PROGRESS IN PHOTOCOMPOSITION*

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More than 400 pages of complex scientific material have now been set on film instead of traditional hot metal in the American Chemical Society's study of the possible use of photocomposition in scientific publication. Photocomposition can handle the problems of chemical and mathematical literature, and the progress of the past few months shows encouraging signs that a much hoped-for cost savings can be realized.

Reducing costs for composition was a major objective when the Society began its investigation of photocomposition two years ago. Composition charges for ACS publications have passed the $1 million-per-year mark, and even a small percentage saving would enable the Society to print more pages for its publishing dollars. The problem of reducing costs in all areas of scientific publication is an urgent one, but if photocomposition speeds the passage of scientific literature from author to reader, this contribution can outweigh other considerations.

Equally important to cost reduction, the Society wants to learn more about a piece of equipment which seems attuned to the machine age of literature dissemination. The equipment used in the study is an electronically operated photocomposition machine trademarked the Photon. It is too soon to predict where photocomposition will fit into the patterns of the machine age of literature dissemination and retrieval. But a device which is electronically operated offers an excellent potential for being useful. Related developments in the field of offset printing which parallel work in photocomposition hold further promise for reduced costs of printing scientific material.

The techniques of photocomposition require little that is different on the part of the editor, author, or reader. To the reader, the appearance of the finished page matches that of the hot metal type-set page. The only difference for authors is that the galley proof comes on a paper with a bluish or brownish cast characteristic of photosensitive paper produced on a Bruning or Ozalid-type machine. The editor marks copy and edits manuscript in the same manner as the conventional setting. Care and accuracy become more important in preparing copy for photocomposition since the handling of changes in film is more difficult than in metal.

The mechanics of composition are quite different. Instead of metal characters, the end product is positive film. After author checking and proofreading, corrections are stripped in the film and pages made up by positioning the film on an adhesive-faced translucent sheet. From this paste-up, the offset printer makes a contact negative. Where engravings would have been used in a metal page setup, negatives of charts and photos are stripped in the blank spaces provided in the original make-up. An offset printing plate is made from the completed negative and the page is ready for printing.

The initial ACS production effort is the setting of the quarterly Journal of Chemical and Engineering Data. The JCED work was started using a matrix disc available in the library of the Photon company. The disc contains many special characters used in setting chemical and mathematical work, but it is not a disc designed for chemical composition. The design of such a disc is expected to cost about $15,000 and to take at least a year to complete the design, engineering and manufacture. We prefer to delay this part of the work until we have more experience.

In setting the first issue of JCED, we solved most of our composition problems, but found that the location on the disc of certain frequently-used characters was slowing operation. After consultation with the Photon company, a revision of the disc in use was prepared on which seven characters (+, -, °, %, ▪, ±, x (times sign)) were moved from various places on the disc into the "home row," which is the semicircle of matrices used in setting the main text of the articles.

To expect much improvement from moving seven characters out of 1440 may seem to be asking a lot. One of the characters shifted in the revised disc was the degree mark (°). Before the change the operator had to make five manual movements of levers and buttons to get this mark on the film (disc change, lens change, letter, lens change, disc change). In using the revised disc, one stroke does the job. The new disc, plus added experience and practice, resulted in a 65% reduction in the time required to set a page in the third issue of JCED as compared with the first two issues.

A more recent development of the project is a faster and simpler method for setting mathematical material. Whether in conventional hot metal or in photocomposition, the setting of mathematical material is slow and costly. On the Photon, the operator may be required to account for nine different levels of alignment, specific placement of groups of characters, along with utilization of Photon's many controls,

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such as counter on-counter off, register on-register off, and photo-nonphoto.

In the method developed by the ACS staff, staggered lenses are used to place characters in their respective numerator-denominator positions of the formula. A third lens was repositioned to handle the proper placement of 2-line integral signs, brackets, and parentheses. A simple switching system enables the operator to select the proper lens quickly. The operator does not have to account for different type levels, and the visualization necessary to position characters in the right place is reduced. Mathematical material is now set with hardly more effort than straight text. This should improve further with the use of the automatic positioning device now in development.

Of as much interest as the cost savings that we expect from the new method of setting formula material is the possibility of using positioned-line techniques in the composition of structural chemical formulas. If the setting of complex organic structures can be achieved, it will be a major step toward reducing composition costs.

Our operation must be considered hardly up to pilot plant level. One operator has handled all phases of the work, including composition, film processing, corrections, and page make-up. The contributions of Mr. Bernard Lazorchak, our operator, and Mr. Walter Ostrander, who worked out the mechanics of our new lens system, have been outstanding. Without their initiative and persistence, we could not have hoped to have achieved the results presented here. But the data of the laboratory are at best indications of what can be expected when a process goes on stream on a commercial basis.

In working out cost data, we have tried to be as objective as possible. But to take the costs of a laboratory effort and project them into a commercial operation is not easy. The problem is further complicated by the large investment required ($60,000 -- $70,000 per machine) and the attendant problems of depreciation and maintenance.

In our cost calculations, we used two methods of figuring the cost of setting a page and readying it for press. Thus, for a letterpress page, we include cost of engravings, and lockup and make-ready; for offset printing, we include plate and negative costs:

	Per Page
Total costs per page in hot metal (current ACS rates)	100%
Total costs per page of ACS operation, including salaries, rent, depreciation, supplies	127%
Total hours per page for all steps in photocomposition x $9.00 (assumed average cost/hour of commercial operation)	90%

Before we can take any action based on these cost figures, we must validate our assumptions regarding costs on a commercial basis. This study is now in progress with the help of Mack Printing Company.

The fact that at this stage costs are within close range of conventional methods is promising for the future of photocomposition. In the third issue of JCED, costs per page for composition on the Photon were reduced one third compared with costs for setting the pages of the first two issues. We do not look for this rate of improvement to continue, but we do expect costs to continue downward as we acquire more know-how, develop new techniques, train personnel, and design a matrix disc for chemical composition.

Our program for the year ahead calls for a 50% increase in output of pages for JCED. To do this, another operator is being trained for the start of a second shift. In addition, we plan some tests on Chemical Abstracts copy. CA is growing at a rate of 7.8% per year and this rapid growth puts a strain on available hot metal equipment. Photon, or its equivalent, may help relieve the situation. Further, we plan to firm up our cost studies. If we continue to show the progress made in the past year, by late 1961 photocomposition should be ready to assume a more important role in producing ACS publications.

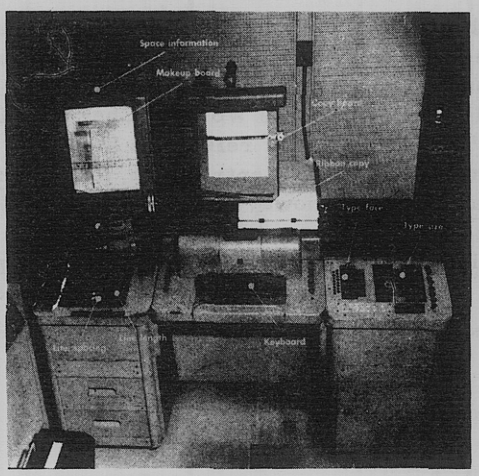

Figure 1.--The Photon typing console; from this keyboard the operator has control of all the variables encountered in complex scientific composition.