide is now ready for the binding. Get some black "needle" paper, sometimes also used for the backs of pictures, and have it cut into lantern slide size for mats. The mat is the frame for the lantern slide picture. An opening to fit the desired part of the slide should be cut neatly and smoothly with a sharp knife or trimmer wheel. Lay the mat on a piece of glass or, better, a sheet of zinc while cutting. The cut edges should not be ragged, and they should be parallel with the edges of the plate. A great deal of the beauty of a fine slide is lost by a mat cut in a poor and slovenly manner. Place the mat on the film side of the lantern slide plate. Put on a thoroughly cleaned crystal cover glass and bind the two plates together with lantern slide binding strips. For this I know of no neater apparatus than the Ideal lantern slide vise. Draw the strip through a dish of water to wet both sides. When it is flexible apply it to the edge of the plates and cause it to overlap evenly on both sides. Press down well on the edge and sides, and especially at the corners.

Finally the slides should be properly labeled. Printed labels may be gummed on one end with the name of the subject, maker, school and date. They should be so put on as to at the same time serve as a thumbmark for the ready insertion into the lantern.