

author. Preliminary study suggests that there are not more than a score of sub-titles of importance, e.g. "Volume I", "paperback", "school edition", etc., and a regular code is being specified which will cover the bulk of these cases.

Duplication of codes

It is anticipated that some errors will occur because of duplication of codes and for other reasons, and it is therefore not intended at present that invoices will be produced directly from the coded title cards, but that the list of titles will be printed out first for visual verification against the original order. The final invoices are already checked against customers' orders in the present procedure, so that no extra costs will be caused by the new process—the checking operation is merely brought forward to an earlier stage.

As well as the printed list, a new input punched card will be produced, with the machine address number on it in place of the encoded title. Any cards found to be in error after checking the printed list can then be corrected.

Alternatively, either the input data or the output data may be written electronically directly onto the disk storage. Then, after correction cards have been inserted to overwrite the listings that are in error, the invoices may be produced automatically without further input.

In the cases where there is a duplication of codes, the two or more titles will be listed on the print-out but the computer will record only the more frequently demanded of the two clashing titles every time. Therefore the use of a correction card will be necessary only when the lesser-used title is required. For instance it turns out that neither of the two titles *Selections from Borrow* and *Selections from Byron* has been required very often, so that the fact that their codes are duplicated would not cause much difficulty in practice.

Reference

- BOURNE, Charles P., and WARD, Donald F. (1961). "A study of methods for systematically abbreviating English words and names", *J. Assoc. for Computing Machinery*, Vol. 8, No. 4. (This article contains a bibliography of 38 references.)

Book Review

"Microelectronics Using Electron-Beam-Activated Machining Techniques" by K. R. Shoulders. (Part of *Advances in Computers*, Vol. 2, Academic Press, 1961.)

The author starts from the assumption that a computer of the future is likely to need 10^{11} or more electronically active components, and his purpose is to outline a programme of research work which may ultimately lead to the fulfilment of this requirement. He concludes, as others have done, that the most promising method of fabricating the components is by vacuum evaporation, and his programme proposes the use of active elements depending on the field-emission of electrons. An eventual packing density of 10^{11} components per cubic inch is postulated, and problems of heat dissipation and the inter-connection of components are

This illustrates the point that the frequency of clashes over the whole list of titles is only a theoretical measure of the effectiveness of the coding system, and assumes implicitly that each title is required with equal probability. This is the least favourable assumption for the coding system, and in practice the variation in the probability with which different titles are required should be taken into account. On average, by so arranging that the computer always chooses the more frequently demanded of two clashing titles, the number of times that corrections will have to be made will be much less than that suggested by the proportion of titles that are confused.

Punching speed

The system suggested here has not yet been installed, and the reduction in punching speed and the loss of accuracy that may be caused by requiring punch girls to combine the relatively intellectual occupation of deriving a title code with the mechanical process of card punching has not yet been assessed. Experiments will be made to measure these factors, and possibly a redundant coding, such as punching the first three letters of every word, might prove to be quicker to use. However, because the normal procedure of verifying the punched card will be discontinued, since a quicker, visual verification occurs at the machine stage, a moderate reduction in punching speed will not increase the cost of the operation.

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discussed. A large part of the article is devoted to techniques of fabrication, including methods of micro-machining, the production of etching resists, the preparation of substrates, the control of evaporation and the examination of the final product by electron-optical methods. Finally, there is a description of ultrahigh-vacuum apparatus which is being built for these purposes.

This is a stimulating article which anyone interested in these matters can read with profit. It is also an infuriating article which continually leaves the reader in doubt whether a particular statement refers to something which has already been achieved, to a hope not yet fully realized, or to a pipe dream which is unlikely to come to pass within the next twenty years.

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