For any value of y_1 the Peaucellier inverter gives a rigorous mathematical solution for y_2. A schematic diagram of the autofocusing mechanism at 1X as used in the projector is shown in Figure 3. The four outer links are of equal length (L) and can be of any length consistent with the desired geometry (and range of magnification). The length of the two intermediate links (1) is determined by L and the focal length (f) of the lens used. It is expressed by the following relationship:

$$1 = \sqrt{L_2 - f^2}.$$

Figure 4 is a schematic diagram of the inverter set at 1.5X magnification.

Due to its compactness and autofocusing feature the projector is expected to find a wide field of application. It is estimated that the large projection area will enable this instrument to handle about 80 per cent of the work currently done by much larger projectors.

AN ACCOUNT OF SOME RECENT ATTEMPTS TO IMPROVE AIR NEGATIVE QUALITY BY PROCESSING CONTROL*

R. W. Lambert, Photographer, Air Survey Division, Dept. of Lands and Forests, B. C. Provincial Government

ABSTRACT

A processing method is described to obtain the maximum amount of printable detail from aerial negatives that have a wide range of subject contrast. Several developer formulae were tried and the most satisfactory formula was found to be a modified D-76, in which the elon-hydro-quinone ratios were equalized and Kodalk substituted for the borax, resulting in slightly lower contrast but maximum activity. Resulting gammas were in the range of 0.80 to 0.85. A satisfactory series of negatives have been produced under most conditions of exposure.

W. E. VARY

MANY factors affect the processing technique of air negatives. Among these are the type of terrain, the exposure, light and weather conditions, type of printing apparatus, and the ultimate use of the finished print.

The physiography of British Columbia, ranging from its snow-capped mountain peaks reflecting a brilliant sun, to the deepest timbered valleys and canyons beneath a heavy layer of haze and smoke, poses a major photographic problem. In an endeavor to improve the reproduction of this wide range of non-photogenic material through processing control, a series of tests was started to find a developer and a technique which would produce a type of negative containing the maximum amount of *printable* detail over the widest range of subject contrast and exposure conditions. If a negative of this type could be produced, then the photographer would have a useful commodity with which to interest the photogrammetrist.

From past experience it was decided to try a number of fine and semi-fine grain, low contrast developers on a practical comparison basis, with the selection to be made from the finished prints. As all negatives in this unit are enlarged 1.85 X from a 5″×5″ original, the same procedure was followed in the tests and further enlargements to check grain appearance were made to 6 X, this being the maximum routine enlargement by this Division.

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The developers—D-23, DK-20, DK-60B, and D-76 (Kodalk)—were selected and both air and ground negatives were used in the tests. Time-Gamma-Temperature charts were obtained for these developers and the manufacturers instructions were followed carefully in all respects. Particular attention was paid to the agitation during development, and as we use a hand-operated spiral developing unit, control was fairly easy in this respect. The result of this trial was the selection of D-76 (Kodalk) as the developer most likely to serve our purpose, and this was used by us for some time. A modification of the formula (D-76) was obtained, equalizing the hydro-quinone-elon ratio thus giving a little less contrast, and as Kodalk was substituted for borax, maximum activity was assured. Agitation again was the subject of careful experimentation along with variations in the development period. A combination was worked out which gave a negative approaching our requirements. As we were interested in the production of a particular type of negative and not its development to a specific gamma, the lack of an appropriate Time-Temperature-Gamma chart for the modified D-76 (Kodalk) formula did not hinder the tests. The graphs for D-76 itself were used and this provided all the control we needed; because of this an accurate gamma rating cannot be given but it is in the nature of .8 to .85.

The formula (D-76 b) Kodalk is now in use by this Division and a satisfactory series of negatives have been produced under most conditions of exposure. All rolls of film are processed in a standard manner, but if photographs are taken under particularly abnormal conditions, the developing time is adjusted slightly.

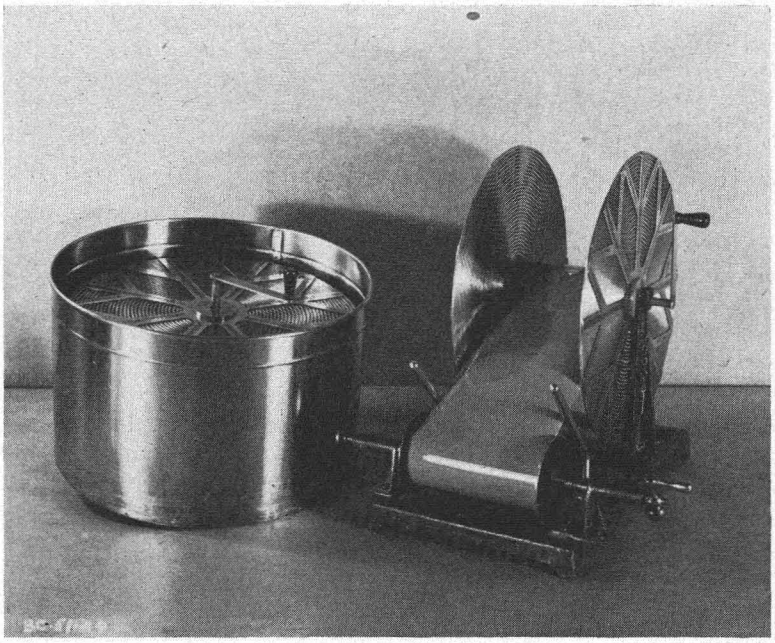

FIG. 1. Spiral Developing Unit for Films 5½″×60′. The film is fed from the spool through the pair of guide arms, which, being spaced slightly less than the width of the film, produces a slight curl to facilitate its entry between the spiralled steel, to the clip on the core between the flanges. Here the film is held by this clip and the reel rotated, drawing the film forward and outward from the center. The layers of film are spaced by the spiralled flanges and held quite firmly providing all handling is done in a gentle manner. It may be noted here that stress and strain on the film is at a minimum when using this arrangement; this satisfies an important requirement of Air Survey photography.

The spiral unit previously mentioned is regarded by us as a desirable apparatus for accurate processing of long lengths of film. The principle of its design parallels the miniature film developing reels and is capable of taking a roll $5\frac{1}{2}''$ wide of any length up to 60 feet. This system permits the complete length of film to be immersed in solutions instantaneously thus permitting even development throughout the length of the roll, and without the pressure marks on the ends that are the trade-mark of the "back and forth" type of machine most frequently in use today. Thus we are sure of faultless negatives almost to the ends of the roll and with a reduced wastage of film. Whether or not a spiral could be made for the larger size films in current use is difficult to say but the results should justify the effort. Figure 1 shows the spiral developing unit for films $5\frac{1}{2}$ inches by 60 feet and includes a brief description of its operation.

Although considerable effort has been made to produce a negative from which every trace of detail can be extracted in a routine printing procedure, it of course has not been entirely successful due to the vast range of subject contrast encountered, and to the high contrast projection unit employed by us for printing. This unit features the Western Union Telegraph Company's Concentrated Arc Lamp of 25 watts and a carefully selected lens-condenser combination. The arc lamp provides the near-ideal pin point light source from which the rays are collected by the condensers and focused to the center of the projection lens. This efficient collecting agency makes possible the low power illuminant and of course a correspondingly small source. Our projection system is an unrelenting check on negative quality, for every infinite mark, abrasion, and fault of development is bared for all to see in the resulting print.

In the attempt to further improve our negatives, some tests were made recently using a new developer (Von-L) but as this is still the subject of experimentation no useful comment can now be made.

Methods and techniques employed by the Air Survey Division to process rolls of aerial negatives have been governed considerably by local demand and conditions, but it may be that some aspects of our system would be of use to other agencies. Although there is an abundance of literature both general and detailed on this subject, it still remains for the photographer to sift and weigh all this information in the light of his own requirements; having done this a standardization of procedure should follow.

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