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A technique for analyzing the paper fiber accumulation on the blanket of a web offset press

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A TECHNIQUE FOR ANALYZING THE PAPER FIBER ACCUMULATION ON THE BLANKET OF A WEB OFFSET PRESS

By

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Abstract:

High-speed stroboscopic photography was utilized in the study of paper fiber accumulation and agglomeration on the blanket of a Web offset press during press operation. The photographic technique employed provided an excellent method for detecting this fiber accumulation. The microdensitometric analysis of the negatives proved to be useful but very time consuming. The accumulation of paper fibers and agglomerations of the same were found to increase with the number of impressions. The higher the percent dot of the printing area the more larger agglomeration was detected. The accumulation of paper fibers and agglomeration of the same along some borders between two different percent dot areas was found to be more then that within a uniform printing area. A technique for predicting the orientation or location of this border was not possible to formulate.

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Introduction:

The accumulation of paper fibers (linting) ~~by~~ the blanket of an offset press poses many problems in the production of quality printed products. This paper describes a technique for analyzing this accumulation during press operation.

The particular problems encountered as a result of linting may be generally stated as a degradation of the printed product due to inhibited ink transfer and an undue amount of wear on the blanket, plate and inking rollers of the press. Paper fibers are collected on the blanket due to the tack of the blanket and the ink on the blanket lifting them from the paper. These fibers collect and agglomerate on the blanket then transfer to the plate and eventually into the inking rollers. In each stage the fibers and clumps restrict the transfer of ink and increase the wear on the press parts. In extreme conditions the fibers and agglomerates on the plate may result in making the plate unreceptive to ink (blinding).

With the utilization of various photographic techniques it was thought that this problem of linting might be more fully studied. The versatility of using a high-speed stroboscopic light source in the stopping of motion and the ability of conventional 35 mm cameras to capture this effect of the stroboscopic source together formed the technique utilized in this investigation.

Method:

The technique used in this investigation was largely determined by the equipment available. The apparatus used provided a very effective means of studying the fiber accumulation on the blanket of the press during operation. When reading the following description of apparatus and technique refer to figures VII and VIII.

Photographic Technique-

The photographic method utilized was that of high-speed photography. A very short duration (30 micro seconds) stroboscopic light was used as a light source (shown as C and D in figure VII). The photographic record was made utilizing a conventional 35 mm single lens reflex camera with a 50 mm lens and a bellows extension of 20.8 mm (shown as B in figure VII). A standard black and white film of ASA 160 was used as a recording medium, the resulting camera exposure was $\frac{1}{4}$ second at f 16.

The major difficulty was the syncronization of the camera and the stroboscopic light so that the shutter would be properly opened for exposure. This was accomplished through a precise triggering technique for both the stroboscopic light and the camera shutter. Therefore by adjusting the shutter exposure time a complete and single exposure could be accomplished with the shutter completely opened.

This triggering technique was accomplished using a double-pole micro switch mounted against a cam on the axle of a blanket on the press. The micro switch triggered the stroboscopic light once every revolution at the same blanket position. This made it possible to photograph the same image area of the blanket every time. The other side of the micro switch completed a circuit to an integral counter which then counted once for every blanket revolution. The counter in turn closed a circuit with the camera trip solenoid (shown as A in figure VII) at any preselected count. Therefore the camera could be triggered every certain number of impressions or revolutions of the blanket. It was found that the counter circuit closure was not of sufficient duration to allow adequate camera tripping by the solenoid. This problem was over-come by allowing the counter to close a circuit to another relay which was so wired to hold itself closed upon receipt of this short duration contact with the counter. Then this relay in turn tripped the camera solenoid. After a shot was taken this relay was opened by breaking its hold circuit with a switch. In order to reduce wear on the stroboscopic light it was turned on manually when the counter indicated a shot was about to be taken then turned off after it had flashed every revolution until the shot had been taken. This technique then required constant attention so as to turn on the strobe light, break the camera trip circuit and finally to advance the film after every shot was taken.

Press Technique-

The photographic study was made on the yellow printing unit of a Web offset press printing on newsprint. The yellow printer is the first printing unit come into contact with the paper and therefore collected the most lint. The portions of the press printing unit are shown in figure VII, F being the inking rollers, G being the plate and plate cylinder and H being the blanket which is made of rubber.

An area of the blanket was photographed which contained four different percent dot printing areas, those areas were of approximately 5, 20, 40 and 60 percent dot. The resulting negative was of .5 times magnification and covered a 2 by 3 inch area of the blanket. Photographs were taken at every 450 impressions. This number was selected in order to allow the maximum number of photographs to be taken per roll of paper printed without having to change film during the press run.

Data Analysis Technique-

It was felt after viewing the photographic results and considering the many variables affecting linting, and the varying effects of single fibers and agglomerates ~~had~~ on the finished printed product, that a single numerical value for the amount of lint on the blanket would not be satisfactory as an indicator of what is happening on the blanket. A typical photographic result is shown in figure VIII; this represents an enlarged print of the blanket area studied after 6,880 impressions. As can be seen the fiber distribution is not uniform or random, but is affected by percent dot on the blanket, and there are interactions along borders between areas of different percent dots. The resulting evaluation technique was a break down to the fiber size verses frequency distributions at various percent dots and after various numbers of impressions.

Three different impressions were selected for study, these were 1,290, 6,880, and 12,470 impressions, representing times early in the run, in the middle and near the end of a press run. The size-frequency distributions of the fibers and agglomerates were then in turn studied in the four different percent dot areas.

The technique used to determine the size-frequency distributions was microdensitometer scanning. Each area of percent dot of the three negatives representing the three different impression numbers was scanned. Figure VIII displays the type of image scanned, arrow A indicates the direction and area of scan covering the various percent dots while arrow B indicates the scan made over a border. The microdensitometer scanning rate was 4 mm per minute with a circular aperture of 2.5 mm diameter and a magnification of 25 times. The resulting thrace was made at a graphing rate of 8 inches per minute and an example is shown in figure IX. Fibers and agglomerates stood out from the grain of the film on the traces (shown as A in figure IX) and were classified as to their relative size starting at the smallest detectable fiber. Relative size was determined by the width of the fiber on the microdensitometer trace shown as B in figure IX. The scale for relative size was from 1 being 0.10 mm and increasing by 0.02 mm for each step, 2 then being .12 mm and so on. These sizes are not accurate due to possible image blur and noise in the microdensitometry in the form of grain but are approximations which on the ~~the~~ relative scale are adequate for this analysis.

Visual inspection of the photographs showed a significant change in the fiber accumulation and clumping along a border between two different percent dot areas. This characteristic was studied by scanning a border through the three impressions series with a slit of 2.5 mm in width and plotting the fiber clump distributions of that edge (as shown in figure V) using the same analysis technique as in the previous scans.

The question then arose concerning the orientation of the fibers and agglomerates because all the microdensitometer scans were being made in one direction.

If anything but a random orientation of the fibers is present the scans may not be valid. Therefore an area of the negative was scanned in perpendicular directions and fiber distributions were constructed as before and compared to see if any significant differences were present, the results are shown in figure VI. From this figure it can be seen that there is no appreciable difference in the two measurements so my distributions are valid for any microdensitometer trace orientation.

Data:

The results of this investigation are shown graphically in the following figures:

Figures I - IV

Plots of relative size verses frequency of occurance per half inch of blanket of fibers and agglomerates for the various number of impressions and percent dot areas. Also plotted are the number of agglomerates per half inch of blanket which would have plotted off the relative size scale in these graphs.

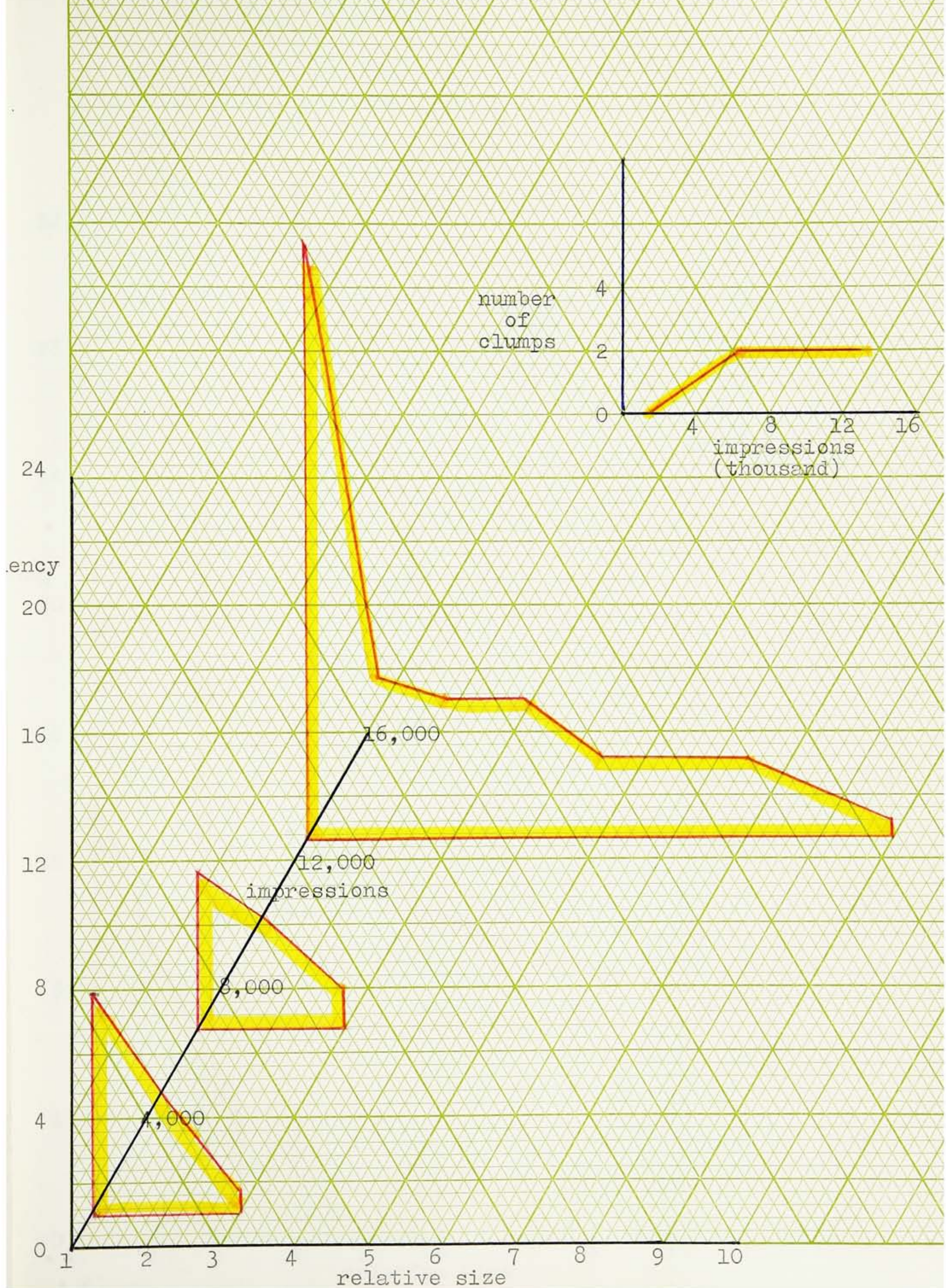
Figure V

A plot of the relative size verses frequency of occurance per half inch of blanket of the fibers and agglomerates along an edge for the three impressions studied.

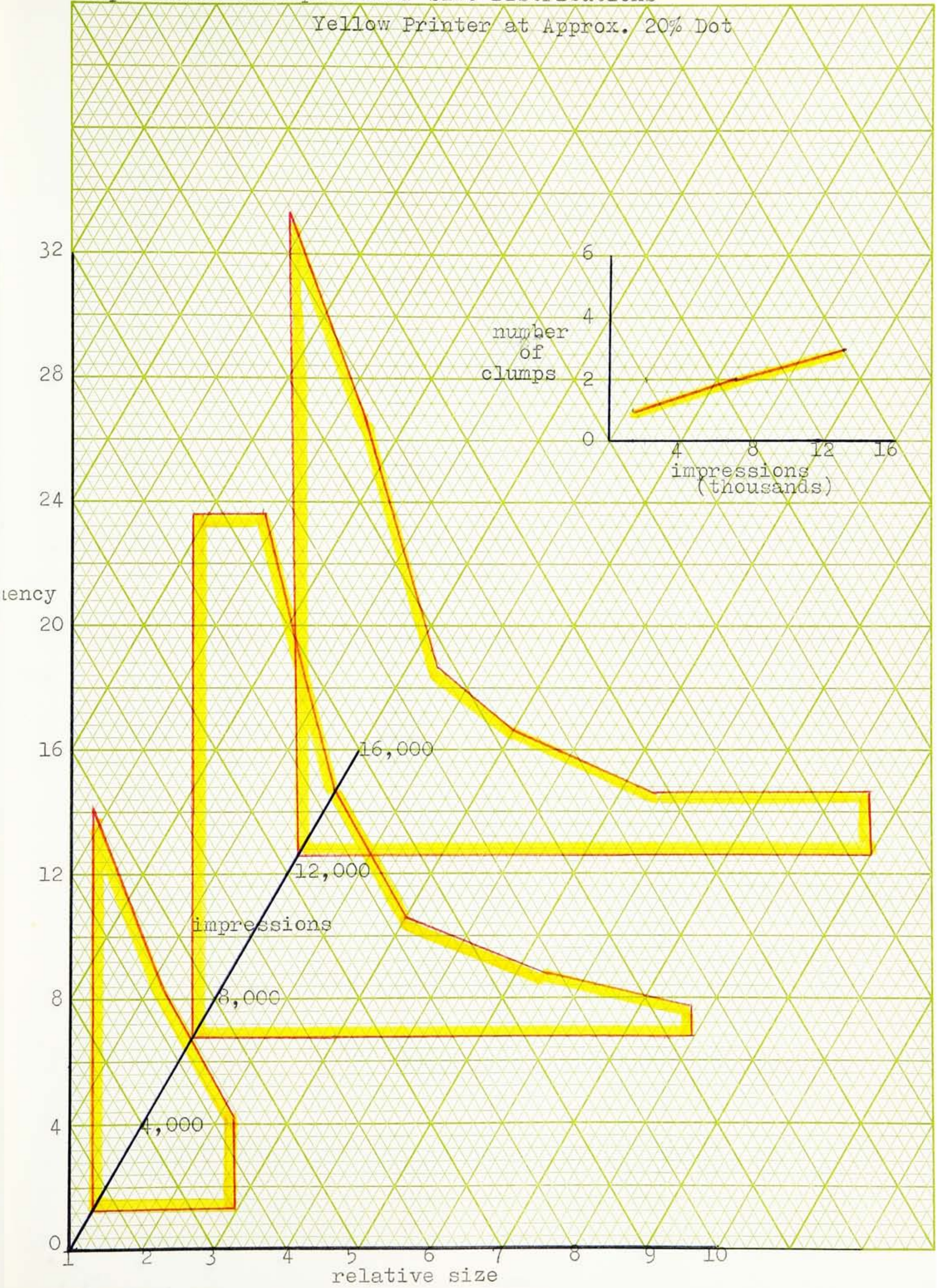
Figure VI

A plot of the microdensitometer test for the dependence of orientation of fibers on the analysis technique

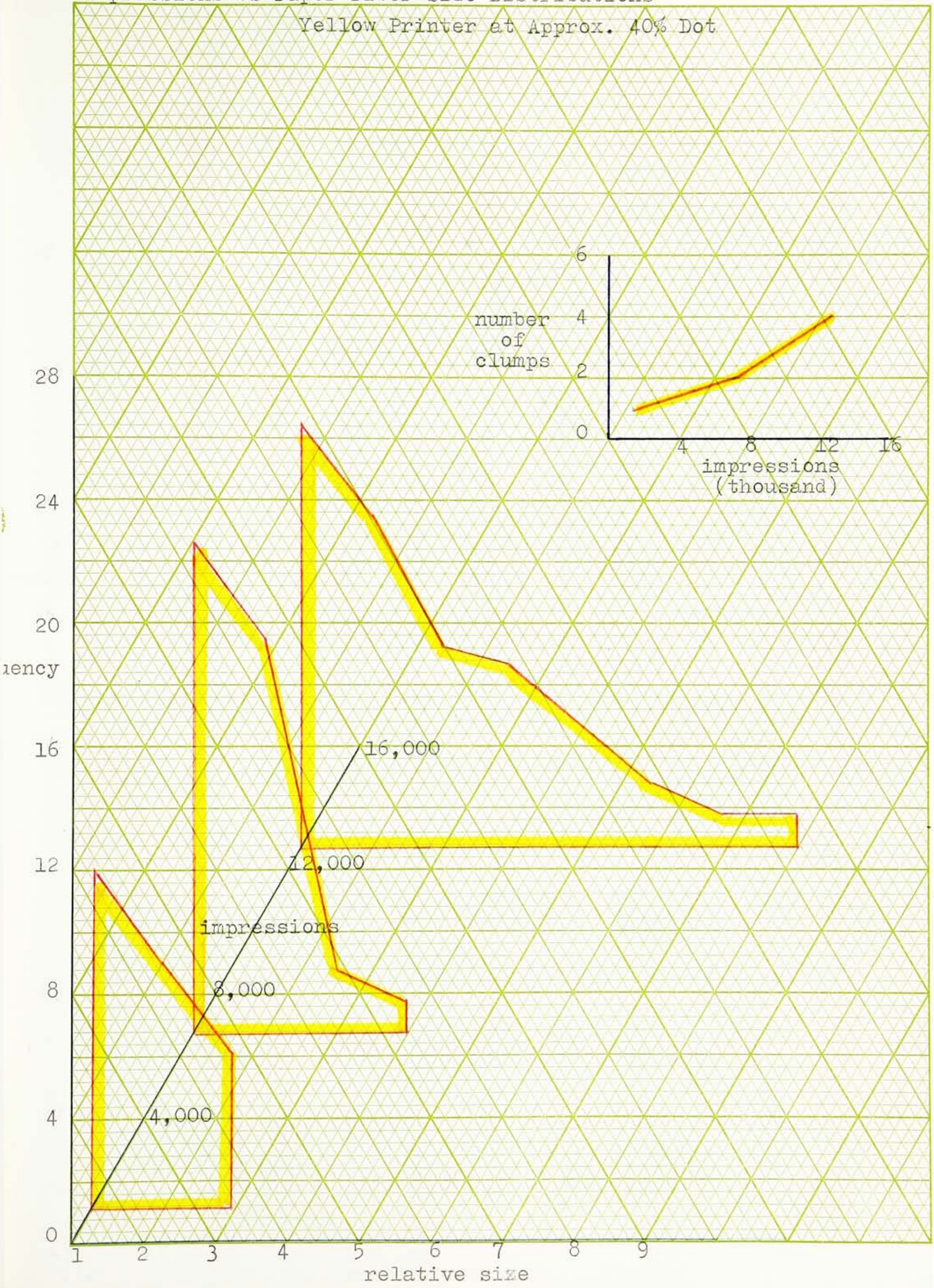
Impressions vs Paper Fiber Distributions
Yellow Printer at Approx. 5% Dot



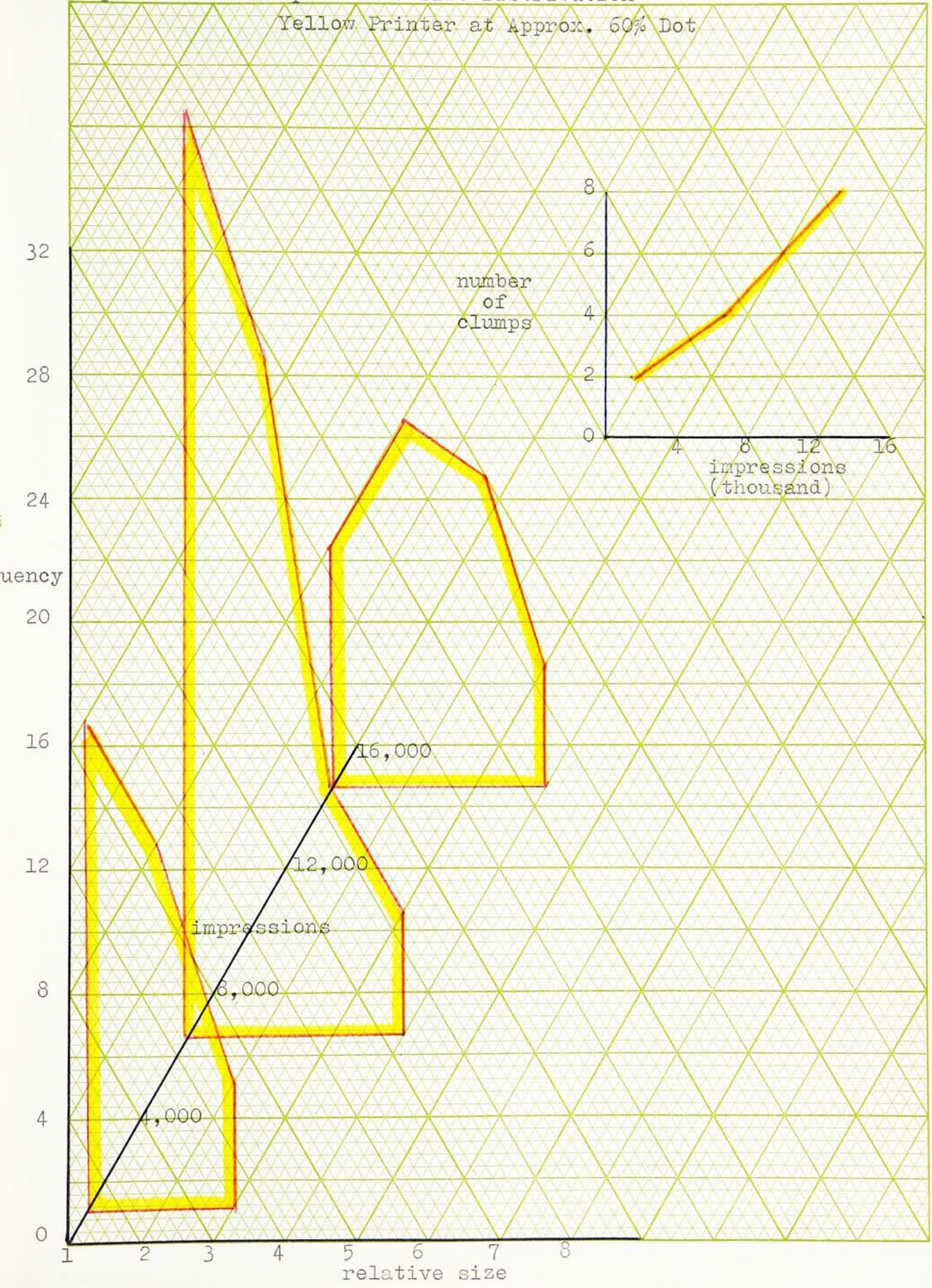
Impressions vs Paper Fiber Size Distributions



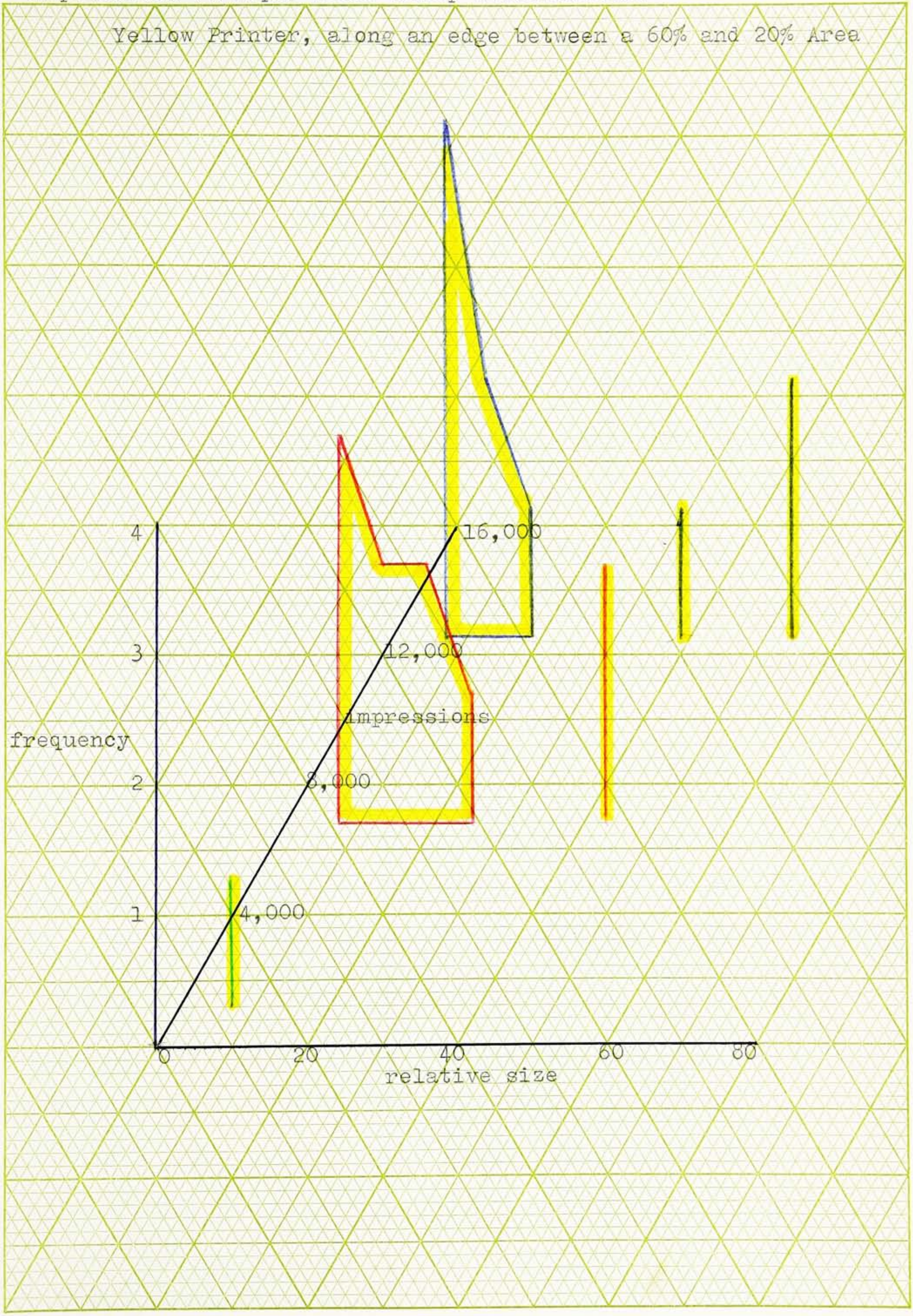
Impressions vs Paper Fiber Size Distributions



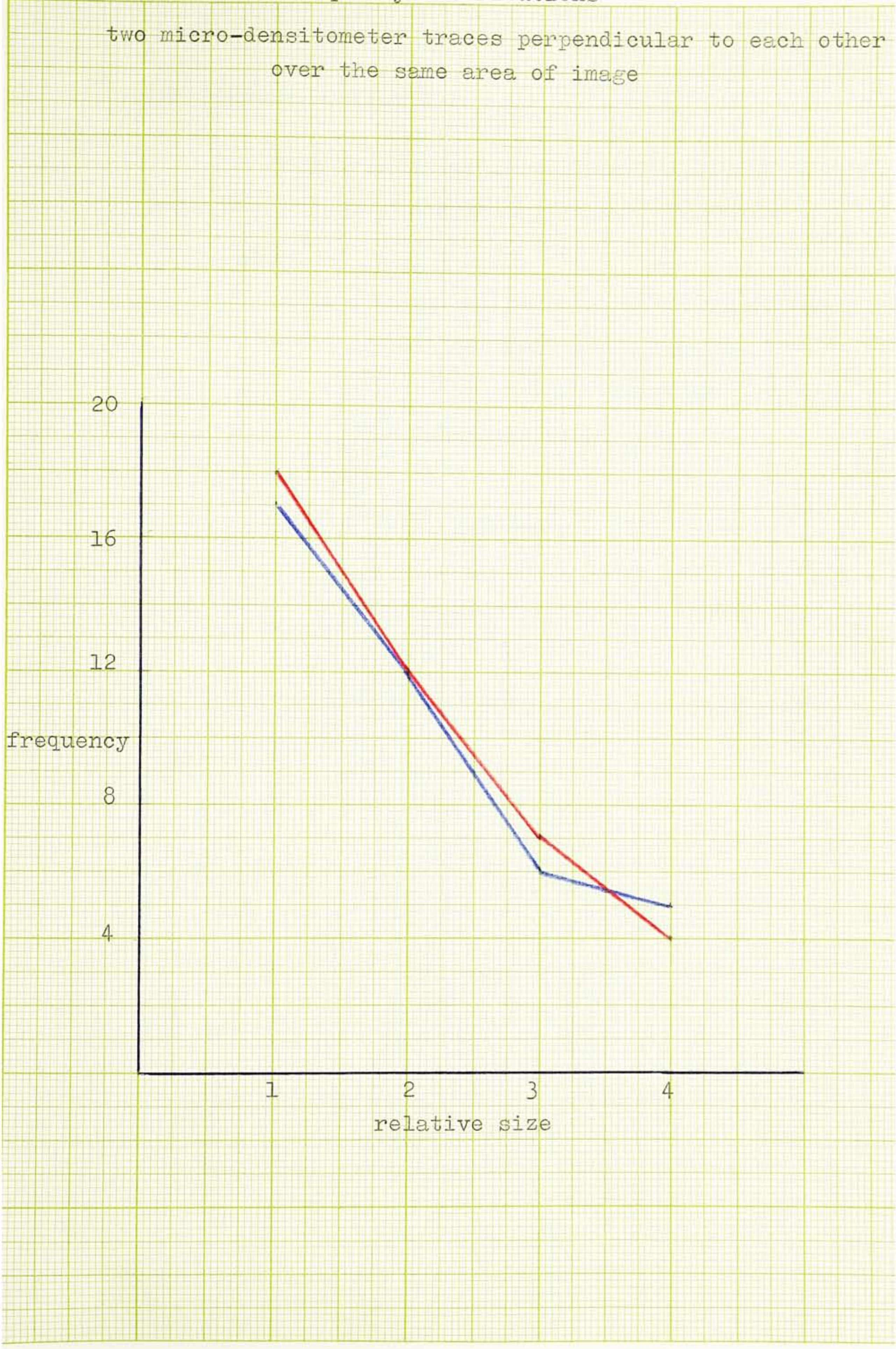
Impressions vs Paper Fiber Size Distribution



Impressions vs Paper Fiber Clump Distributions



Paper Fiber Size vs Frequency Distributions



Photographs and Figures:

Two photographs are shown which represent crucial portions of experimentation. They are:

Figure VII

A photograph of the camera set up on the press. An overlay is labeled for identification of important portions of the apparatus utilized.

Figure VIII

A print of a negative used for final microdensitometer scanning. Indicated are the areas used for the scans.

Also presented is a sample microdensitometer trace. Figure IX.

Figure VII-

Camera set up on press.

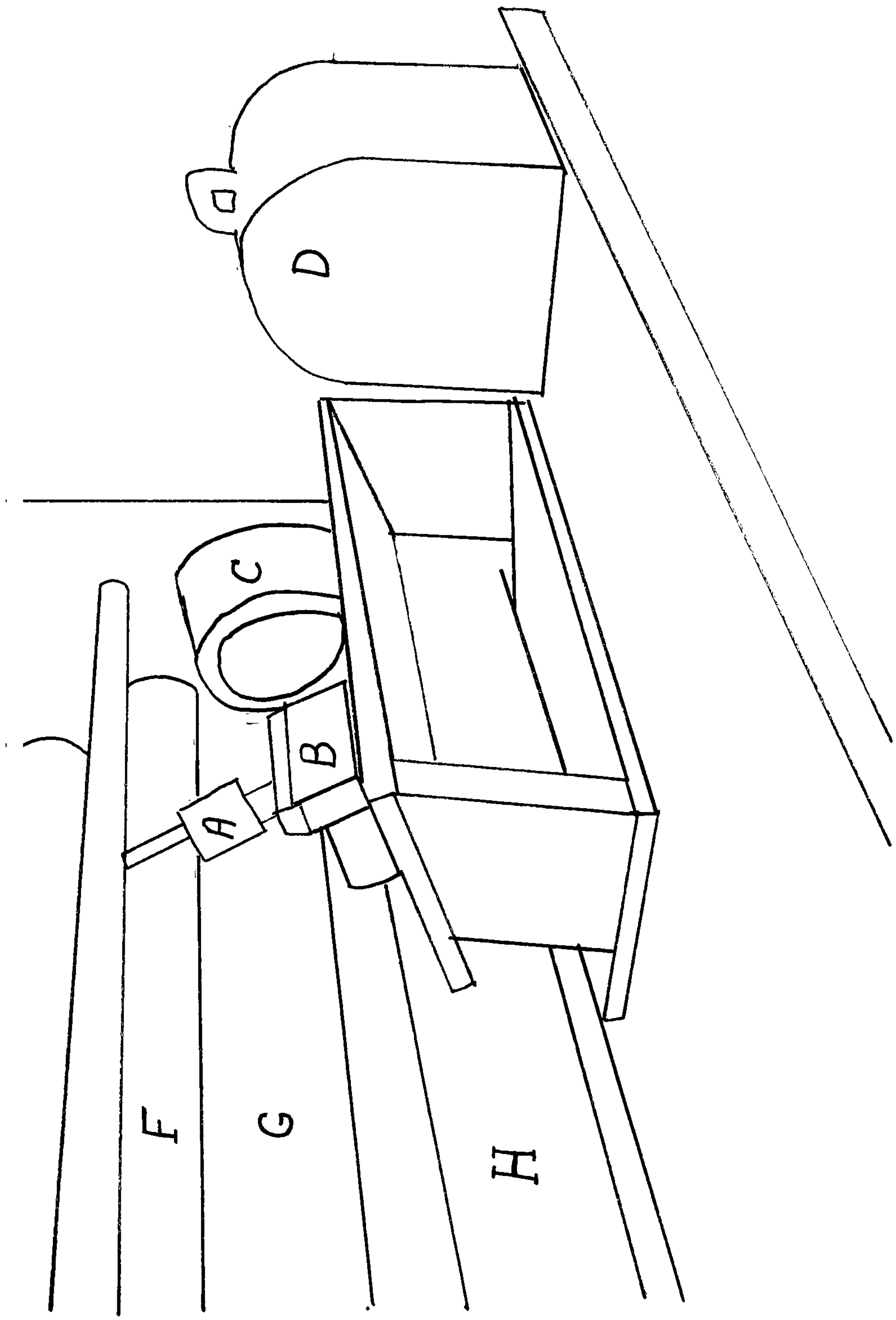
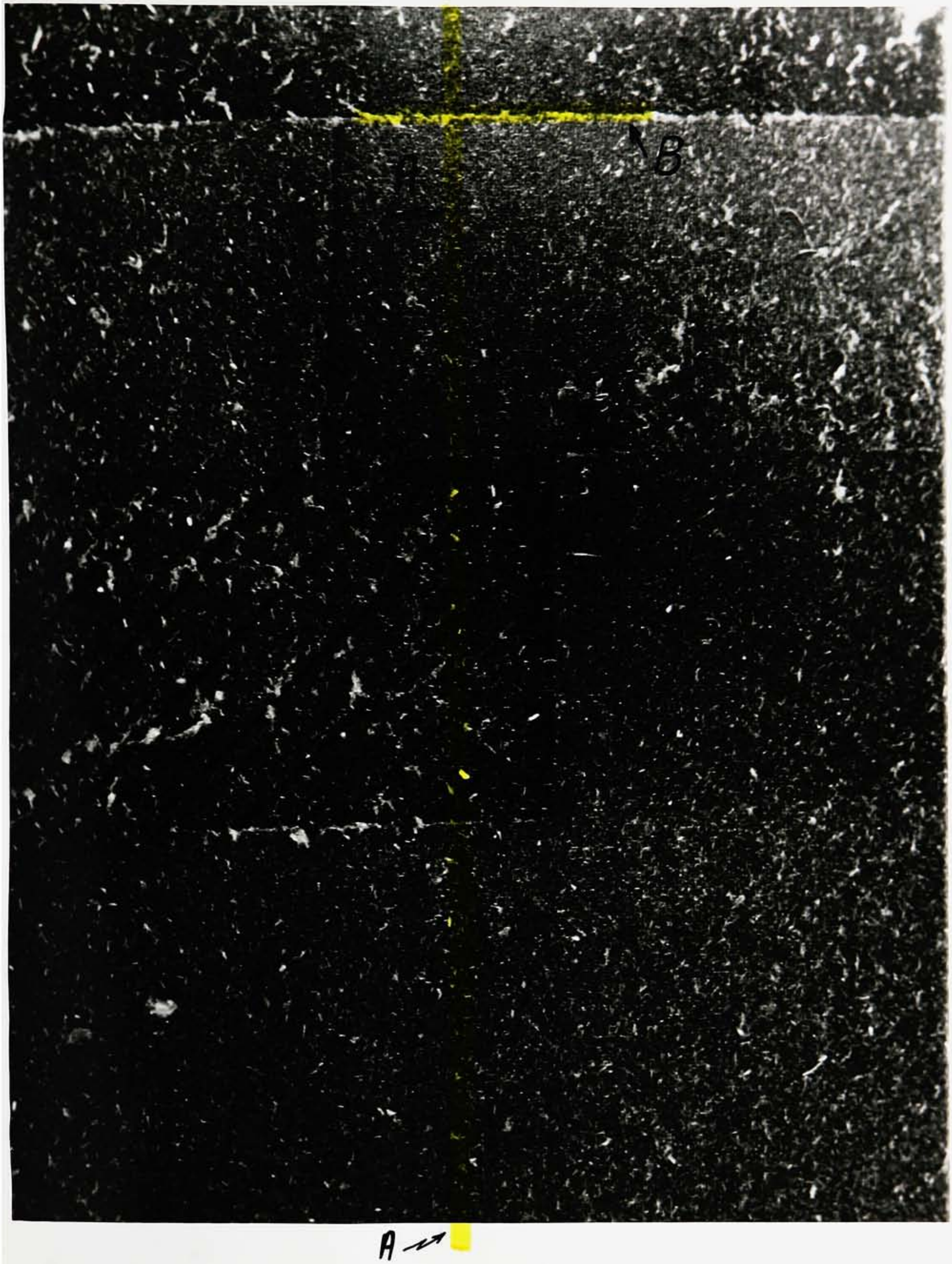


Figure VIII, Print of negative used for microdensitometry.



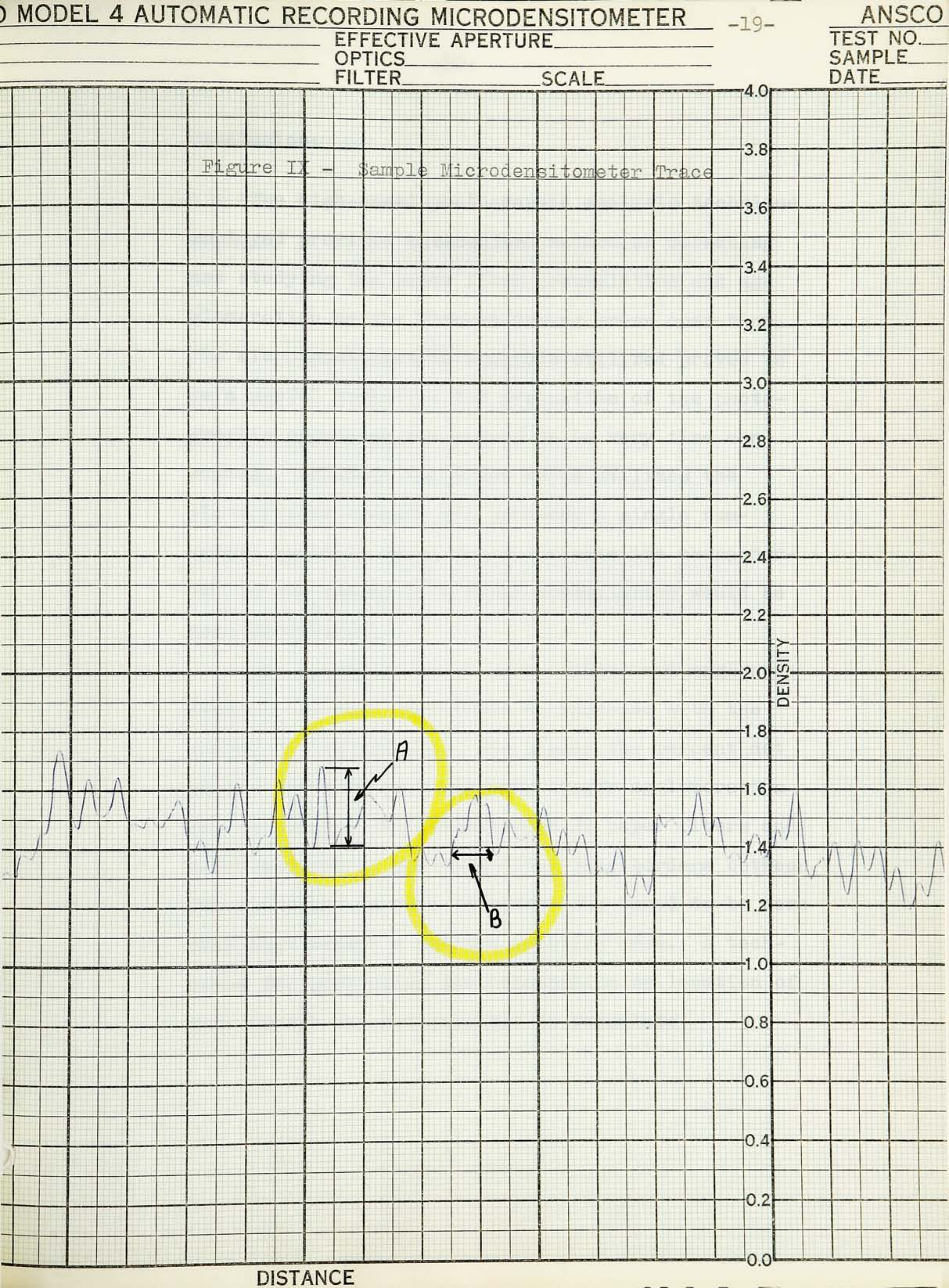


Figure IX - Sample Microdensitometer Trace

Conclusion:

The high-speed photographic analysis technique employed provided an excellent method of detecting and studying the paper fiber accumulation and agglomeration on the blanket during press operation. The microdensitometric analysis utilized proved to be a useful technique for evaluation of the photographic negatives but proves to be very time consuming. Analysis technique which utilizes the photographic results and produces a single numerical quantity which would indicate the characteristics and quantity of fiber accumulation would be more desireable.

The accumulation of paper fibers and agglomerates of the same were found to increase with the number of impressions. The higher the percent dot of the printing area the more larger agglomeration was detected. The accumulation of paper fibers and agglomeration of the same along some borders between two different percent dot areas was found to be more then that within a uniform printing area. A technique for predicting the orientation or location of this border was not possible to formulate.

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Appendix:

Appendix I-

The following is a list of equipment utilized in this investigation:

Beckman Preset Counter, model 5426 - 5

General Radio Strobolume, model 1532 - D

Nikkorex F 35 mm SLR, 50 mm f 2.0

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Schematic of complete apparatus set up.

Appendix II- Schematic of apparatus