understanding of past and present philosophies and perhaps civilizations. This fact has not been generally recognized by the necessary change in the college or university curriculum.

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PUBLICATION BY PHOTOGRAPHIC REPRODUCTION OF TYPEWRITING

IN Volumes IV and V of the Transactions of the Astronomical Observatory of Yale University, recently published, very extensive use was made of a photographic reproduction of typewriting. As far as I am aware this is the first application of this process to the publication of extensive scientific results. The method employed is described in the introduction to Volume IV, page 31, thus:

> The tabular matter was typed with an ordinary typewriter on heavy Ledger Bond paper, backed with carbon so as to print on both sides, giving a black opaque impression. These sheets were then transferred photographically to zinc plates, reducing them in the ratio of four to five. . . . The catalogue was then run off on Chester Offset Bond paper. The cost of composition, paper and running off is about one third that of printing with ordinary lead type. Furthermore, one complete proof reading of all the material is saved; this is not only an additional economy, but entails fewer errors in the final impression. The pages do not seem to be inferior to type in their legibility.

An inspection of the tables thus reproduced shows that the results attained are all that is claimed for them.

The very great economy of the method naturally raises the question as to whether it could not be adapted to rather general use for the publication of scientific journals and books. Variety in the size of type or special characters or symbols should not cause any great difficulty. A large institution like a university press would equip itself with special typewriters according to its needs. Also a considerable improvement in appearance, perhaps sufficient to satisfy the more rigid requirements for general use, seems readily attainable. The irregular spreading of the ink on the typewritten sheet at present forms too big a proportion of the total width of the lines forming the letters and figures. This could be reduced and a clean-looking page obtained by making a radical improvement in the style of letters and figures, by the use of much larger type and by a greater reduction in the photographic step. The whole typewritten sheet would have to be larger so as to allow a reduction to perhaps one half instead of four fifths scale.

Publication of the results of research presents quite serious financial problems. The expenditure of a relatively moderate sum of money in the directions indicated above for the further development of the method employed so successfully by the Yale University Observatory would be well worth while. It seems quite safe to predict that such a considerable improvement could be attained that the main question would no longer be whether or not we may prefer the lead type but rather whether we shall be justified in continuing its use in the publication of much of our scientific work. The disproportionate economy of the newer method should go a long way toward balancing certain advantages of ordinary type and a considerable amount of prejudice which most of us would find it difficult to overcome.

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A SIMPLIFIED INDICATION FOR THE CONSONANT SOUND REPRESENTED BY THE LETTERS TH

WOULD it be a sufficient saving of type, printers' ink and muscular effort if instead of writing th we should express the same sound by a letter which is merely an h with the vertical arm crossed like a t? This sound is a very frequent one in the English language and in some others. Such a letter would be perfectly understandable wherever seen if the convention were once accepted. Of course, a number of languages have or have had a single letter to indicate this sound.

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SCIENTIFIC APPARATUS AND LABORATORY METHODS

FINELY REGULATED MOVEMENT BY USING HYDRAULIC DEVICES

IN designing a micromanipulator for the isolation of single bacteria and for microinjections the question arose of the value of an hydraulic system comprising a small controlling piston and cylinder forcing fluid into a larger cylinder and piston as a means of obtaining finely regulated movement. Several models were built and tested. The most satisfactory type had three pistons arranged at right angles to each other, having the vertical cylinder pivot on a base and the two horizontal pistons press against flat faces on the vertical piston. Springs were used to hold the flat faces of the vertical piston against knife edges on the horizontal pistons. The controlling pistons