IBM 702
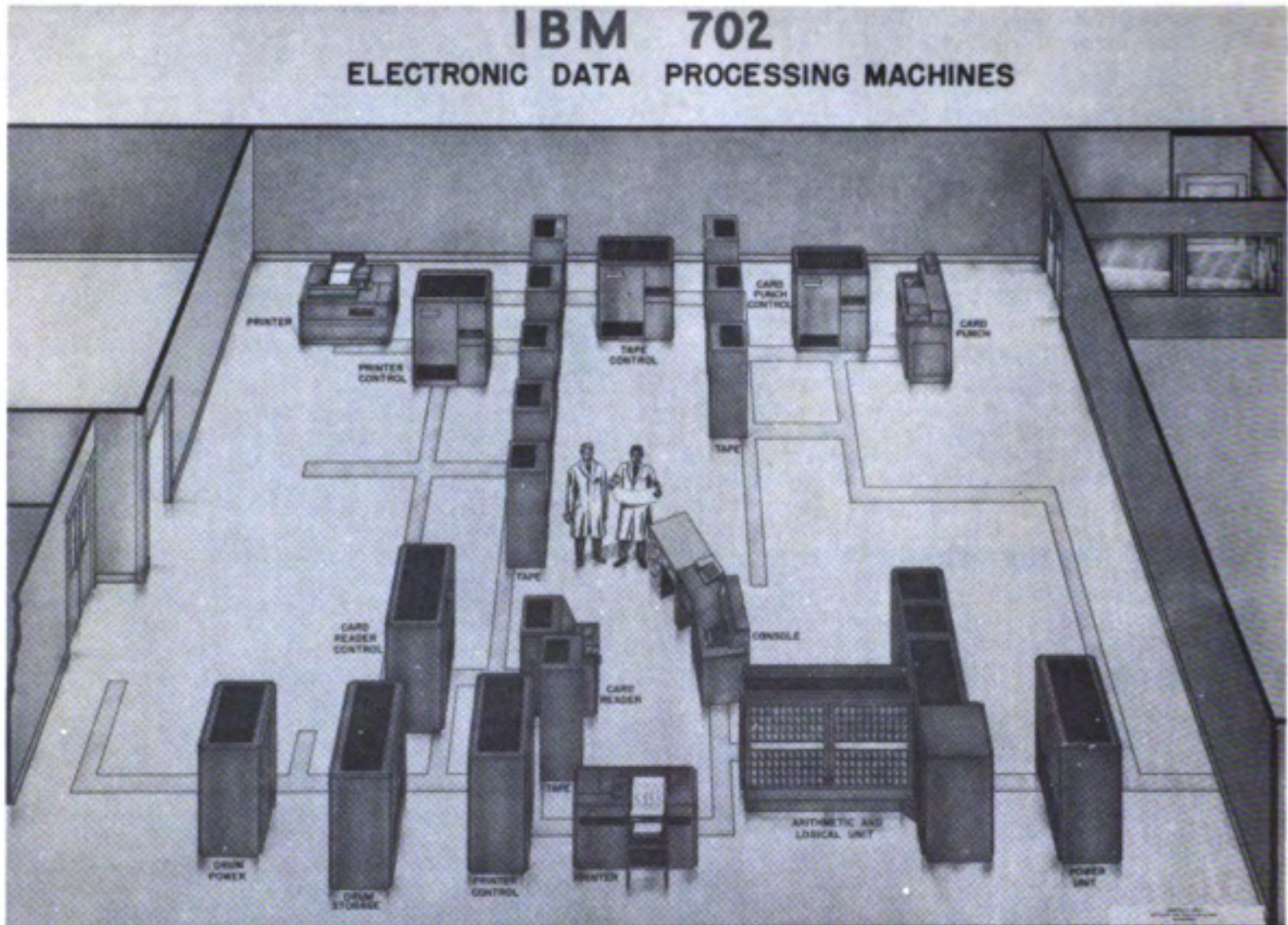
International Business Machines Type 702 Electronic
Data Processing Machine

MANUFACTURER

International Business Machines Corporation

IBM 702
ELECTRONIC DATA PROCESSING MACHINES

Picture by the General Electric Company

APPLICATIONS

Manufacturer
Commercial and scientific.

Government Sample
U. S. Navy Aviation Supply Office
Commercial, inventory control.
Industrial Sample
Bank of America
Accounting statistical analysis
Chrysler Corporation Service Parts Warehouse
Invoicing, cost of sales and inventory control.
Commonwealth Edison Company of Chicago
Customer billing and accounting.
General Electric Company, Hanford Atomic Product's
Operation
Provide general data processing and computing service
to entire plant, both commercial and scientific
work.

NUMERICAL SYSTEM

Internal number system	Binary coded decimal and alphabetical
Characters per instruction	5
Instructions decoded	32
Instructions used	32
Arithmetic system	Fixed point
Instruction type	One address
Number range	Variable
Timing	Synchronous for central processing unit and asynchronous for input-output.
Operation	Sequential and concurrent

The machine is not a fixed word length system. It is
possible to have both variable field and variable
record lengths. Consequently there are no "words".
The characters are alphanumeric. Five characters
are required to make up an instruction.

Picture by the Bank of America

Industrial Sample
Bank of America
System may be used with a number range of
$10^{-511} < n < 10^{511}$ without multiple precision.
General Electric Company, Hanford Atomic Products
Operation
Variable word length; floating point programs are
10 and 2 decimal.

ARITHMETIC UNIT

The time required to add is 23 microseconds, exclud-
ing the storage access time. The time required to
multiply is given by

$$23 \left[N_p (N_c + 4) + 1 \right] + 115 \text{ microseconds.}$$

The time required to divide is given by

$$23 \left[10 + N_d + (N_d - N_r)(7.5K + 15) \right] + 115 \text{ micro-}$$

seconds.
where
N_p = number of multiplier digits

N_c = number of multiplicand digits

N_d = number of dividend digits

N_r = number of divisor digits

K = N_r if $N_r > 8$ and $K = N_r + 0.005 (8 - N_r)$ if

$N_r < 8$

The arithmetic unit is constructed of vacuum tubes,
crystal diodes and magnetic cores and operates
serially by binary coded decimal character and
parallel by bit.

STORAGE

Media	Alphanumeric Characters	Microsec Access
Electrostatic or Magnetic Core	10,000	23 or 17
Magnetic Drum	60,000	8,120+40N
Magnetic Tape	5,760,000	10,140+67N

Magnetic drum has 300 sections of 200 characters
each. N = number of characters.

Government Sample
U. S. Navy Aviation Supply Office
System has magnetic core storage unit in lieu of
electrostatic.
Industrial Sample
Bank of America
System has magnetic core in lieu of electrostatic
storage unit and does not have magnetic drum storage.
Chrysler Corporation Service Parts Warehouse
System has magnetic core and magnetic drum.
General Electric Company, Hanford Atomic Products
Operation
System has magnetic core, magnetic drum, and magne-

IBM 702

Picture by the Commonwealth Edison Company of Chicago

tic tape storage.

INPUT

Media	Speed
Magnetic Tape	75 inches/sec
Punched Card	250 cards/min

Government Sample
U. S. Navy Aviation Supply Office
Magnetic tape unit operates at 200 char/inch and 75 inches/sec. Card reader operates at 250 cards/min at 80 char/card.

Industrial Sample
General Electric Company, Hanford Atomic Products Operation
Card reader at 250 cards/min with off-line card to tape conversion. Magnetic tape speed is (10,000 + 67N) microseconds, where N is the number of characters.

OUTPUT

Media	Speed
Magnetic Tape	15,000 char/sec, 75 in/sec
Punched Card	100 cards/min
Typewriter	600 char/min
Printer	500 lines/min, 120 print pos.
	150 lines/min, 120 print pos.
	1,000 lines/min, 60 print pos.
	1,000 lines/min, 120 print pos.

Government Sample
U. S. Navy Aviation Supply Office
System has all above output systems.

Industrial Sample
Bank of America
System has all above output systems.

General Electric Company, Hanford Atomic Products Operation
Magnetic tape to card and tape to printer conversion done on "off-line" basis.
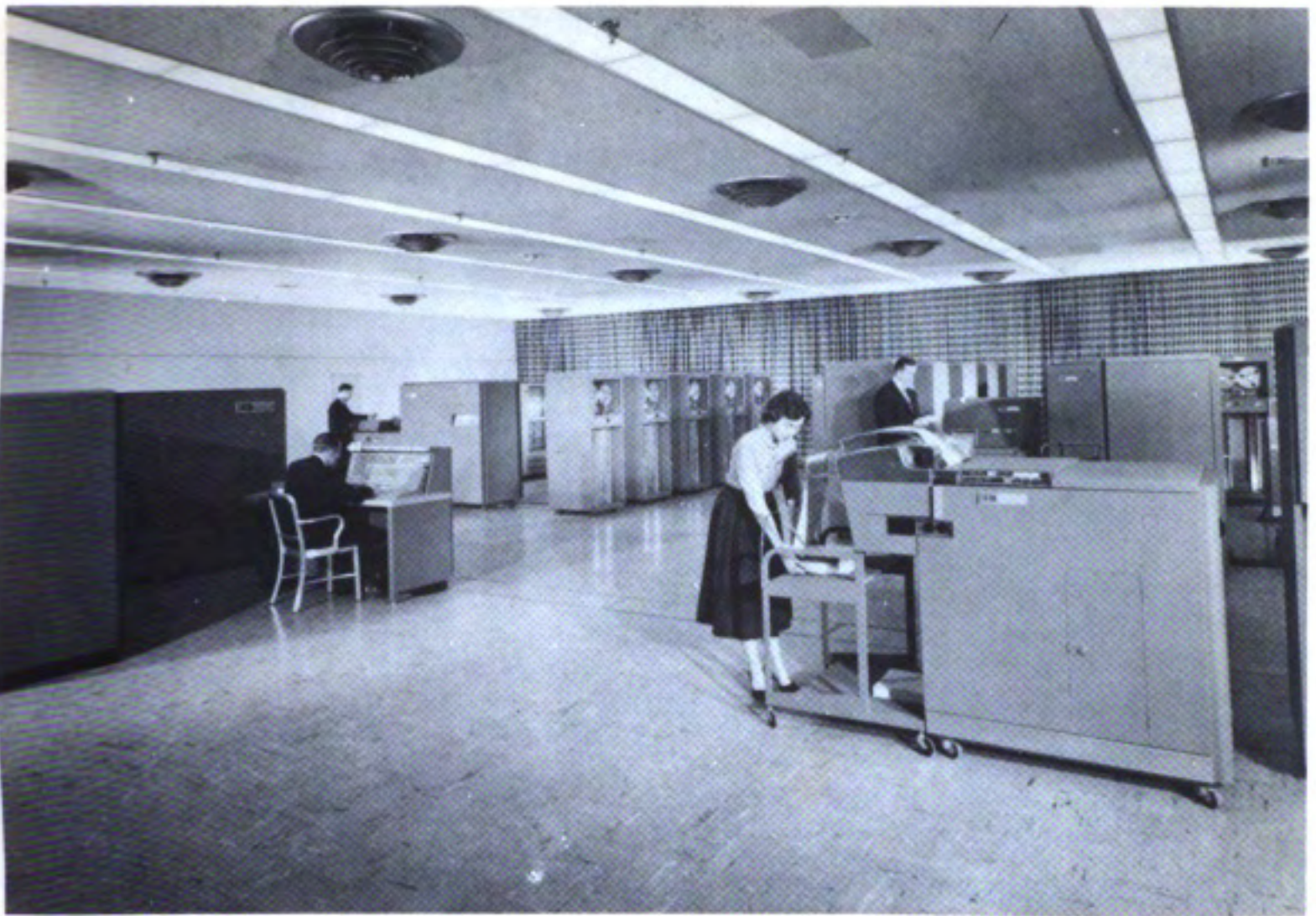
CIRCUIT ELEMENTS ENTIRE SYSTEM

Tubes	10,000
Tube types	10
Crystal diodes	17,000

Industrial Sample
Bank of America
In addition to the above, the system has 165,000 magnetic cores. It utilizes tube types 6211, 5965 and 5687.

Picture by the International Business Machines Corporation

CHECKING FEATURES

Instruction

During the execution of an instruction, a character code error, an invalid operation part transfer, or an operation part interpretation, may be detected and indicated.

Machine

The machine check indicator is turned on when a character code error is detected during the execution of all instructions (except write, write and erase, read, and read check) in which information is read from accumulator storage or memory. Read-Write -- checks the transmission of data from all input units to memory. It also checks the transmission of all output data from memory to the drum, tape unit, card punch record storage, printer record storage, and typewriter.

Printer-Punch

This indicator reflects any error when information is punched in a card or when printed on the printer.

Overflow

The overflow check indicator is turned on during an add or subtract operation when the number of digits in the result is greater than the number of digits in the longer of the original fields. An overflow is indicated as a result of a round off operation if a carryover is made out of the highest order position of the original accumulator storage field.

Sign

The indicator turns on when a field addressed by an arithmetic instruction does not have plus or minus zoning over the right hand digit.

Industrial Sample

Bank of America

The following checks are used:

Odd-even redundancy
Read-write operations
Longitudinal redundancy on magnetic tape processing.

General Electric Company, Hanford Atomic Products Operation

Parity check using 7 bit code with only six bits of real data is used for all internal operations and all input-output. All corrective action can be programmed or machine can be set to stop on error at the programmer's discretion.

Normally operated with internal error detection set to stop, but with input-output error correction programmed.

Picture by the General Electric Company

POWER, SPACE AND WEIGHT

| Type	Name	Qty.	Power K.W.	Current Amps.	Heat B.T.U.	Weight lbs.	Size Width	(Nearest Inch) Length	Height
702	Central Processing Unit	1	25.0	87	85,000	5,291	147	139	63
	Main Power Unit	1				2,961	34	61	66
	Console	1				508	35	61	46
712	Card Reader	1	5.0	17	17,000	1,053	43	28	49
756	Card Reader Control Unit	1				1,712	27	57	64
717	Printer	1	9.0	31	30,700	2,244	30	64	47
757	Printer Control Unit	1				1,866	27	57	64
722	Card Punch	1	7.6	26	26,000	1,176	25	53	50
758	Card Punch Control Unit	1				1,866	27	57	64
732	Drum Unit	1	6.9	24	23,600	1,775	27	62	64
	Drum Power Supply	1				1,646	27	40	64
727	Tape Unit	10	13.0	45	44,200	9,110	26	24	66
752	Tape Control Unit	1	8.4	29	28,700	1,636	27	57	64
	Total		74.9	259	255,200	32,844			

Approximately one Ton of air conditioning required for 12,000 B.T.U.

Government Sample
U. S. Navy Aviation Supply Office
System requires 75 KW, occupies 19,494 cu. ft., 2,052 sq. ft., measuring 57 ft. by 36 ft. by 9-1/2 ft. The system weighs 33,000 lbs. The air conditioning consists of a 40-Ton unit and a 15-Ton unit, occupying 3,168 cu. ft. of space and 288 sq. ft. of area, measuring 12 ft. by 24 ft. by 11 ft.

Industrial Sample
Bank of America
System requires 93 KW, 16,000 cu. ft., 2,500 sq. ft., measuring 55 ft. by 45 ft. by 8 ft. Air conditioner requires 68 KW, 2,552 cu. ft., 319 sq. ft., measures 29 ft. by 11 ft. by 8 ft., and has a capacity of 60 Tons. The air conditioning equipment designed to accommodate requirements for comfort conditioning of
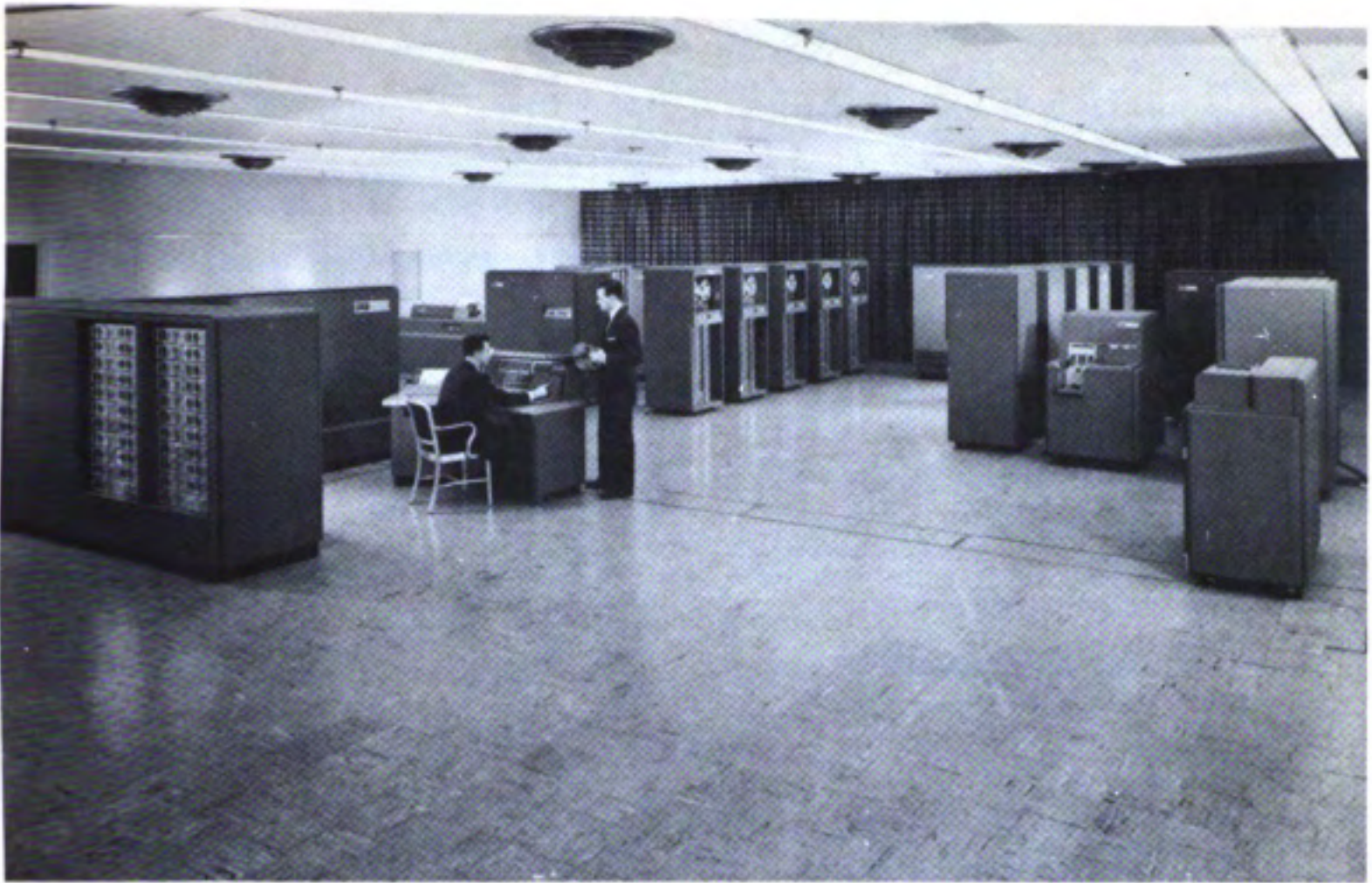
Picture by the International Business Machines Corporation

engineering, mail handling, tabulating, and office personnel and space.

General Electric Company, Hanford Atomic Products Operation

Power service to system is 300 amps., 208 volts, 3 phase for computer and 105 amps., 440 volts, 3 phase for air conditioner. The machine room is 40 ft. by 60 ft. and the air conditioner requires an area of 20 by 20 ft. The air conditioner capacity is 52 Tons. Power consumption has been stated in terms of service supplied rather than actual machine consumption. The space required is a function of the amount of engineering and observation space and other miscellaneous working areas which are considered necessary or desirable to have in addition to the actual cubic footage of the equipment.

PRODUCTION RECORD

| Produced | 14 |
| Operating | 14 |

COST, PRICE AND RENTAL RATE

Type	Rental Rates of System Components	Monthly Charge
702	Central Processing Unit	$8,650
712-756	Card Reader and Card Reader Control Unit	1,050
717-757	Printer and Printer Control Unit	1,800
722-758	Card Punch and Card Punch Control Unit	1,050
727	Magnetic Tape Unit	550
752	Tape Control Unit	550
732	Magnetic Drum Storage Unit	2,800
719	Printer, 1,000 lines per minute 60 printing positions	1,400
730	Printer, 1,000 lines per minute 120 printing positions	2,100
760	Storage Unit for Printers and Tapes	1,850

There is no predetermined grouping of equipment. Any combination of above is available depending on customers needs. Rates subject to change.

Government Sample
U. S. Navy Aviation Supply Office
Prime shift monthly rental rate for system is $30,200.

Industrial Sample
Bank of America
Rental rate is $9,900 for basic system and $15,475 per month for additional equipment.

Commonwealth Edison Company of Chicago

Serial No.	Description	Quantity	Unit Rate	Monthly Rental (Primary Shift)
702	Central Processing Unit	1	$9,900	$9,900
712	Card Reader	2	770	1,540

756	Card Reader Control Unit	2	300	600	
717	Printer	2	1,200	2,400	
757	Printer Control Unit	2	600	1,200	
722	Card Punch	2	750	1,500	
758	Card Punch Control Unit	2	325	650	
727	Magnetic Tape Units	17	550	9,350	
752	Tape Control Unit	1	550	550	
776	Record Storage Unit	2	1,850	3,700	
732	Magnetic Drum	1	2,800	2,800	
	Total			$34,190	

2nd and 3rd Shift Rental charged at 50% of above rates.

General Electric Company, Hanford Atomic Products Operation
Rental rate is $34,900/month for system, including average extra shift rental. Rental rate for punched card machines, including extra shift but excluding key punches and verifiers is $2,175 per month.

PERSONNEL REQUIREMENTS

Daily Operation	Engineers
One 8-Hour Shift	4
Two 8-Hour Shifts	7
Three 8-Hour Shifts	10

One console operator and 2 floor operators per shift are required. Programmers vary from 4 to over 30, depending on number of applications on system.

Government Sample
U. S. Navy Aviation Supply Office

Daily Operation	Engineers	Operators
One 8-Hour Shift	3	9
Two 8-Hour Shifts	6	12
Three 8-Hour Shifts	9	15

The operators are divided as follows: For first shift, 3 are on main frame, 3 auxilliary and 3 supervisory. For second shift, 3 main frame operators are required and for the third shift three operators are required for the main frame.

Industrial Sample
Bank of America

Daily Operation	Engineers	Tech or Operators
One 8-Hour Shift	3	2
Two 8-Hour Shifts	5	5
Three 8-Hour Shifts	6	

Commonwealth Edison Company of Chicago
Three 8-Hour shifts require 9 engineers and 18 technician-operators.
General Electric Company, Hanford Atomic Products Operation
Three 8-Hour shifts require 5 engineers and 8 technician-operators. The engineers are employed by IBM. Personnel covers operation on a 7-day-a-week basis.

RELIABILITY AND OPERATING EXPERIENCE

Government Sample
U. S. Navy Aviation Supply Office
Approximate reliability is 0.85, where reliability is obtained by subtracting the sum of Machine Error Time, the Unscheduled Maintenance Time and the Tape Trouble Time, from the Available Time and dividing

the difference by the Available Time. The above figure is based on the period from July to September 1956.

Industrial Sample
Bank of America
Average error-free running period 2 hours
Good time 12.56 hours/day
Attempted to run time 14.13 hours/day
Operating ratio (Good/Attempted to run) 0.89
Figures based on period 1 July 1956 to 30 September 1956.
Acceptance test 20 August 1955.

Of the 0.11 lost in the operating ratio above, approximately 0.037 was due to main frame down time, 0.037 was due to tape unit down time, 0.030 to corrective restart time and 0.006 was due to tape remake time.

Chrysler Corporation Service Parts Warehouse
Productive time, maximum 0.94
Productive time, minimum 0.78
Based on period 5 April 1956 to 27 September 1956.
System accepted 22 August 1955.

Commonwealth Edison Company of Chicago
Average error-free running period 4-6 hours estimate
Good time 18 hours
Attempted to run time 20 hours
Operating ratio (Good/Attempted to run) 0.90
Figures based on period 1 October 1956 to 31 December 1956.
Acceptance test July 1955

General Electric Company, Hanford Atomic Products Operation
Average error-free running period 68 hours
Good time 1,275 hours
Attempted to run time 1,301 hours
Operating ratio (Good/Attempted to run) 0.98
Figures based on period 1 August 1956 to 14 October 1956.
Acceptance test 1 July 1955

Core storage unit installed July 1956. Preventive maintenance is scheduled 4 hours/day for 4 days per week. Over the weekend 68 hours elapse between scheduled maintenance sessions.

The Prudential Insurance Company of America
It is expected that conversion from electrostatic storage to core storage will further reduce unscheduled maintenance from an overall average of 5.8% experienced between 14 November 1955 and 31 August 1956. Two-Shift operation occurred during that period.

FUTURE PLANS

Industrial Sample
Commonwealth Edison Company of Chicago
System will be replaced by an IBM Type 705 Electronic Data Processing Machine in March 1957.

INSTALLATIONS

Government Sample
U. S. Navy Aviation Supply Office
Philadelphia 11, Pennsylvania
Industrial Sample
Bank of America
500 Howard Street
San Francisco, California

Chrysler Corporation
Detroit 31, Michigan

Commonwealth Edison Company
72 West Adams Street
Chicago 90, Illinois

Ford Motor Company
Dearborn, Michigan

General Electric Company
Hanford Atomic Products Operation
Richland, Washington

Monsanto Chemical Company
St. Louis, Missouri

Prudential Life Insurance Company of America
Newark, New Jersey

ADDITIONAL FEATURES AND REMARKS

Manufacturer
Inter-tape-card-printer conversion.
Rental rates include servicing, educational assist-
ance through a 702 school, special representatives
and programming service.

System is being replaced by the Type 705.
Autocoder system is used.
Component units, which have various functions, are
housed in a half-dozen or more separate cabinets,
the number of each type depending upon the user's
needs. The use of these separable units allows
freedom in the design of the data processing system.
Essential components include the arithmetical and
logical unit, the operator's control console,
magnetic tape units, an input card reader, and an
output printer and card punch. Often a magnetic
drum will also be included in an installation, or
several drums might be used.

IBM 702