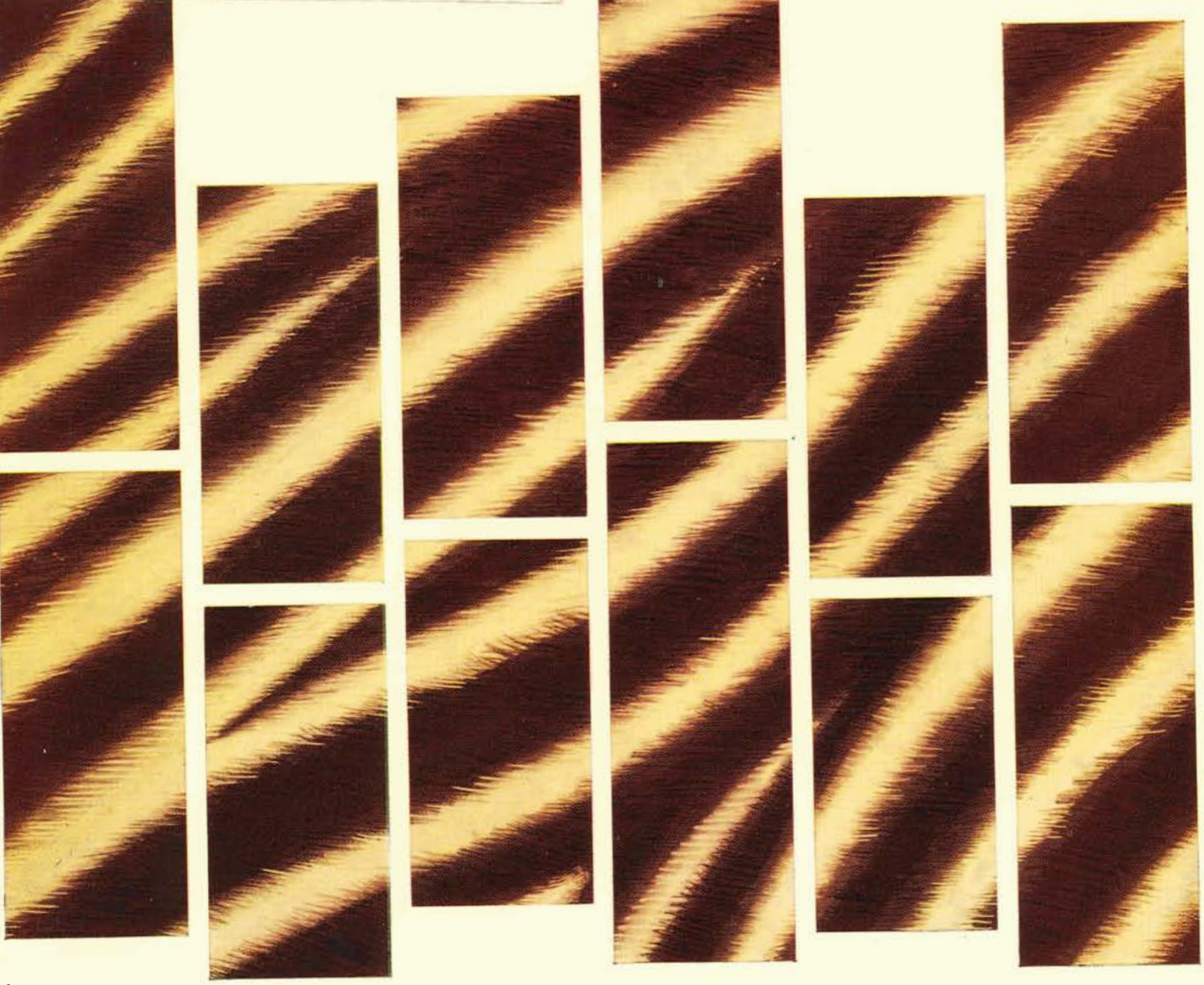
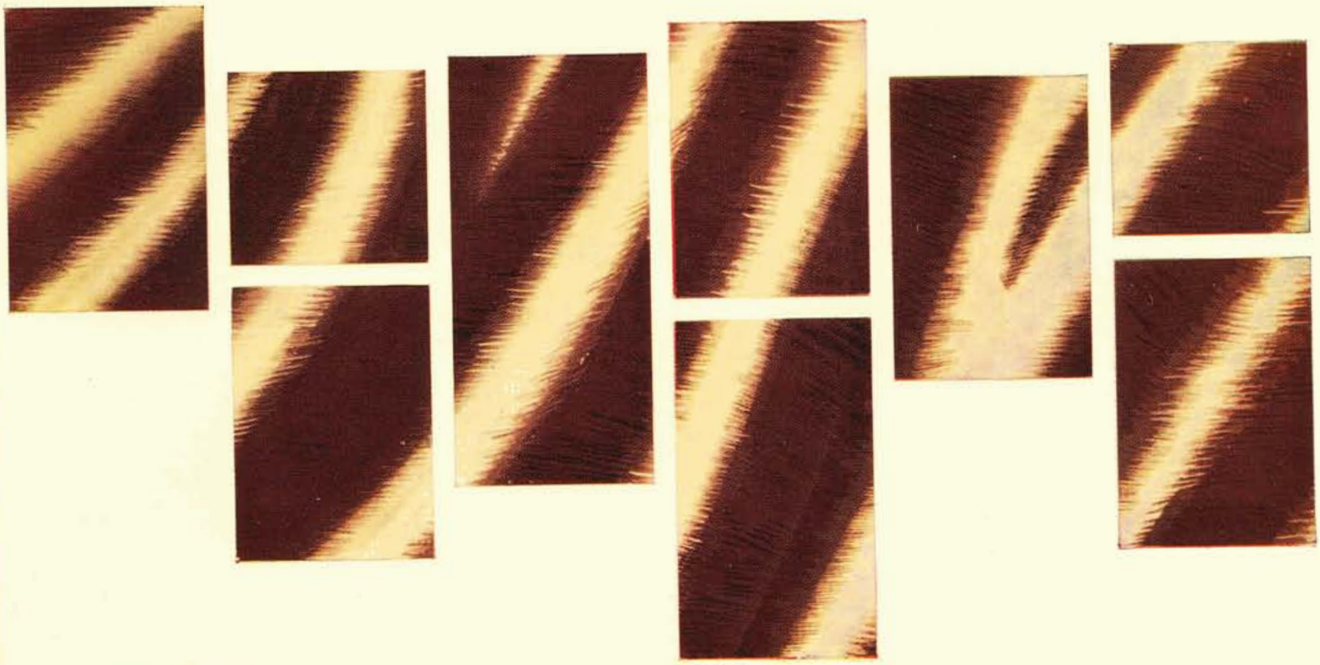
L/105
Ed. 1.



STANTEC ZEBRA



STANTEC ZEBRA

electronic

digital computer

ELECTRONIC SYSTEMS GROUP

Standard Telephones and Cables Limited

Registered Office: Connaught House, Aldwych, W.C.2.

INFORMATION PROCESSING DIVISION

NEWPORT, MONMOUTHSHIRE

Telephone: Newport (Mon.) 72281 *Telegrams*: Essteecee, Newport, Mon.

A double input-output Stantec-Zebra computer used for transonic and supersonic aerodynamic research at the Aircraft Research Association, Bedford, England.

Foreword

The STANTEC-ZEBRA computer is a medium-sized electronic digital computer originally designed through collaboration between mathematicians of the Dutch Post Office and engineers of Standard Telephones and Cables Limited. Due mainly to the entirely new programming concept and the simple logical design upon which it is based, the cost of the STANTEC-ZEBRA is far less than might be expected for a machine of its capabilities.

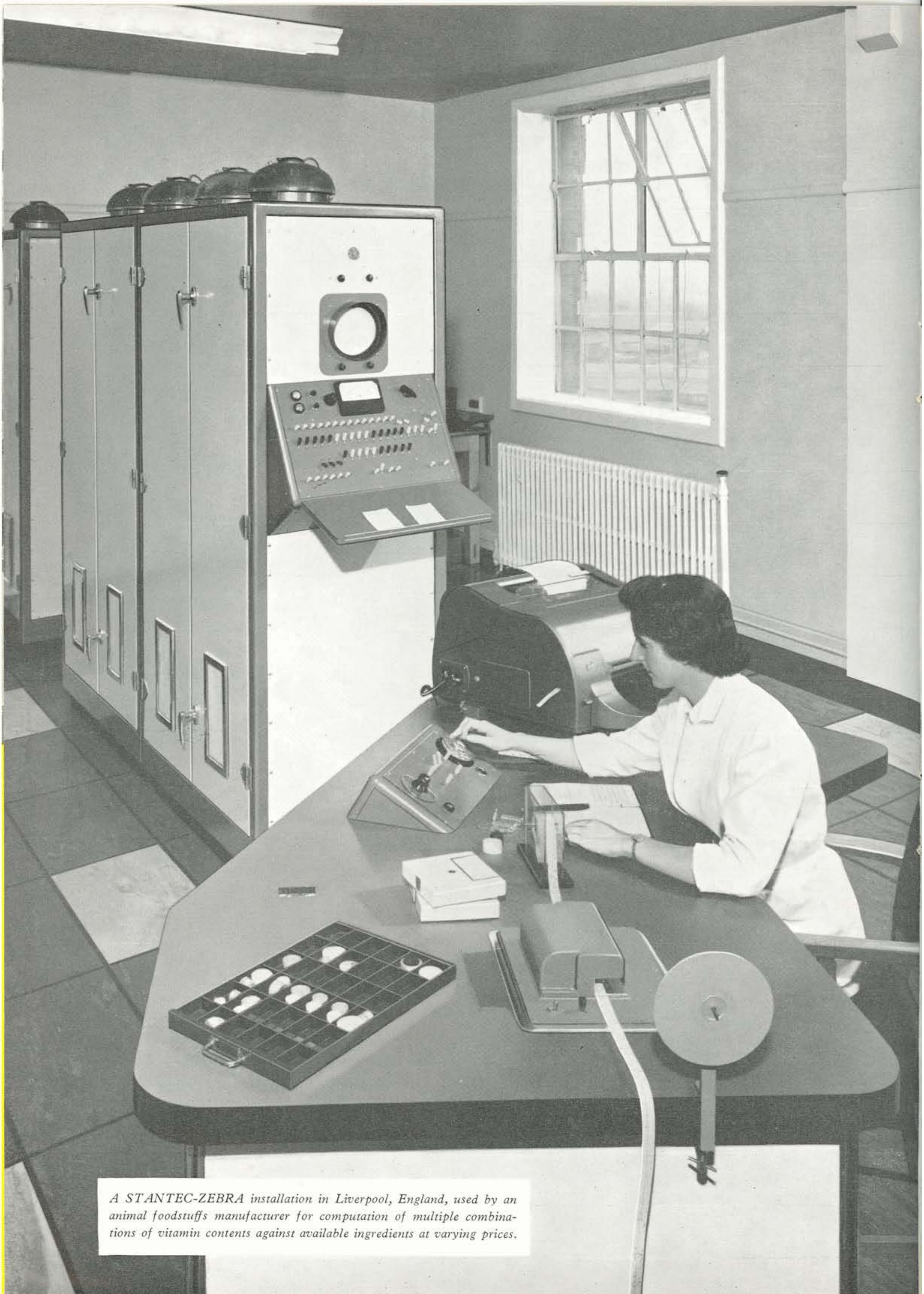
Intended in the first instance for mathematical use, the STANTEC-ZEBRA is sufficiently flexible to operate with a variety of peripheral equipment and, in this way, may be used as the control centre for small Data Processing Systems. In this latter field no rigid system is offered, for each system is tailor-made to suit a particular job. This absence of restriction allows full scope to the flexibility of the machine.

Thus, the STANTEC-ZEBRA is suitable for research work of all kinds and also for many Industrial applications. One example of a Zebra application in Industry is its use in determining the best, i.e., most economic, choices for the purchase, stock and use of basic materials in the manufacture of a range of composite products. Other STANTEC-ZEBRAS, installed in Great Britain, Holland, Switzerland, Germany, South Africa and Canada, are being used in the differing fields of:

Aircraft Research
Crystallography
Optical Research
Photogrammetry
Wind-Tunnel Data Reduction
Hydrodynamics and Marine Research
Post Office Research and Statistics
Production and Purchase Control
Nuclear Physics

These are but a few from the vast range of possible applications. New fields of use for the STANTEC-ZEBRA are becoming apparent daily.

Such varied applications indicate a computer of great flexibility, a quality due, in the main, to the two powerful Zebra programming codes. In the design of the STANTEC-ZEBRA great attention has been given to obtaining a high standard of reliability and, to this end, up-to-date and, in some cases, novel equipment design techniques have been evolved. Furthermore, by using proven devices and eliminating all superfluous equipment the design has resulted in a machine which compares favourably in price with any computer of similar capability and capacity.



A STANTEC-ZEBRA installation in Liverpool, England, used by an animal foodstuffs manufacturer for computation of multiple combinations of vitamin contents against available ingredients at varying prices.

PHYSICAL DESCRIPTION

The basic STANTEC-ZEBRA, illustrated on the facing page, consists of:

A CONTROL DESK which houses operating controls and input/output equipment. A punched paper tape reader, operated at up to 100 characters per second, is used as the input medium, and a 50 character per second paper tape punch and a teleprinter, at 7 characters per second, are incorporated for output of results.

THE COMPUTER CUBICLE comprises two cabinets, each approximately 3 ft. 3 in. wide by 2 ft. deep by 6 ft. 6 in. high, which are provided with detachable doors designed to give easy access to both sides. The cabinets house the main units of the computer-storage devices, control equipment, accumulating registers, etc.

THE POWER CUBICLE is approximately 3 ft. 6 in. wide by 2 ft. deep by 6 ft. 6 in. high and contains the computer power supplies with their control circuits and marginal test facilities. The total power consumption is about 6 kVA.

It should be noted that the input/output devices illustrated are those used with the basic machine. A simple extension allows for double input/output facilities, i.e., two input readers and/or two output punches and/or two output printers. Such additions can considerably increase flexibility and ease of use in relation to some applications. Other extensions further widen Zebra's scope and flexibility.

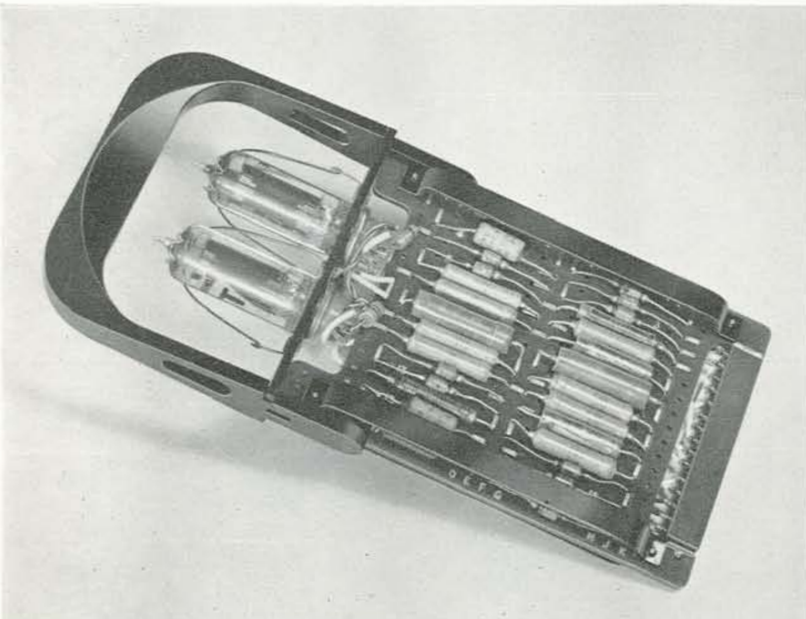
The STANTEC-ZEBRA, illustrated opposite, is an early model. Later models incorporate some fine design developments, particularly with regard to air-cooling. The STANTEC-ZEBRA illustrated on page 2 provides a good example of a later model in which the computer is used with specially developed punched card devices for input and output as an alternative to the normal paper tape medium.

STORAGE

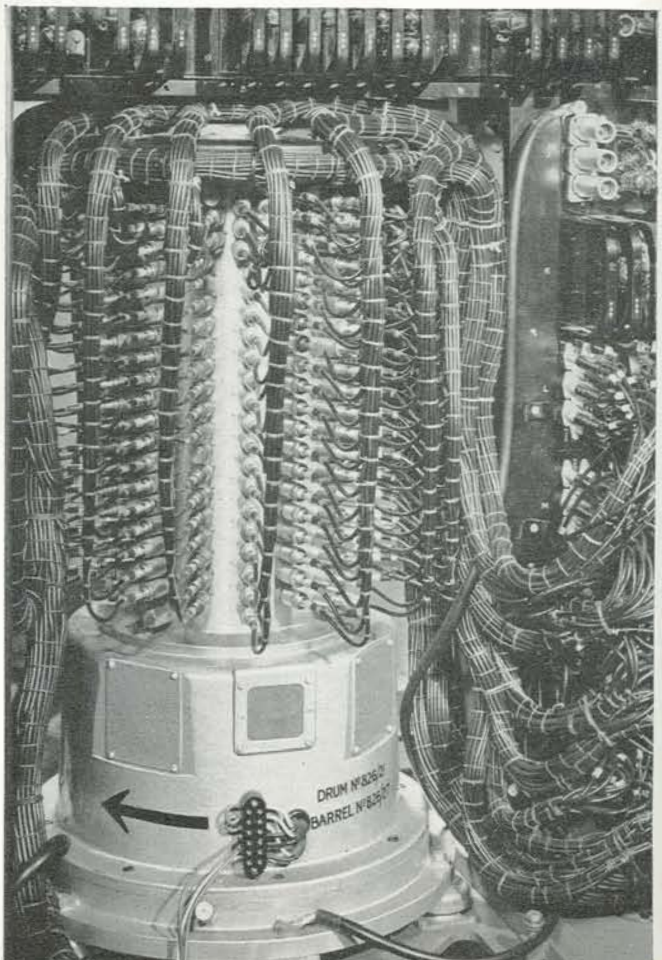
The high storage capacity available in the STANTEC-ZEBRA is provided by a Magnetic Drum. The drum is a 6-inch cylinder, 15 inches high, using nickel plating as the magnetic medium, and revolving at 6,000 r.p.m. The drum is encased by a mantle drilled to carry the writing/reading heads which are used to record information on the drum and to read it back, as required. Whereas the use of this type of store in other computers often tends to slow up operations by its very nature as a random-access store, this disadvantage is off-set in the STANTEC-ZEBRA by an optimising facility which is an integral part of the logical design.

EQUIPMENT PRACTICE

The equipment practice used in the STANTEC-ZEBRA computer has been evolved by the application of principles established over many years of experience in the telecommunications industry, but influenced and modified by the introduction of modern computing methods and techniques.



Typical plug-in unit from STANTEC-ZEBRA.



STANTEC-ZEBRA Main Store.

Thus, the Zebra is, in very large measure, built up from " plug-in " units of a small number of standard types. In the design of these units simplicity and reliability have been the main considerations. Each unit normally provides one circuit function; e.g., bi-stable circuit, buffer amplifier, gating circuit, etc. Wiring is carried out in the main by using the " wire-wrap " technique, developed originally by the Bell Telephone Laboratories in the United States and now employed on a wide scale in telephone work to eliminate the risk always associated with soldered joints.

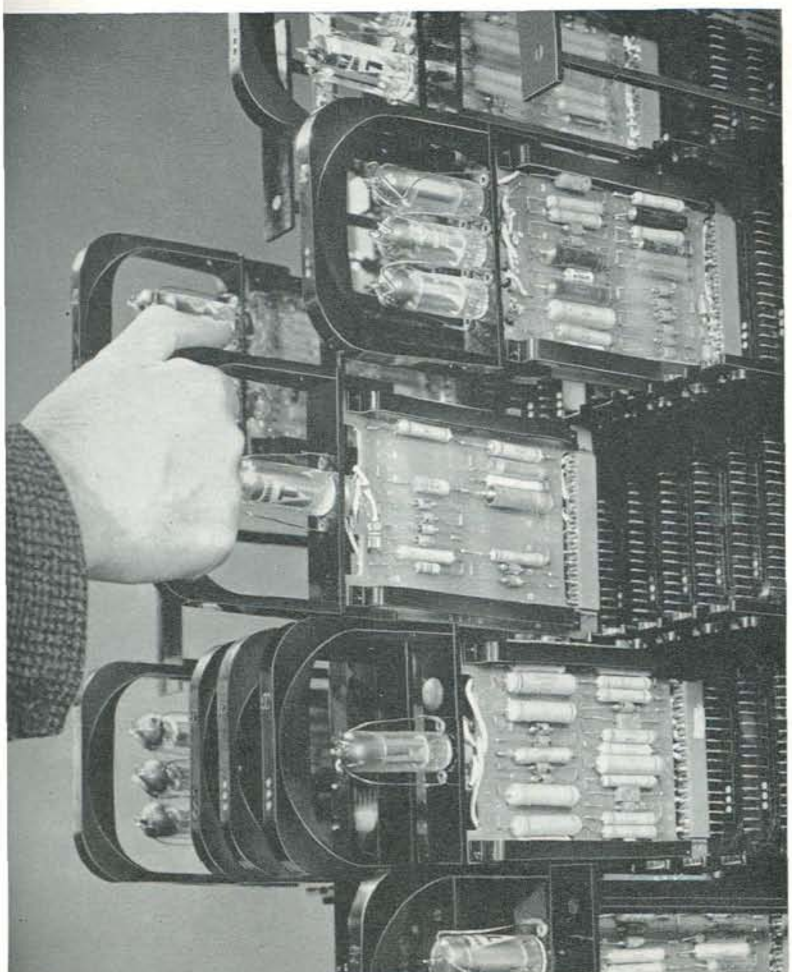
Interconnection between " plug-in " units is carried out by use of printed circuit boards. This has the advantage that this rather complex wiring is provided in exactly reproducible form and eliminates the danger of stray effects inherent in the more random forms of wiring. Certain parts of the machine which do not lend themselves to " plug-in " unit construction have been built up in a form employing established and well-tried techniques.

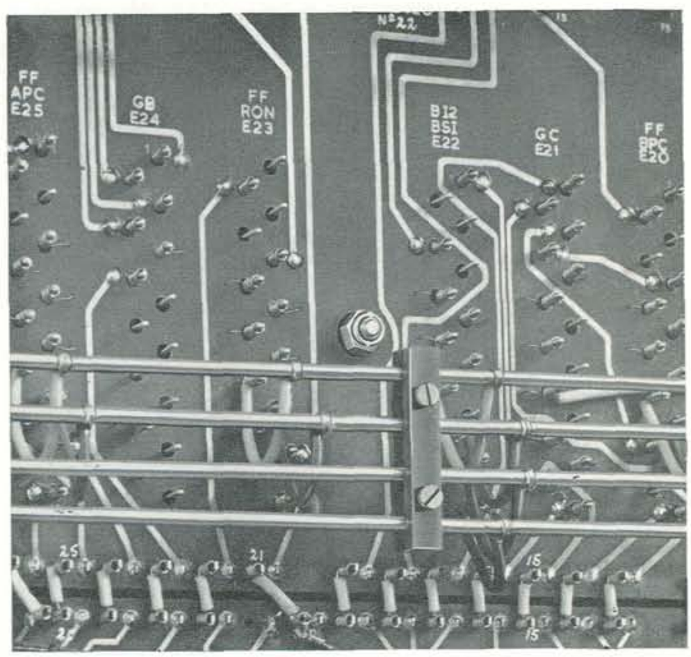
Whilst valves are used largely in bi-stable circuits, amplifiers, etc., all the store switching is carried out by symmetrical junction germanium transistors and, in fact, the number of transistors used is greater than the number of valves.

Two of the many advantages gained by the use of the above techniques are:

(1) The use of " plug-in " units result in greater ease of maintenance, in that rapid fault-clearance is made much easier.

(2) The use of the " wire-wrap " technique avoids the dangers inherent in the soldering of semi-conductors.





Close-up of a section of STANTEC-ZEBRA printed circuit showing wrapped-joint technique at terminals.

Ease of access to components and for testing is provided by the use of specially designed plug-in units.

STANTEC-ZEBRA PROGRAMMING FEATURES

However fast a digital computer may be electronically, the actual speed of calculation depends also on the programming method which governs its action. Hence, the structure of the programming code is a guide to the capabilities of a machine.

NORMAL CODE

The structure of the Normal (machine) Code is based on a novel idea. Single letters specify basic operations such as add, test, store; but there are 15 such letters (called function digits) and these may be used in any combination so that the programmer may construct thousands of different instructions. It is possible to instruct the machine to add, transfer, shift, modify and test *all at the same time,* thus making the effective speed of operation of the STANTEC-ZEBRA greater then the intrinsic electronic speed would suggest.

An address part appears in an instruction to indicate the location where the necessary number or instruction is stored. Sometimes it is convenient to be able to specify both an address giving the operand, and another address specifying the next instruction. A machine operating in this way is called a 1 + 1-address machine. Again, it may be useful to be able to specify two operands in an instruction, giving a 2-address machine. Furthermore, it may be desired to specify both the address of an operand and the address of a factor which can modify an instruction—typifying a 1 + B-modifying address machine. (For historical reasons modifying addresses are called " B-lines.")

The STANTEC-ZEBRA can be used as a single address, 1 + 1-address, 2-address, or 1 + B-modifying address machine, any of 12 immediate access registers, either of its two accumulators, or any input channel serving as modifier.

SIMPLE CODE

By means of a compact interpretive routine the STANTEC-ZEBRA Simple Code may be used. This has been characterised as the simplest available to any British computer. It includes facilities for relative addresses, automatic modification, automatic counting in loops, etc., as well as the normal arithmetic and logical operations. It also has the great advantage of operating with numbers in decimal floating-point form, thus obviating concern with scaling.

STANTEC-ZEBRA INPUT AND OUTPUT

The basic STANTEC-ZEBRA accepts punched paper tape input and produces punched paper tape or printed output. There is also available a range of alternative input/output equipment for use in Data Processing Systems.

INPUT :

Whilst the normal input is one or two paper tape channels (read at 100 characters per second), equipment for reading such tape at higher speeds can be supplied.

OUTPUT:

Punched paper tape output at 50 characters per second is normally provided, and an additional punch for concurrent working is also available. With new equipment being developed it is possible to attain output speeds of up to 300 characters per second.

As an addition to, or a substitute for, the normal teleprinter output operating at telegraph speeds, high speed printers suitable for on-line operation are also becoming available.

TAPE PREPARATION AND EDITING EQUIPMENT

The preparation and checking of the punched paper tapes can be carried out on a number of machines. A recommended initial set is as follows:

(1) Keyboard Perforator—used for the initial preparation of input tapes.

(2) Verifier—used to check the initial tapes produced and to produce a "verified" tape. With the keyboard perforator forming part of the verifier it can also be used to produce initial tapes.

(3) Tape Reproducers—used to produce tapes which may be a combination of other tapes with or without the addition of individual instructions put in manually to suit the particular combination.

(4) High Speed Tape Comparator—used to compare two tapes produced independently and checks that no discrepancy exists between them.

(5) Unipunch—a small hand punch which can be used as a simple correcting tool for some tape errors.

BRIEF SPECIFICATION OF THE BASIC ZEBRA

Mode	Serial-Binary.
Word Length	33 binary digits (includes 1 sign digit).
Word Time	312 microsec.
Main Store	Magnetic Drum with a capacity of 8,192 words. Revolution speed 6,000 r.p.m. Maximum access time 10 millisecs. (average 5 millisecs.).
Computing Store	12 immediate access stores (registers), each of 1 word length. 2 accumulators (registers each equipped with an adder/subtracter and having left and right shift facilities).
Optimum Operation Times	Addition } 312 microsec. Subtraction } Multiplication 11 millisecs. Division 35 millisecs. As an illustration of the overall speed of the machine: Using Simple Code, a 30 × 30 matrix can be inverted in 63 minutes.
Monitor and Test	CRT Monitor display allows the contents of 4 stores to be examined at any one time. Marginal variation of voltage and pulse amplitudes can be used to detect incipient component failures. Test programs are provided for use with marginal testing facilities. Plug-in electronic units are employed incorporating plug and socket arrangements of well-proven design; spares are provided so that suspect units can be removed for test and, if necessary, repair. Test keys are provided to enable orders or instructions to be set-up under manual control, and step-by-step operations to be carried out.
Power Supply	Approximately 6 kVA.
Input Medium	Normally 5-channel punched paper tape.
Input Devices	One or two photo-electric paper tape readers, operating at 100 characters per second or higher speeds.
Output Devices	One or two high-speed paper tape punches operating at 50 characters per second. One or two 7-characters per second on-line teleprinters.

ADDITIONAL STORAGE DEVICES

FERRITE STORES

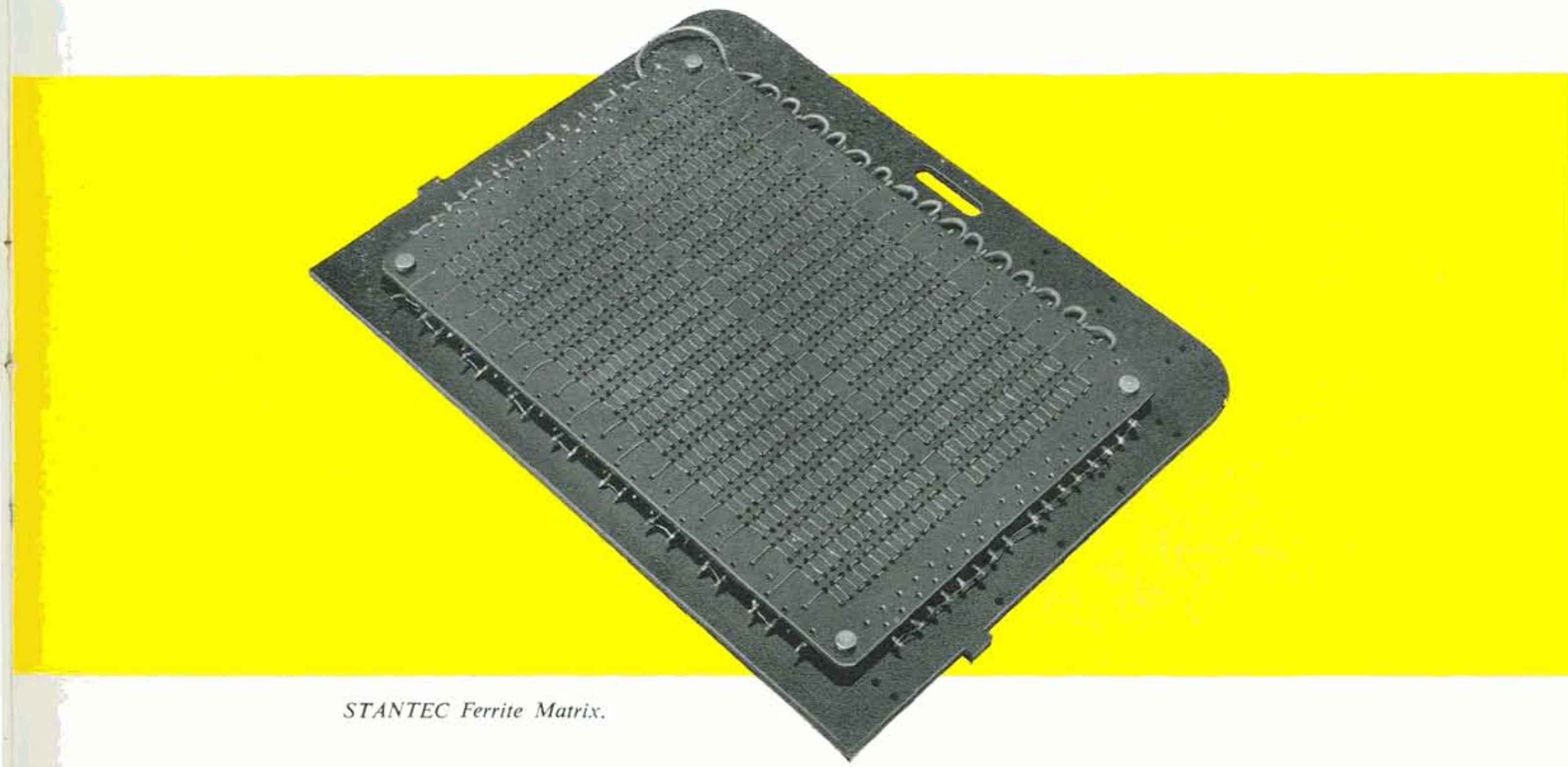
Ferrite storage has been developed and can be used in a number of ways. Immediate advantages are:

(1) Increase in the amount of immediate access storage.

(2) Use as a buffer store between the computer and magnetic tape storage.

MAGNETIC TAPE STORAGE

Several types of magnetic tape machines are available or in late stages of development, which enable very large magnetic stores to be provided for use in association with the computer.



STANTEC Ferrite Matrix.

Standard Telephones and Cables Limited

Registered Office:

CONNAUGHT HOUSE,

63 ALDWYCH, LONDON, W.C.2

Telephone: Holborn 8765 — *Telegrams:* Relay, London

Works:

NORTH WOOLWICH, E.16
Telephone: Albert Dock 1401

NEW SOUTHGATE, N.11
Telephone: Enterprise 1234

NEWPORT, MON.
Telephone: Newport (Mon.) 72281

FOOTSCRAY, KENT
Telephone: Footscray 3333

HARLOW, ESSEX
Telephone: Harlow 26811 (Rectifier Division)
Harlow 24212 (Quartz Crystals)

PAIGNTON, DEVON
Telephone: Paignton 58685

SOUTHAMPTON, HANTS.
Telephone: Southampton 74751

ILMINSTER, SOMERSET
Telephone: Ilminster 237

TREFOREST, GLAMORGAN
Telephone: Treforest 2182

Home Branch Offices:

BIRMINGHAM, LEEDS, BRISTOL, GLASGOW, MANCHESTER

Overseas Branch Offices:

CAIRO, DUBLIN, KARACHI, NEW DELHI, SALISBURY

Resident Representatives at:

ACCRA, COLOMBO, ISTANBUL and NAIROBI

Associated Companies in Europe, the U.S.A., Canada, South America, the Far East, South Africa and Australasia

---

Agents in:

EUROPE

CYPRUS
GREECE
MALTA

INDIA

ANDHRA PRADESH
ASSAM
BIHAR
BOMBAY
HIMACHAL PRADESH
KERALA
MADRAS
MADHYA PRADESH WEST
MADHYA PRADESH EAST
MANIPUR
MYSORE
NORTH EAST FRONTIER
ORISSA
PUNJAB
RAJASTHAN
SIKKIM
TRIPURA
UTTAR PRADESH
WEST BENGAL

PAKISTAN

EAST PAKISTAN

NORTHERN IRELAND

NORTHERN IRELAND

CEYLON

CEYLON

FAR EAST

BRITISH NORTH BORNEO
BRUNEI
BURMA
HONG KONG
INDONESIA
MALAYA (Federation of)
SARAWAK
SINGAPORE (Colony of)
THAILAND

SOUTH AMERICA

BRITISH GUIANA

MIDDLE EAST

BAHREIN
IRAN
IRAQ
JORDAN
KUWAIT
LEBANON
SAUDI-ARABIA
SYRIA

AFRICA

Union of South Africa

CAPE PROVINCE (EAST)
CAPE PROVINCE (WEST)
NATAL
ORANGE FREE STATE

Federation of the Rhodesias and Nyasaland

SOUTHERN RHODESIA
(Bulawayo District)
NORTHERN RHODESIA
(Copper Belt)

British West Africa

GAMBIA
SIERRA LEONE

British East Africa

KENYA
TANGANYIKA
UGANDA
ZANZIBAR

Ghana

ACCRA

Sudan

SUDAN

Mauritius

MAURITIUS

9580

Printed in England