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Material Control by means of the Elliott 803 B Electronic Computer

The authors prove the economic efficiency achieved by using the Elliott 803 B electronic computer for material control. This control is based on the document recording the entry of the material into or its exit from the warehouse.

1. INTRODUCTION

In view of achieving this paper it has been necessary to study the present mode of operation and system which, when completely taken over by electronic computers will be greatly improved. However, utmost simplifying of the present methodology will be required by using only the strictly necessary information and supplying the greatest possible quantity of useful information.

2. PRESENT MODE OF OPERATION

The materials are distributed by warehouses, each warehouse having (one) manager (*i*) and (one) accountant (*i*).

The *material control* is worked out for each warehouse and has as its starting point the *document* drawn up by the warehouse manager.

Current methodology classifies these documents into two large groups:

— Entries:

1. Entry voucher — reception
2. Transfer voucher
3. Material delivery voucher
4. Return voucher.

— Exits:

1. Shipping notice (supply order);
2. Collective material vouchers of consumption vouchers;
3. Transfer voucher.

In view of the variety of materials in a warehouse as well as on account of the fact that the information will be processed by a digital electrinic computer, a numeric codifying of the materials is necessary: every kind of material is given a symbol, this being a number comprised between 10,000 and 70,000.

Likewise, it is necessary to encode the accounts in view of avoiding any computer misinterpreting:

Encoded account	*Real* (book-keeping) *account*
1	102
2	102, 103/01
3	103/01
4	1080, 103/01
5	1080, 106, 103/02, 103/01
6	1080

Any document, either entry or exit, contains the headings: document no., internal symbol, quantity (taken over), unit price, value (of materials taken over), account, total (see Fig. 1, document no. 7761).

The manager draws up the respective document by completing the headings: document no., internal symbol, quantity, then the accountant fills in the headings: unit price and account, and it is still the accountant who must carry out computations in view of completing the headings: value and total, and then also allot the total by accounts.

Thus, for the material control, it will be necessary for the computer to:

Report I

1. record the documents;
2. sort the symbols in their increasing order;
3. carry out partial operations on a document (i.e. to compute the column "value");
4. totalize a document;
5. allot the total by accounts;

Report II

1. sum up total entries by warehouse;
2. sum up total entries by accounts;
3. sum up total exits by warehouse;
4. sum up total exits by accounts.

3. PROGRAMME FUNCTION

The programme is made up in the automatic programming language AUTOCODE MARK III. It draws up reports I and II above.

4. PROGRAMME LOGICAL SCHEMA

We notice that, in fact, a document is a matrix whose columns are the above headings, and the number of lines is given by the number of operations recorded on the document.

We shall note *by* AMN the matrix formed by the columns: internal symbol, quantity taken over, unit price, and account, where M is the number of operations recorded, and N is the number of columns, in our case 4.

Unit I.I.B.
Warehouse 3

Data 19.08.1965

ENTRY AND TAKE OVER VOUCHER No 7761

materials supplied by site 5 Brazi

Internal symbol	materials	U/M	No parcels	Quantity		Stock	Unit price	Value of materials taken over	Account code
				Billed	Taken over				
30,939	Electrodes Japanese FT 51-5 m/m	kg.		400	400	–	4.57		1
20,001	Packing cases, small	pieces		20	20	–	25		3
30,942	Electrodes E 4872-5 m/m	kg.		236	236	–	4.47		1
30,941	Electrodes E 4872-4 m/m	kg.		50	50	–	4.57		1
30,909	Electrodes Böhler 4 m/m	kg.		575	575	–	4.05		1
30,910	Ditto 5 m/m	kg.		100	100	–	4.77		1
30,961	Electrodes Italian INMI -B Ø 3.25	kg.		360	360	–	28.60		1
20,001	Packing cases, small	pieces		10	10	–	25		3
TOTAL									

Fig. 1

For example, in the case of document no. 7761, we have:

$$A_{84} = \begin{pmatrix} 30939 & 400 & 4.57 & 1 \\ 20001 & 20 & 25 & 3 \\ 30942 & 236 & 4.47 & 1 \\ 30941 & 50 & 4.57 & 1 \\ 30909 & 575 & 4.05 & 1 \\ 30910 & 100 & 4.77 & 1 \\ 30961 & 360 & 28.60 & 1 \\ 20001 & 10 & 25 & 3 \end{pmatrix}$$

Let us also note the value column by B, the total per document by T, the total by accounts at the level of one document by C_i ($i = 1, ..., 6$), the total per warehouse by TG, the total by accounts at the level of one warehouse by G_i ($i = 1, ..., 6$) and the number of documents for one warehouse by R.

The logical general schema of the programme is shown in Fig. 2.

5. TAPE FOR DATA AND RESULTS

Both the programme and the data are punched on a tape in the Elliott code, the conventions of the AUTOCODE being observed. For example, the document in Fig. 1 is punched on a tape as follows:

7761 spsp 8 spsp 4 crlfcr
30939 spsp 400 spsp 4.57 spsp 1 crlfcr
20001 spsp 20 spsp 25 spsp 3 crlfcr
30942 spsp 236 spsp 4.47 spsp 1 crlfcr
30941 spsp 50 spsp 4.57 spsp 1 crlfcr
30909 spsp 575 spsp 4.25 spsp 1 crlfcr
30910 spsp 100 spsp 4.77 spsp 1 crlfcr
30961 spsp 360 spsp 28.60 spsp 1 crlfcr
20001 spsp 10 spsp 25 spsp 3 crlfcr

After the computer "is informed" of the programme, it then performs it, with the data supplied, i.e. it ordinates the document, computes the column "value", then the total per document, which it also allots to the account on the respective document. Then, the results obtained are printed in Elliott code on the tape which is decoded and the results are reproduced in decoded characters.

Thus, for the document taken as an example above, the final results appear as follows (including the headings):

Document No.	*Internal symbol*	*Quantity*	*Unit price*	*Account*	*Value*
7761	20001	20	25.00	3	500.00
	20001	10	25.00	3	250.00
	30909	575	4.25	1	2443.75
	30910	100	4.77	1	477.00
	30941	50	4.57	1	288.50
	30942	236	4.47	1	1055.32
	30961	360	28.60	1	10296.00
TOTAL					15250.57
	ACCOUNT 1	ACCOUNT 3	ACCOUNT 6		
	14500.57	750.00	0		

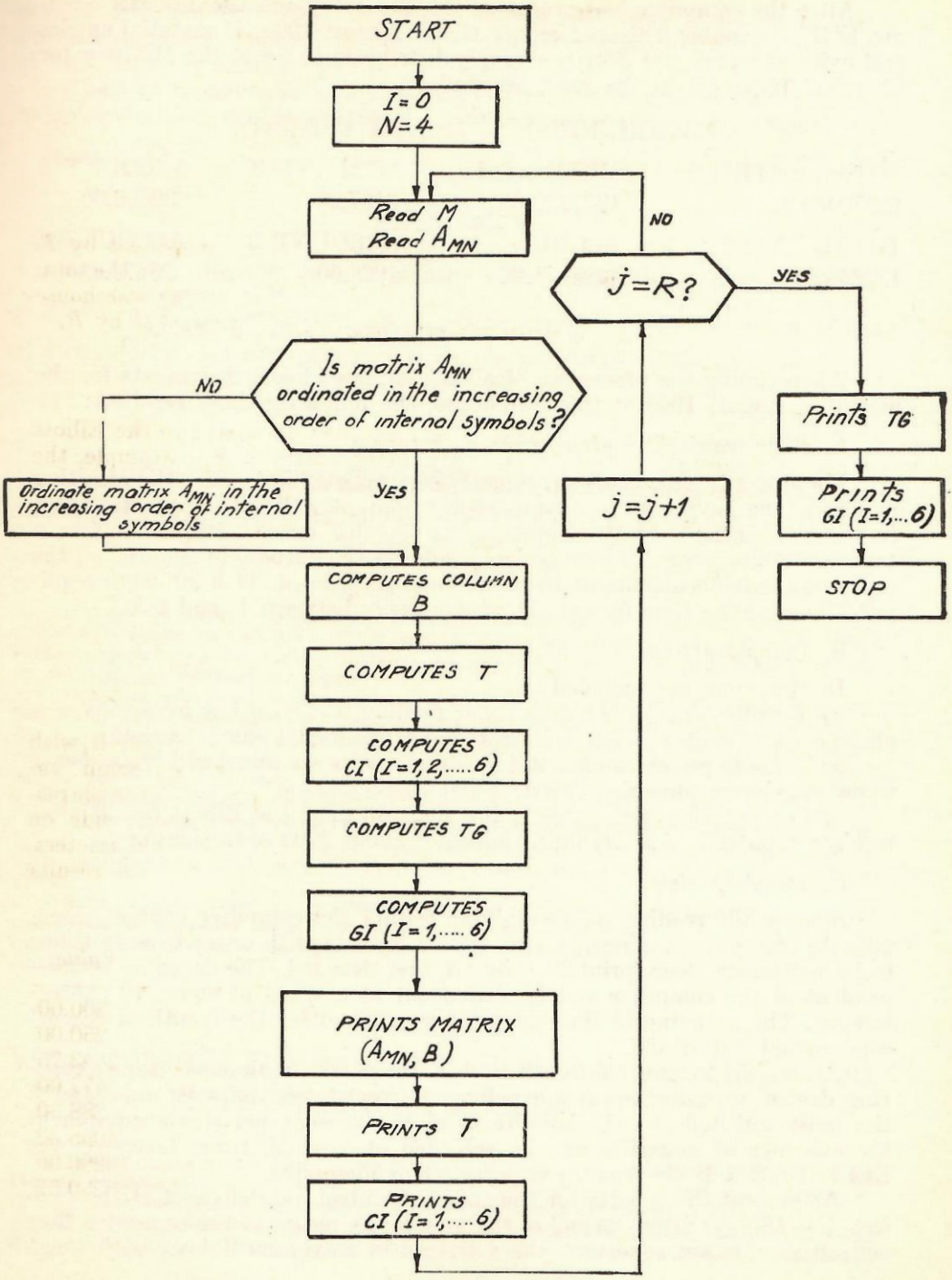
START
I=0
N=4
Read M
Read AMN
Is matrix AMN ordinated in the increasing order of internal symbols?
NO
YES
Ordinate matrix AMN in the increasing order of internal symbols
COMPUTES COLUMN B
COMPUTES T
COMPUTES CI (I=1,2,.....6)
COMPUTES TG
COMPUTES GI (I=1,.....6)
PRINTS MATRIX (AMN, B)
PRINTS T
PRINTS CI (I=1,.....6)
j=R?
NO
YES
j=j+1
Prints TG
Prints GI (I=1,...6)
STOP

Fig. 2

After the computer had processed the 105 entry and the 307 exit documents the computer delivered report II, for August 1965, of material entries and exits at warehouse 3 of the supply distribution base of the Ministry for Chemical Industry, in the form hereunder:

WAREHOUSE 3 MONTH AUGUST

TOTAL ENTRIES	ACCOUNT 1	ACCOUNT 3	ACCOUNT 6
12770039.85	1233736.65	3407.20	39896.00
TOTAL EXITS	ACCOUNT 1	ACCOUNT 3	ACCOUNT 6
1328609.50	1298171.90	1961.60	28476.00

6. TIME EVALUATION

When timing the processing of all the entry and exit documents for the month of August 1965 at this warehouse, the following times resulted:

A. *Time required to prepare the data tape*

The data to be processed are encoded in the Elliott code, the resulting punched tape having to be "read" by the computer. Encoding must respect certain conventions whose trespassing is signaled out by the computer; a tape containing errors of convention is refused. To encode, in August, all the entry and exit documents at the warehouse mentioned, 11 h 30′ were required. The encoding time for one document varies between 1′ and 1′30″.

B. *Computer time*

In this time are included:

a) Reading-time of the data tape; reading is carried out by means of a photo-electric reader which is able to read about 500 characters/sec.

b) Time to punch the result tape; the results are punched by a puncher whose maximum punching speed is 100 characters/sec.

c) Computation time; this is the shortest since the Elliott 803 B electronic computer has a computing speed of about 2000 operations/sec.

C. *Decoding time*

Since while reading data or giving results the computer cannot concomitantly compute, the results also appear on a tape in order to save time; to be written in clear (printed) they are first decoded. The decoding is independent of the computer and is carried out at a speed of about 10 characters/sec. The decoding of the document mentioned for the month of August was carried out in 30′.

According to our observations, the peripheric equipment (tape preparing device, introduction and expelling devices) takes the most time and is the most solicited. In the conditions of the present peripheric equipment the evidence of materials can be achieved at least 50 times faster on the ELLIOTT 803 B electronic computer, than manually.

At present the reports for the material control are delivered at the earliest 15—18 days after the end of the month; by means of the computer they can, in the present conditions, be delivered in maximum 3 days, with consi-

derably less, but competent personnel. In the conditions of adequate peripheric equipment it should be possible to deliver the report in the first day of the following month.

The high economic eficiency obtained by transferring the work pertaining to the material control to electronic computers results clearly from the above.

REFERENCES

1. IONESCU, H., MIRESCU, P. and NĂDEJDE I., *Programarea liniară*, Editura Ştiinţifică, Bucureşti, 1964.
2. KITOV, A. L. and KRINITSKI, N. A., *Maşini electronice cifrice. Programare*, Editura Tehnică, Bucureşti, 1963.
3. KAGAN, B. M. and MIKAELIAN, T. M., *Rezolvarea problemelor inginereşti cu calculatoare numerice*, Editura Tehnică, Bucureşti, 1965.

L'EVIDENCE DE L'ADMINISTRATION DES MATERIAUX A L'AIDE DE LA MACHINE ELECTRONIQUE A CALCULER ELLIOTT 803 B

L'auteur démontre dans cet article l'efficacité économique de l'utilisation de la machine électronique à calculer ELLIOTT 803 B dans les opérations d'évidence des matériaux. Cette évidence a pour base le document du matériel, par lequel a été effectué l'enregistrement d'entrée ou de sortie du matériel du dépot.

Grâce au calculateur électronique, on a effectué l'enregistrement des documents d'entrée ou de sortie des matériaux; l'arrangement des symboles en ordre croissant des opérations partielles (le calcul de la valeur pour chaque symbole); la totalisation des valeurs des documents; la répartition par valeurs des comptes contenus dans le document. On a calculé par la suite la valeur totale des entrées et des sorties des matériaux ainsi que la valeur totale par comptes, tant pour les entrées que pour les sorties.

Le programme a été rédigé en langage automatique, par programmation AUTOCODE MARK III, qui établit les situations susmentionnées. En même temps, les données introduites sont perforées sur bande par code ELLIOTT en respectant les conventions de l'AUTOCODE.

Par le chronométrage des opérations, on a pu estimer le temps nécessaire et on a calculé que le temps nécessaire pour l'enregistrement d'un document contenant une moyenne de quatre positions (symboles) est 50 fois plus réduit que le temps réclamé par les opérations manuelles.

УЧЕТ ХОЗЯЙСТВА МАТЕРИАЛОВ НА ЭЛЕКТРОННОЙ СЧЕТНОЙ МАШИНЕ «ЭЛЛИОТТ 803 Б»

Данная статья показывает экономическую эффективность использования электронной счетной машины «Эллиот 803 Б», в работах по учёту материалов. Основой этого учёта является документ материалов, регистрирующий вход или выход материалов со склада.

С помощью электронной счетной машины были зарегистрированы документы входа и выхода материалов; были упорядочены в восходящем порядке символы; осуществлены

частичные операции (расчет стоимости для каждого символа); суммирование стоимости документов; стоимостное распределение по счетам, содержащимся в документе. Затем, был подсчитан итог стоимости входящих и выходящих материалов, а также и стоимостный итог по счетам как для входящих, так и выходящих материалов.

Программа построена на языке автоматов программирования «Автокод Марк III», которые составляет вышеуказанные сводки. Также введенные данные перфорируются на ленте, в коде «Эллиот», при этом соблюдаются условия автокода. Из хронометража работы выявилось рабочее время и было подсчитано, что время необходимое для операции с документом, содержащим в среднем четыре позиции (символа), в 50 раз меньше, чем при ручном подсчете.