THE COMPUTER MUSEUM REPORT

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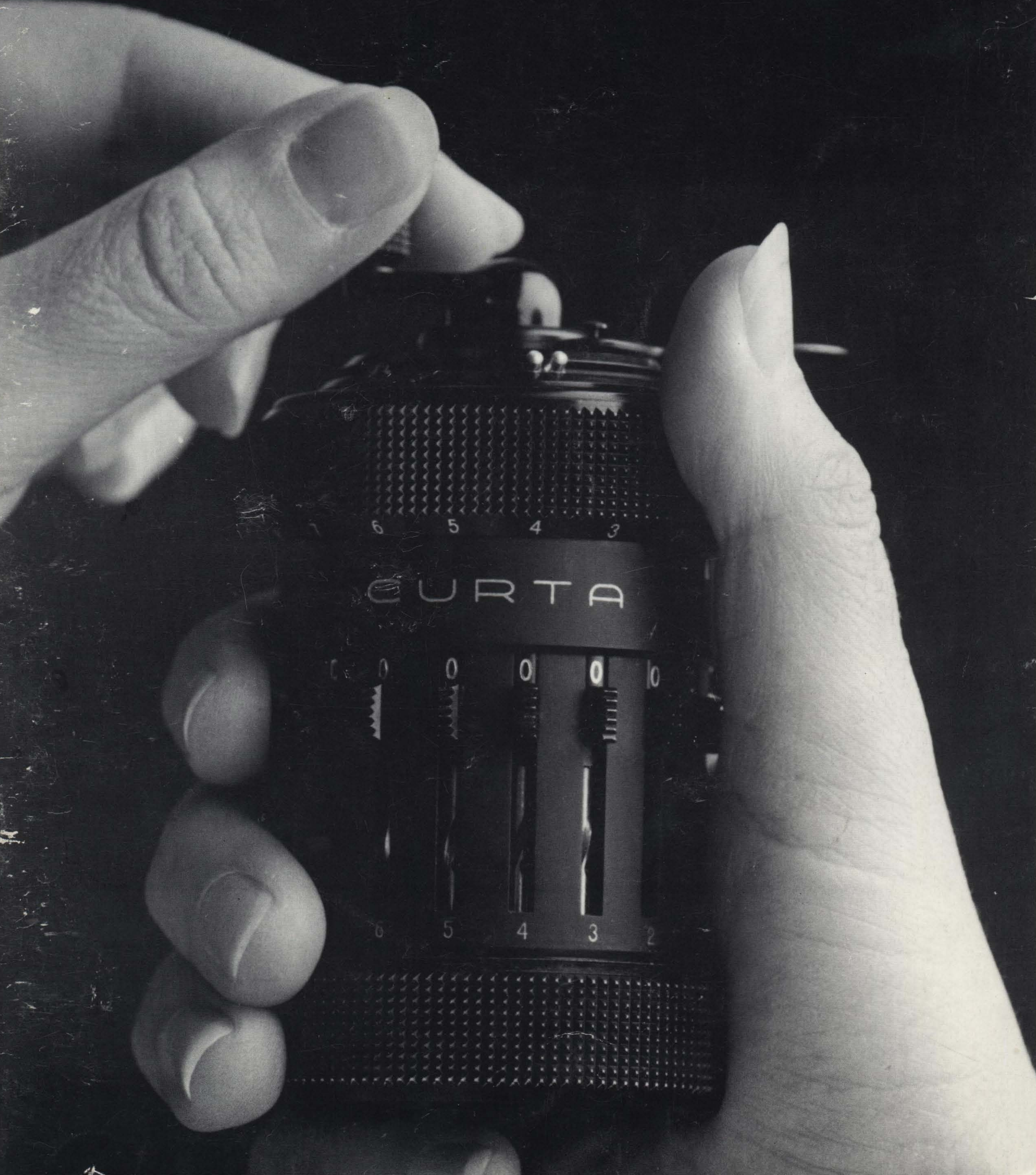

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The President's Letter
Gwen Bell, President

ON ONE HAND...
Pocket Calculators Then and Now

Today we almost take pocket calculators for granted. Yet, the inexpensive and convenient electronic calculator we use today is less than fifteen years old.

"How many sheep do I have?"
"How much are three loaves of bread?"

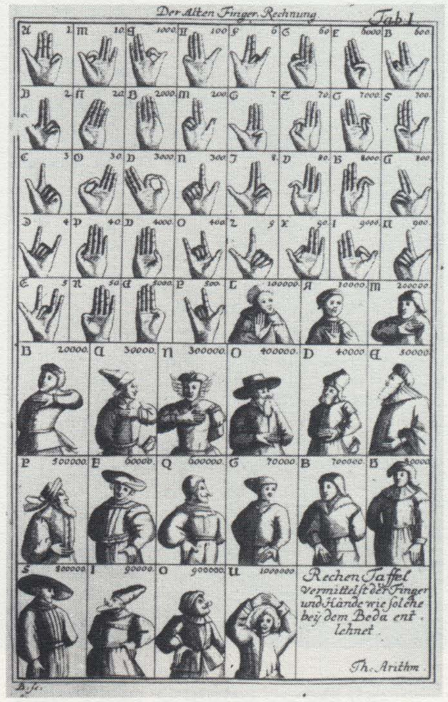
The need to answer such questions is nearly as old as human civilization. Throughout history, people have developed ideas and devices to help them work with numbers and to answer such questions quickly and accurately. People have used many different materials to make handy calculators, from sticks and stones, to gears and electrons.

This issue of the Report is based on an exhibit that allows you to journey through the history of the pocket calculator. You will meet the people who have used pocket calculators in the past and discover the problems they solved. At the exhibit you can try your hand at using their calculators. While in this publication, you will learn more of the anecdotes associated with the artifacts.

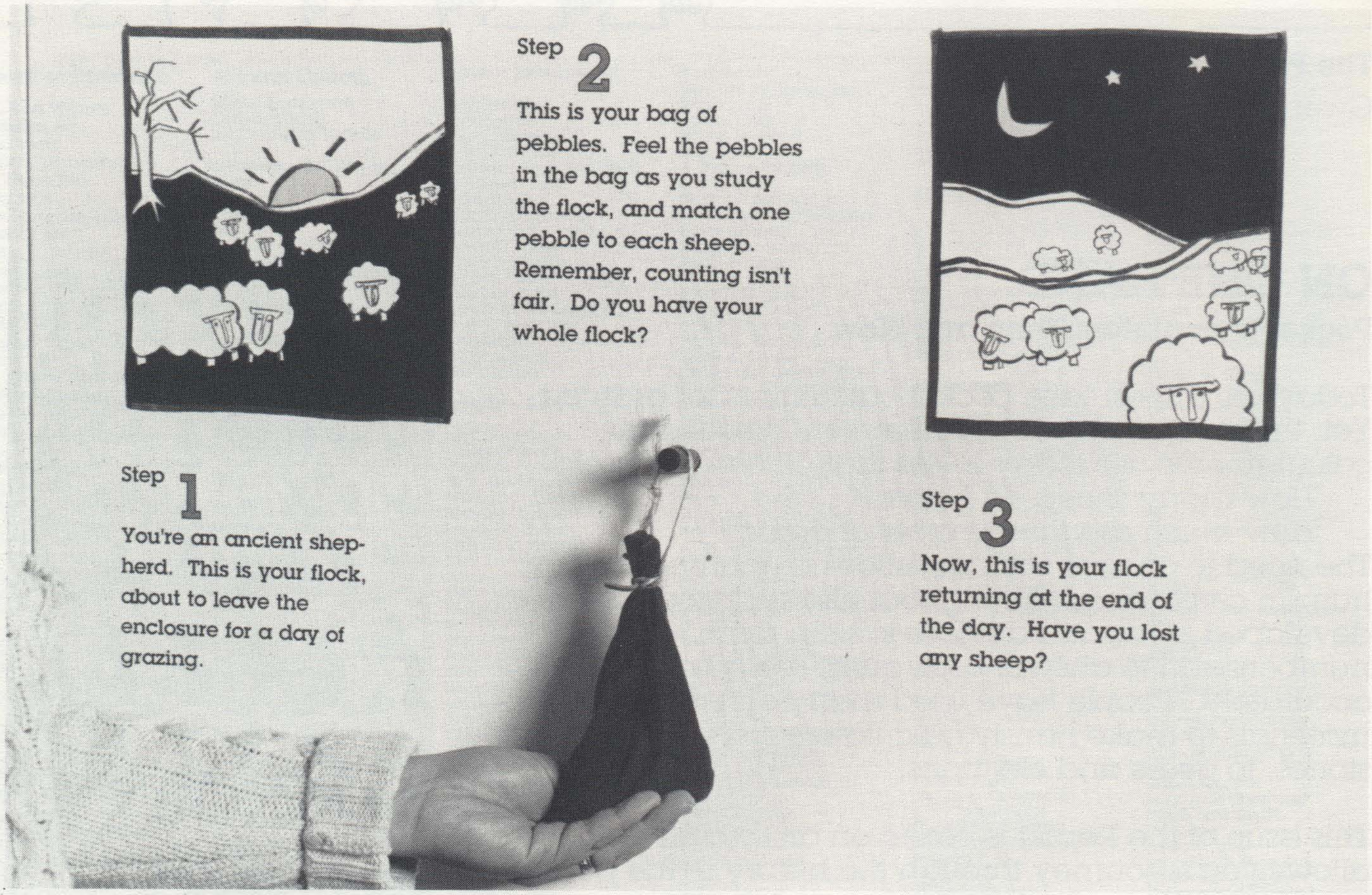
The idea of the exhibit was conceived on a trip to London where I saw many 18th and 19th century pocket calculating devices. Then it was made possible by a grant from the Hewlett Packard Foundation. It was developed by Greg Welch after his graduation from Harvard and before leaving on his Shaw Travelling Fellowship to visit the science museums of Europe. The exhibit and this report were designed and produced for the Museum by Michael Sand, Inc.

On One Hand is to be the Museum's first travelling exhibit. It will help us bring the Museum to you. The exhibit, appropriate for Science and Children's Museums, University Galleries, and Corporate Exhibitions, is expected to be available in the summer of 1987. Please let us know if you wish to suggest a placement for the exhibit.

Gwen Bell



The First Pocket Calculator: The human hand was used as a calculator long before the first pocket. Many cultures throughout history have used hands to calculate and represent large numbers. Finger counting often led to the development of number systems. Indeed, most number systems around the world are based upon groupings of five or ten. This diagram from the 8th century A.D. illustrates a system of elaborate finger counting used in Europe during the Middle Ages. Numbers up to 1,000,000 could be represented by various positions of the fingers and hands.

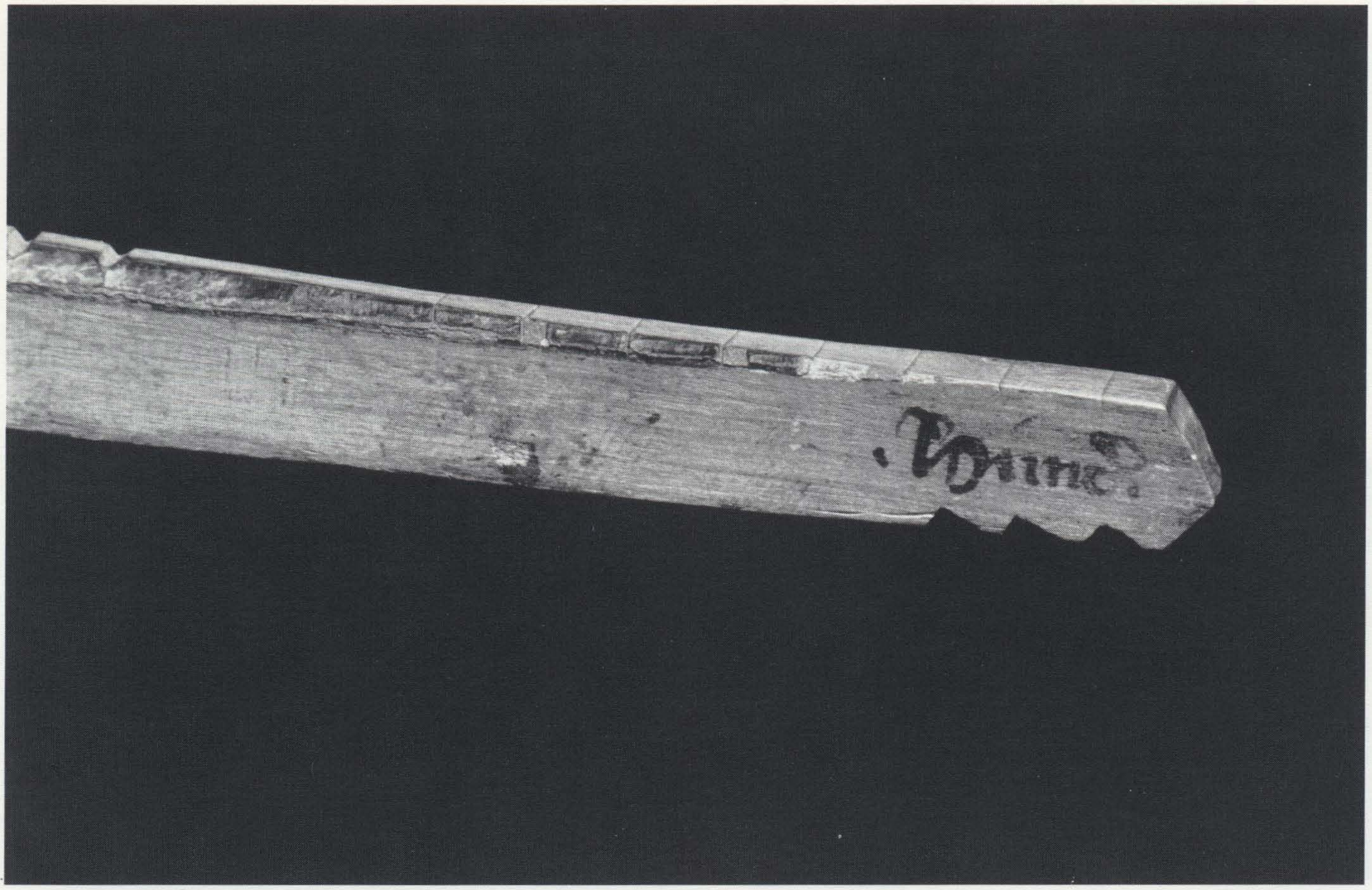


Shepherd's Pebbles. Mesopotamia, circa 1000 B.C. Shepherds of old let their sheep graze free by day, and at night put them into an enclosure. The problem they faced was knowing if they had all their sheep. Did one wander away while grazing? Was one stolen in the night?

To keep track of their flock, they used a bag of pebbles and a bowl. In the morning they put one pebble in the bowl for every sheep that left the enclosure. At night, they put the pebbles back in the bag, one by one, as the sheep returned. If there were pebbles left over, they went looking for sheep.

The shepherds weren't counting as they did this. They weren't thinking "one, two, three...." They were thinking "sheep, sheep, sheep...." As a result, they did not know how many sheep they had altogether, or how many pebbles either. They just knew that there should be as many sheep as pebbles.

This one pebble/one sheep system had its drawbacks. For one, a big flock meant a very heavy bag of pebbles. For another, someone might manage to steal a sheep and a pebble, and the shepherd would never be the wiser. Still, the system worked for ancient



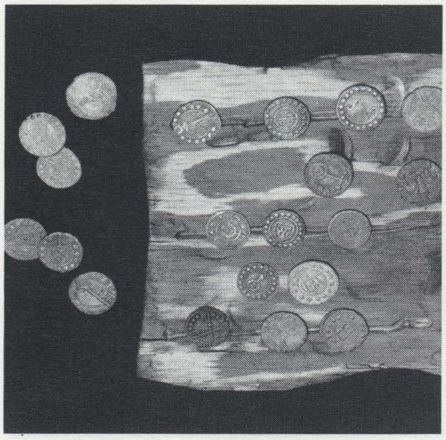
shepherds, and it continues to work for some of their modern-day descendants. And versions of the system are seen in some religions today, which use beads (like a rosary) to keep track of repeated prayers. Cultures have had to learn to count, just as children do. They have had to learn numbers. A number allows people to keep track with a mental idea of quantity. So instead of carrying around a bag of seventeen pebbles, you carry in your memory the number seventeen.

Cultures that count made an important modification in the one-pebble/one-sheep system. They could let different objects stand for different quantities. They did not necessarily have a way to write out the number, but they had the idea, they had a way to represent the idea, and most invented some sort of device, some sort of pocket calculator, that would help them work with numbers. As early as 3500 B.C. in China, rods of bone, wood, or ivory were arranged in various patterns to represent numbers. In ancient Rome, styli were used to scratch numbers into wax tablets for both calculation and storage.

Tally stick: Cultures across the globe carved records on sticks. The earliest known "tally" sticks date from 30,000 B.C.

Notched tally sticks such as this one were used to store financial records in England from the 13th to the 19th century. The pattern of the notches represents a quantity of money: large notches indicate pounds, smaller ones shillings, and scratches pence. On the remaining faces of the tally, opposite each other, were the name of the payer and the date of the transaction, written in ink by an officer called the writer of the tally. After a transaction was recorded, the stick was split in half down its length, and one half was given to each party as a receipt. The practice was ordered to be discontinued by the Act of 1782 that came into force in 1826. Subsequently, the House of Lords discovered that it had warehouses full of tally sticks and used them as fuel in their chambers. Echequer Tallies are extremely rare today. From the Samuel S. Dale Collection, Rare Book and Manuscript Library, Columbia University.

A competition between the Hindu-Arabic form of mental and paper arithmetic that we use today and Roman numeral figuring using jettons. The dismay of the jetton user shows graphically who is winning. The mid-18th century saw the widespread availability of paper, of printing, and the use of the Hindu-Arabic number system with the simultaneous decline of the use of Roman numerals and their computation with jettons.



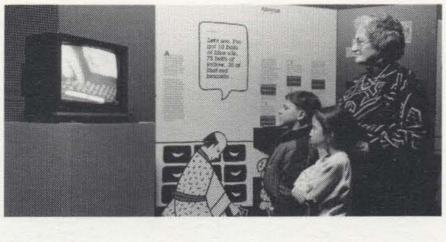
These copper jettons are from 14th-century Italy. The designs on jettons were often symbols of different trades or coats of arms. Depending upon the wealth of the owner, jettons were produced in metals varying from copper to gold but they were not coins. In fact, a new set of jettons was a customary New Year's gift. The old set would then be thrown in a river, symbolically clearing last year's accounts.

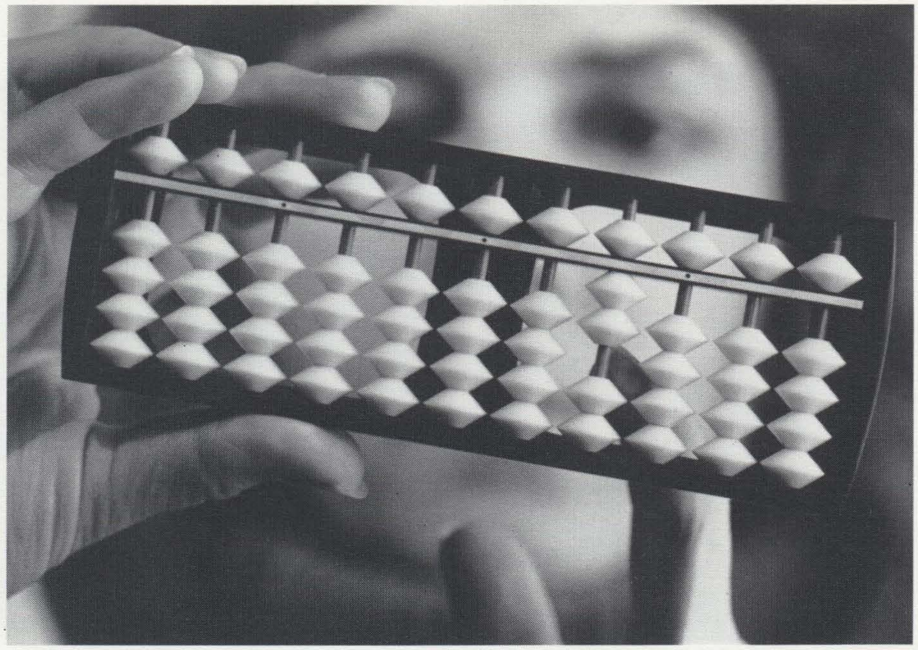
Remnants of jettons remain with us today. Merchants had boards in their shops on which to toss their jettons to calculate bills; stores today still have "counters." From the collection of Gwen and Gordon Bell.

Jettons. During the Renaissance, Europeans counted with Roman numerals. But even for people accustomed to using them, Roman numerals are not easy to calculate mentally, and paper and pens were hard to come by. Merchants used copper tokens called "jettons" to calculate prices.

The jettons were moved about on lines. Merchants could draw the lines on the ground or scratch them on a table. The lines represented different values of ten: ones, tens, hundreds, and so on. For intermediate values, like five or fifty, a space was left between the lines. In the same way that you know immediately what is meant by $1.98, the Renaissance buyer and seller immediately recognized the price by the position of the jettons on the lines.

Until 1700, calculating tokens were common in Europe. The tokens usually derived their name from moving them about the lines while calculating: the word "jettons" comes from the French verb "jeter" meaning "to throw." Adept calculators must have made their jettons fly across their counting boards! By the mid-18th century both the Roman numeral system and jettons had disappeared from everyday use.



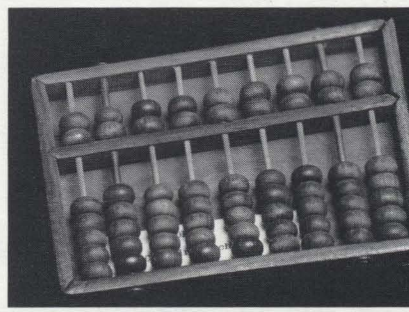


The Japanese "soroban" has sharp edges to its beads and only one bead in *heaven* and four beads in *earth* to make operations faster. From the collection of the Peabody Museum of Salem.

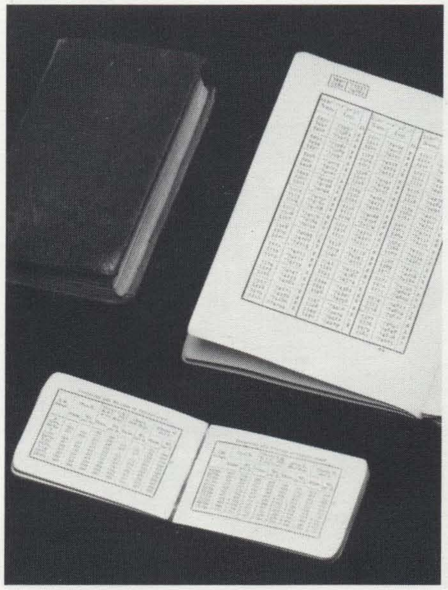
The soroban has not declined in use since the advent of its rivals the calculator and computer. In some banks, the daily computerized totals are double checked with a soroban. In learning the soroban, students learn to visualize the position of numbers. The soroban champion, Ms. Nishida, can add eight ten-digit numbers in less than ten seconds simply by visualizing the position of the beads in her head. In fact, the Japanese claim that learning the use of the soroban can increase a students I.Q.

Abacus. Most eastern countries used an abacus of some sort. It emerged from the Middle East sometime after 500 A.D. and was based on a system in which pebbles were moved around on the ground to represent numbers and perform calculations. (The word abacus is from the Semitic word "abaq," meaning dust.) The Chinese developed a version that they called a suapan. The Japanese modified the suapan and called it a soroban.

An abacus is rather similar to jettons. The difference is that instead of scratching lines and carrying loose jettons, the tokens were strung on wires, and then framed. The abacus became the indispensible calculator for eastern merchants. It was easy to carry. And for the skilled user, it is very fast. People who use an abacus learn to recognize numbers simply by looking at the position of the beads.

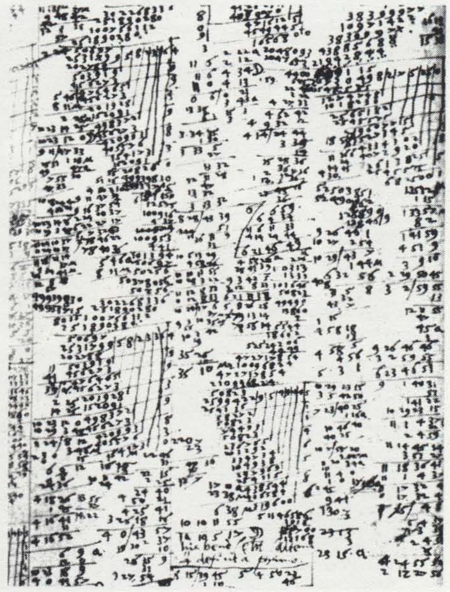


The Chinese "suapan," or "counting tray," has round beads and is divided into two sections. The top section is called *heaven* and contains two beads, each worth five units. The bottom section is called *earth* and contains five beads, each worth one unit. The suapan was used in China by the 1300s, and it became widely popular in 1593 when the mathematician Chen Ta-wei published a book on abacus computation. The abacus is still such an important part of Chinese culture that May 10 is celebrated as National Abacus Day. From the collection of Gwen and Gordon Bell.



The concept of the pocket book of tables started with the development of printing itself. (1) The 1683 table of trigonometric values was useful to navigators, surveyors, astronomers, mathematicians and architects. Such tables eliminated the need to constantly calculate the trigonometric values of numbers. However, few tables were free from mistakes, and corrections were often put in by hand. From the collection of Gwen and Gordon Bell. (2) This set of logarithms tables was compiled in 1839 in England by The Society for the Diffusion of Useful Knowledge. To multiply two large numbers an astronomer would look up the numbers in the table, and add the listed logarithm values. The number in the tables that corresponded to the sum of the logarithms was the answer to the original multiplication problem. From the collection of the IBM Corporation. (3) Easily carried in a shirt pocket, Thompson and Thomas's *Electrical Tables and Memoranda,* published in London in 1898, was a handy reference for the electrical engineer wherever he went. From the collection of Gwen and Gordon Bell.

These calculations were performed by Johannes Kepher for his *Ephermerides,* dedicated to Napier for his invention of Logarithms. These were typical of the long hand arithmetic used to numerically describe the movements in the heavens.

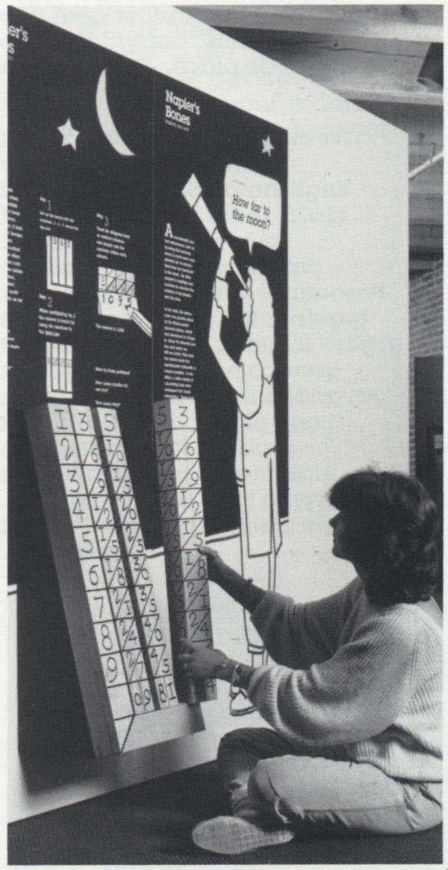


Scientists' Instruments The year 1670 marked the first recorded appearance of Halley's Comet. A seventeenth-century astronomer bent on knowing the heavens and such predictions as the recurrence of the comet, faced very complicated calculations. He often needed to multiply vast numbers to describe the motions of the planets and the stars.

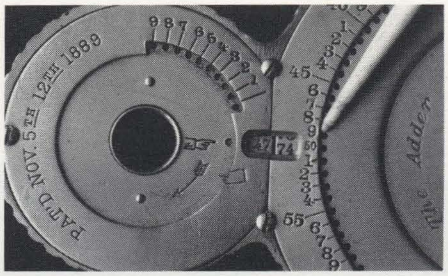
Astronomers were greatly aided by the Hindu-Arabic numeral system introduced to Europe around the fifteenth century. This number system made the sophisticated arithmetic of science possible. In addition, a wide variety of calculating tools were developed that stored information including the development of printing and the production of books of tables. These tools saved the scientist time and increased the accuracy of his calculations.

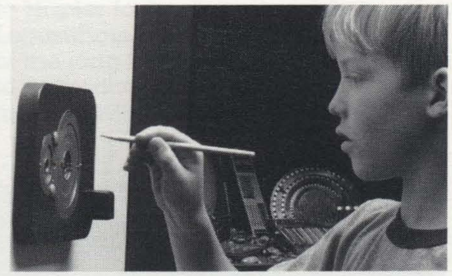
Napier's Bones were invented in 1617, when John Napier, a Scottish baron, published a book describing the device. Within a few years, it had spread throughout Europe and as far as China. Napier's Bones (so-called because they were often made of bone) were rods with multiplications tables on them. At the time, educated people often knew their multiplication tables only as far as 5 x 5.

The 18th century scientist/scholar/gentleman had a number of elegant devices that could be carried in the pocket and be the mark of a learned man. These include such items as (1) A pocket set of drawing instruments in an elegant shagreen and silver case would have been useful in producing a map of the heavens. From the collection of Gwen and Gordon Bell. (2) A portable sun dial, made in Augsburg, Germany, during the middle of the 18th century, was a precursor to the pocket watch, for telling the time of day. From the David Eugene Smith Collection, Rare Book and Manuscript Library, Columbia University. (3) An Arab astrolabe that could be used to determine the position of the stars and sun on any day of the year. The spikes on the top piece of brass represent the major stars and could be turned about the brass plate below it. The etching on the plate is a map of the heavens. Different plates are used depending upon the user's latitude. From the David Eugene Smith Collection, Rare Book and Manuscript Library, Columbia University. (4) Napier's Bones in its secure case. From the collection of Gwen and Gordon Bell.

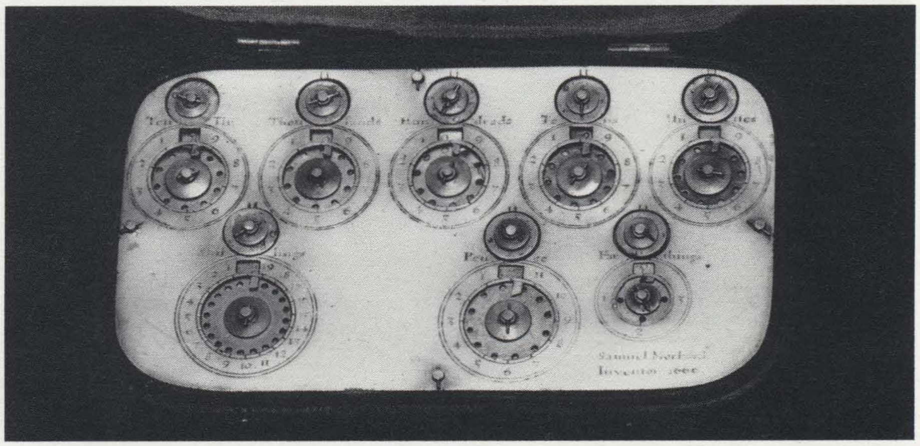


Napier's Bones were used for multiplication, division, and square and cube root problems. It was simple to arrange the rods to solve complicated problems. In the Museum's exhibit visitors utilize a super-sized model of the device.

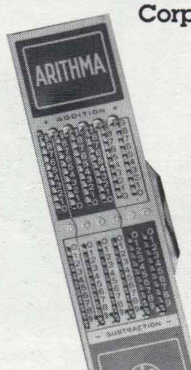




The Webb Adder was patented in the United States in 1869. Any two-digit number could be directly entered on the large gear with a stylus. When the large gear had made one complete revolution it advanced the smaller gear one place, thus "carrying" to the hundreds place. Gift of Gwen and Gordon Bell.



The oldest mechanical pocket calculator, designed by Englishman Samuel Morland (1625-1695) in 1666, avoided some of the mechanical problems that plagued the Pascaline. Morland did not link together the gears for different digits. Instead, each time a digit gear completed a full turn it advanced the small gear above it one place. At the end of a problem the small gears indicated how much to add (carry) to the next digit places. From the collection of the IBM Corporation.



The Addiator was a very inexpensive and widely-sold pocket calculator. Introduced in 1920, over 100,000 were sold the first year. The Addiator was not truly mechanical in operation. The user added by sliding either up or down strips of metal with numbers marked on them. No gears or inter-linked parts were involved. The basic idea was first invented in 1889 by a Frenchman named Troncet. Troncet called his calculator the Arithmographe. From the collection of Gwen and Gordon Bell.

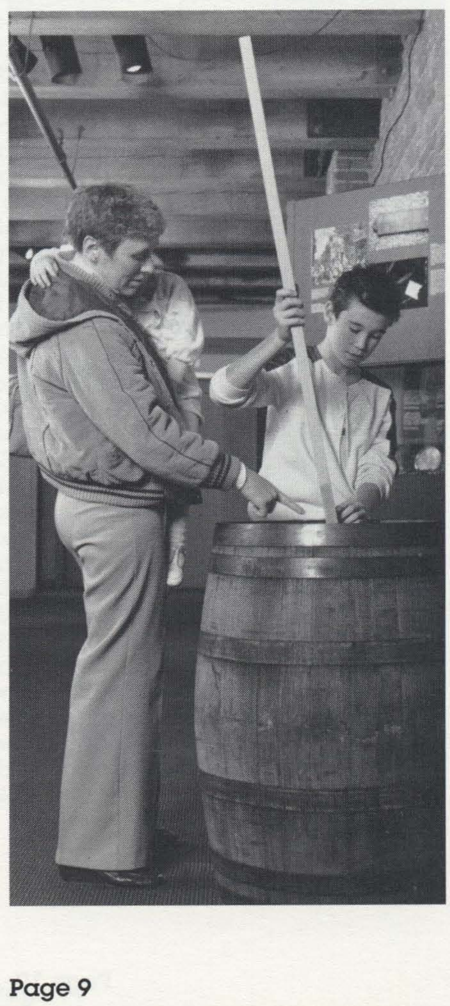
Digital Adders. Most mechanical adders use gears to "count." As you enter a number the machine "counts" the number of gear teeth that you advance. Calculating by counting is called digital calculation. The idea of using a stylus to advance gears to perform addition dates to 1642, when the French mathematician Blaise Pascal (1623-1662) invented a calculator called the Pascaline. Many mechanical calculators built for the pocket operated on similar principles.

The gears only went in one direction and the machines only held one register. Subtraction was carried out by 9's complement arithmetic, and multiplication by repeated addition. These were able to be widely produced for a very low cost and became the mechanical helper for many people.

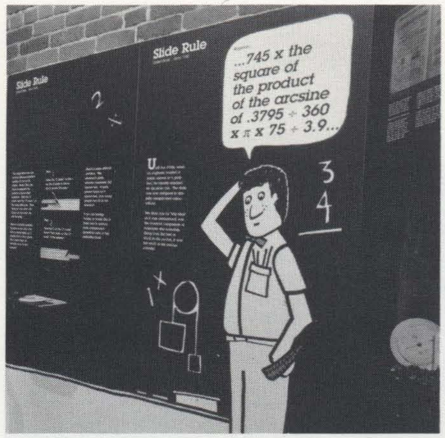
In the background of this etching by William Hogarth, a mob is attacking a tax assessor's office and tearing down its sign. The tax levied on alcohol was not very popular and it led to many political clashes. Its unpopularity was not just due to the tax, but to the precision of the devices for measuring the amounts and the inability to evade the assessor in the traditional ways.

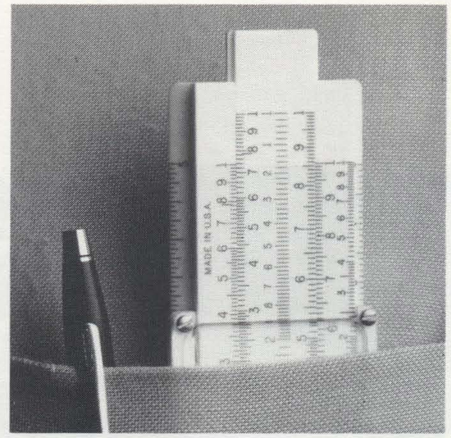
Slide Rules. Edmund Gunter (1581-1626) was the first to construct a scale rule that could be used to multiply. He divided his scale according to Napier's principle of logarithms, so that multiplication could be done by measuring and adding lengths on the scale. In about 1630 William Oughtred (c.1574-1660) improved upon Gunter's idea by fixing two rules together so they could slide against one another.

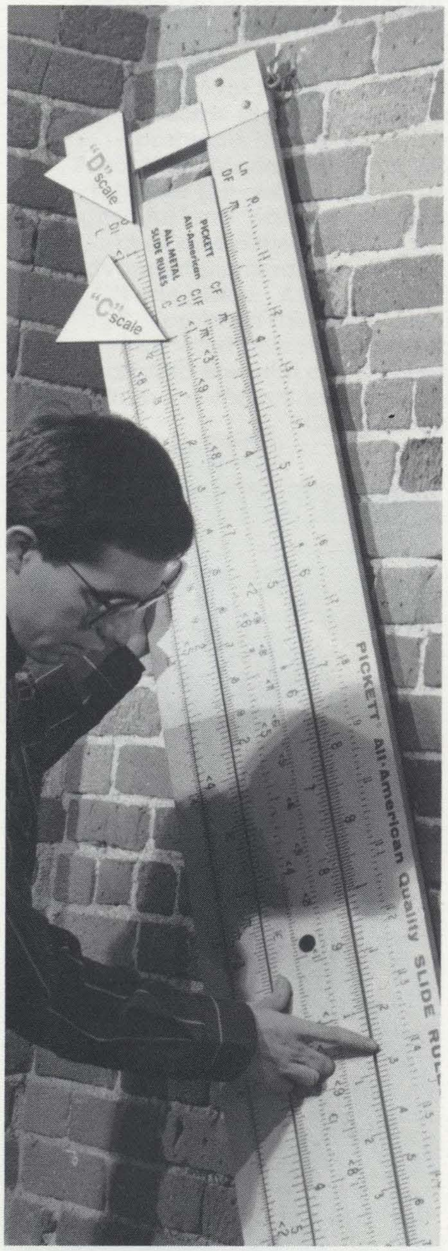
Slide rules were not the only widely used analog calculators. Quadrants evolved from instruments used for measuring angles between stars in ancient Babylonia. In the 16th century scales were etched on these devices which made them more useful to laymen as calculators. Gunter was one of those most responsible for the quadrant's improvement and use. Other popular analog calculators were the proportional compass and the sector.

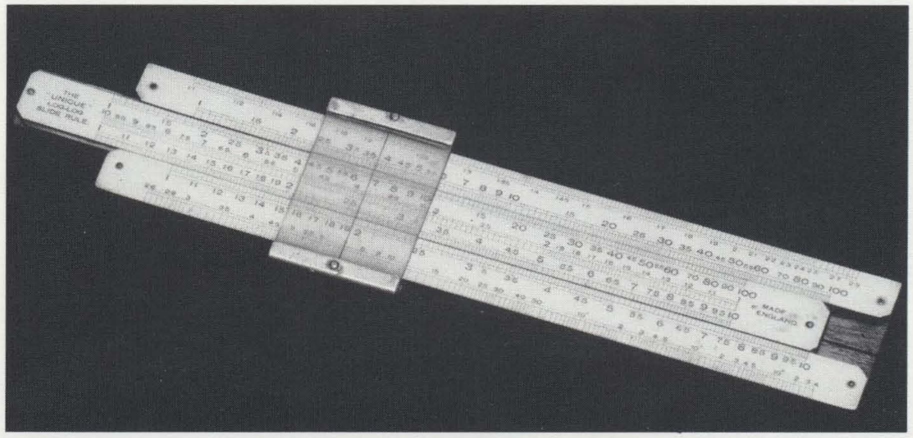


The "Unique Log-Log" slide rule, and the later Dietzgen Redirule are slide rules designed for the shirt pocket. In general, the shorter the slide rule, the less accurate it is. From the collection of Gwen and Gordon Bell. Gift of I. Bernard Cohen.







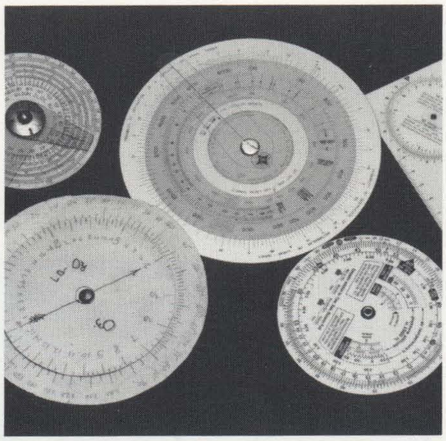


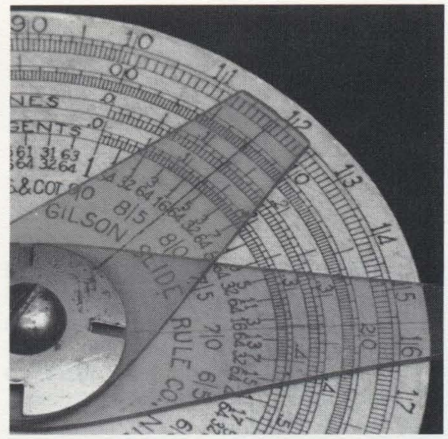
In the seventeenth century, the English government devised an efficient system for taxing ale and wine by producing a slide rule to help the assessors calculate the tax, right at the barrels. The alcohol tax was levied only on the amount that had been sold, and the slide rule allowed the assessor simply to determine the liquor that remained in the barrel. He used a gauging rod, like a dip stick in a car.

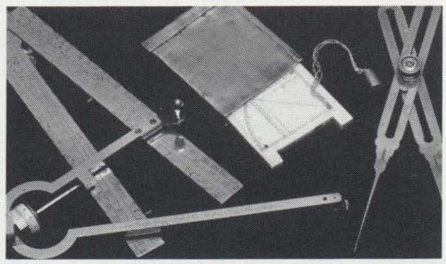
The first such slide rule was described in 1683 by Thomas Everard. In 1739 Charles Leadbetter improved upon the design by adding scales that could calculate the contents of a keg whether it was standing on end or lying on its side. The rule was used with a folding gauging rod to measure the depth of liquor in a keg. Sometimes tax assesors had their rule and gauging rode fit into a cane; not quite a pocket calculator but certainly of the same notion.

Slide rules were the work horse of scientific calculation for many decades. They were fast and reliable, and an experienced user could perform a long and complex calculation with ease.

Circular slide rules operated on the same principle as straight slide rules, but they took up less space. Both William Oughtred and his student Richard Delamain claim to have first thought of the circular slide rule. (1) A general circular slide rule. Gift of Stanton Vanderbilt. (2) This slide rule was used by pilots to estimate arrival times, and to calculate other aspects of their flight according to changing conditions.From the collection of Steve Kallis. (3) A bombardier would have used this slide rule to calculate the chances of destroying his target under various conditions. Gift of David Martz. (4) Harvard Project Physics circular slide rule could be slipped into a student's textbook. Gift of I. Bernard Cohen. (5) This homemade version made by Charles Bachman helped the family compare the price of goods at the grocery before the days of unit pricing. Gift of Charles Bachman.



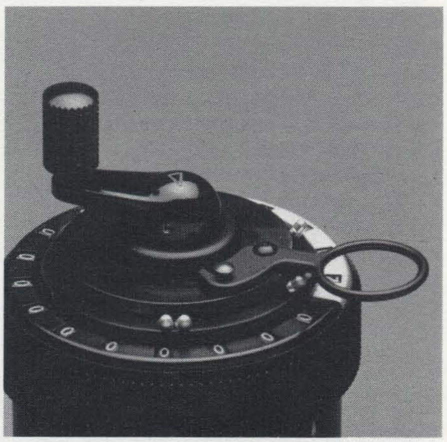




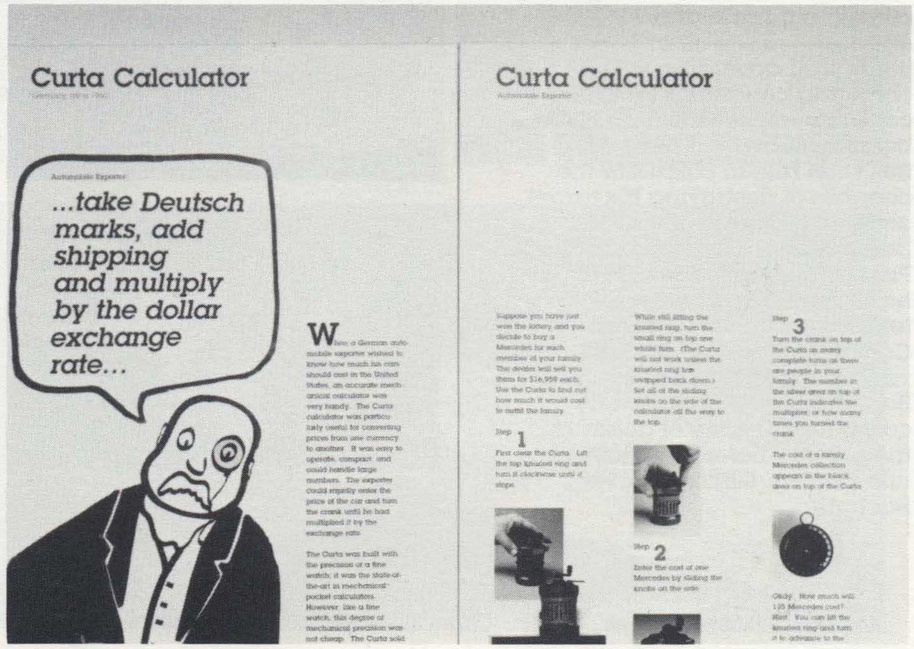
A variety of pocket-sized analog calculating objects developed for use by scientists and engineers with a wide variety of specialized products for different uses. (1) By tracing the outline of a curve, a planimeter can measure the area contained within even the most twisted curve. These pocket sized devices were often carried by airplane engineers to determine various surfaces. From the collection of Gwen and Gordon Bell. (2) An engineer could perform a wide variety of mathematical calculations by adjusting the position of the hinge and by measuring the distances along the scales marked on the arms of this sector. The sector evolved from a calculator invented by Galileo for use in aiming cannons. From the collection of Gwen and Gordon Bell. (3) This simple ivory quadrant was made in Italy during the early 19th century. It might have been used by an architect to perform calculations while on the site of a building. From the David Eugene Smith Collection, Rare Book and Manuscript Library, Columbia University. (4) By adjusting the position of the pivot nut on this proportional compass, architects and map makers could immediately change the scale of their drawings. If the nut was set at the line marked 2, then any line measured by the long points would be divided in half and represented by the distance between the short points. From the collection of Gwen and Gordon Bell

Slide rules had two drawbacks. First, slide rules were only as accurate as the fineness of their scales, because they were analog calculators and measured quantities. If the scale were any finer you could not read it. Notice how you have to estimate the position of a three-digit number on the scale. This degree of accuracy, however, was generally enough to estimate the answer to most scientific and engineering problems. Second, slide rules have no decimal points. The same mark can be read as 0.125, 1.25, 12.5, or 125. The user had either to keep track of the decimal point or to place it wherever it was reasonable when the problem was finished.

Until the 1970s, when an engineer wanted a quick answer to a problem, he usually reached for his slide rule. The slide rule was designed to simplify complicated calculations. Leather cases that could be clipped to the belt were often used by scientists to carry large slide rules with them wherever they went. The slide rule (or "slip stick" as it was nick-named) was the constant companion of engineers and scientists. Slung from the belt or stuck in the pocket, it was the mark of the serious scientist.



The Curta was invented by Curt Herzstark and manufactured in Liechtenstein starting about 1950. Each part was manufactured to a tolerance of .001 millimeter. Gift of Robert Brickford.



Mechanical Multiplying Calculators. In 1671, Leibniz conceived the idea of a multiplying machine by repeated addition, and constructed his earliest model in 1694. Since 1879 it has been preserved in the Royal Library at Hanover, where at one time Leibniz was the librarian. An important feature of the machine was the stepped wheel which is the basis for many subsequent mechanical calculators. Most of these are quite large and heavy, couldn't even think about being portable - not to mention fit into the pocket.

The Curta was the only multiplying, mechanical pocket calculator. Built with the precision of a fine watch, it took mechanical calculation to its finest development. However, like a fine watch, this degree of mechanical precision was not cheap. The Curta sold for close to $150 in the early 1960s. Like many of the fine pocket instruments of earlier days it became a symbol for the need for precise calculations and was closely associated with car rallying. Its manufacturing costs only increased and by the mid-1970s electronic calculators were faster, smaller, lighter, more powerful and less expensive than the Curta.

The Hewlett-Packard HP-35 was the first scientific pocket calculator. It could very quickly and accurately perform many of the slide rule functions that were too complicated for simple four-function calculators. It was nick-named the "electronic slide rule." Thanks to the speed of electronic circuits, the HP-35 could calculate the logarithm of a number at the push of a button. When introduced on February 1, 1972, the HP-35 cost $395.

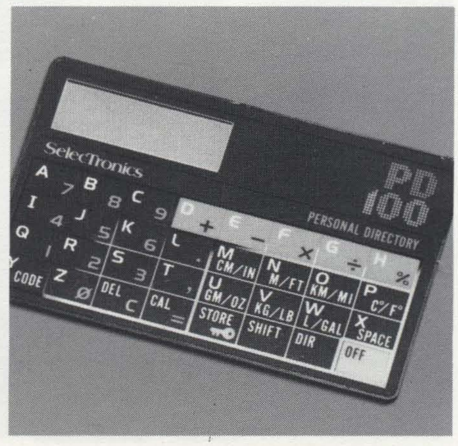
Prior to the first scientific calculator, the HP-35, finding the value of a function (such as the sine of an angle) meant looking it up in a table, or being satisfied with the limited accuracy of a slide rule. The HP-35 could instantly calculate the sine of an angle to ten decimal places. The same is true of other trigonometric functions and logarithms. Gift of the Hewlett-Packard Company

Electronic Calculators. By the mid-1970s electronic calculators reached the masses. The development of very small and cheap electronic circuits for computers during the late 1960s and early 1970s allowed small electronic calculators to be constructed and sold inexpensively. Over time, calculators became even more sophisticated, cheaper, and smaller.

Today electronic calculators can:

- store numbers and information like early pebble calculating systems and wax tablet records,
- add large numbers quickly like the abacus or Webb Adder,
- multiply rapidly like Napier's Bones, and the Curta,
- quickly find the values of mathematical functions like mathematical tables or slide rules,
- be programmed to perform complicated and lengthy calculations at the push of a button,
- perform whole new tasks such as translating languages and dialing phones.

This PD-100 is manufactured by SelecTronics and is only slightly thicker than a credit card. In addition to being a four function calculator that can convert directly into metric quantities, it can store up to 2,040 characters of text in a filing system, enough for up to 100 addresses. Gift of SelecTronics, Incorporated.



The Bowmar 901B, manufactured by the Bowmar Instrument Corporation and seen here in a version sold by Craig, was the first pocket-sized electronic calculator. Introduced at the end of 1971, the 901B could add, subtract, multiply and divide eight-digit numbers. It cost $249.95. Gift of the Bowmar Instrument Company.

The Texas Instrument Corporation, which manufactured the circuits used in the Bowmar 901B, soon entered the market of pocket calculators. This 2500 Datamath is one of Texas Instruments's earliest electronic calculators. Texas Instruments is a large producer of calculators to this day. Gift of Ian Gunn.

Introduced in 1973, the Sharp EL-805 was one of the first calculators to use a Liquid Crystal Display (LCD). This substantially prolonged the life of its battery. Gift of Sharp Electronics Corporation.

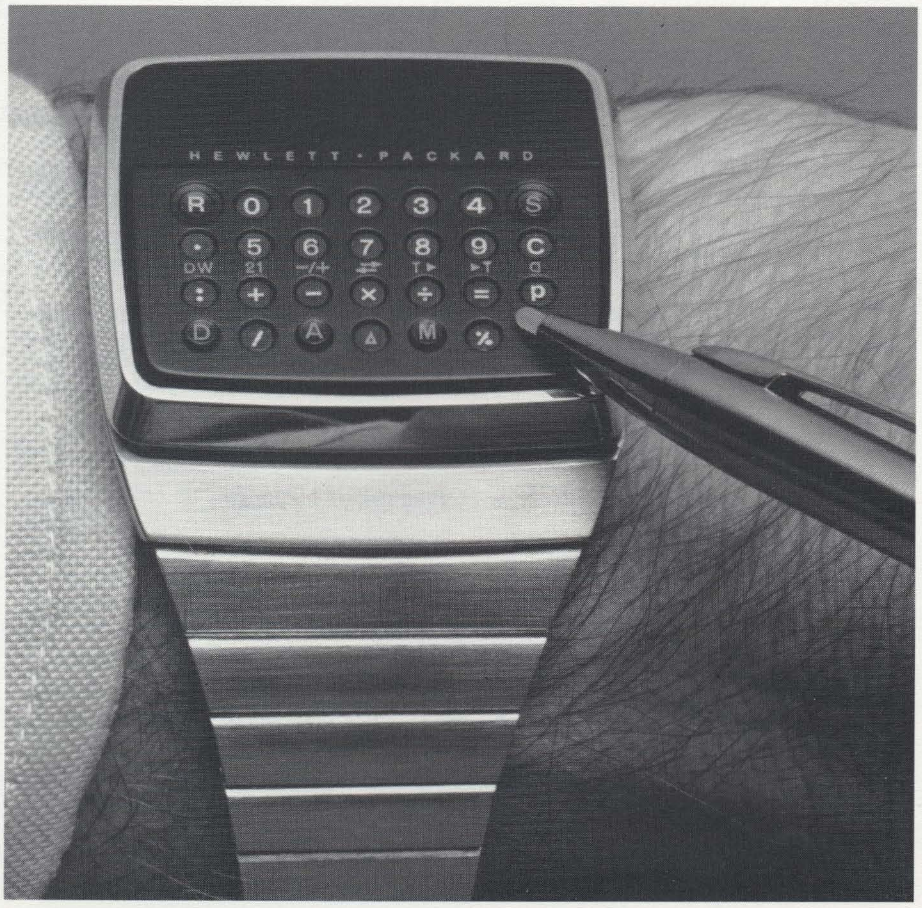
The Hewlett-Packard HP-65 was the first pocket calculator that could read programs off magnetic cards. Programmability allowed the HP-65 to quickly perform a very long series of calculations without the user pressing many keys. This improved the power and convenience of the pocket calculator. When introduced in 1974 the HP-65 cost $795. Gift of Darwin Smith.

Early pocket calculators could only add, subtract, multiply, and divide. However, they offered speed and accuracy over most previous pocket calculators. The first electronic calculators were not cheap: the Bowmar 901B when introduced in 1971 sold for close to $250. Within five years similar calculators sold for one-tenth as much, and far more powerful calculators were also available.

Some of the earliest aids to calculation were little more than means of recording quantities. Today micro-electronic circuits allow us to store large amounts of information in our pocket.

The Sharp EL-5500 III is a hand-held computer as powerful as many of the first desk-top personal computers. Designed for scientific uses, the EL-5500 III can be programmed in the computer language BASIC. Gift of Sharp Electronics Corportion.

The SL-800 Film-Card announced by Casio in 1983 was the first calculator to be truly the size of a credit card. It sold for less than $20. The SL-800 contains no moving parts. A fully automated factory produces an SL-800 in only 2.8 seconds. Gift of Casio Incorporated.



The watch calculator is even more convenient than one in the pocket. In 1977, the first wrist watch calculator, the HP-01, came with a special pen to press its buttons and cost $650. Only three years later, in 1980, Casio introduced its first watch calculator, the C-80 . Today, wrist watch calculators are common, and many can store large amounts of information. From the collection of the Hewlett-Packard Company and from the collection of Casio Incorporated.

The Computer Museum in Tokyo

In August 1986, The Computer Museum participated in a 10,000 square foot exhibit called "Computer Wonderland" in the Seibu Department Store. In this single month over 400,000 people saw the exhibition starting with the Pascaline and going to the latest, hottest computer game.

The Museum provided the first section of the exhibition, including the Hollerith Machine for the 1890 Census, a Whirlwind and Sage exhibit, the Altair, the classic PDP-8, and other artifacts.

The evolution of computer games was one of the major features of the exhibition. This started with the Museum's re-creation of SpaceWar! on the Macintosh and ended with a space game in which the player was encapsulated.

On two Friday evenings in the US (Saturday morning Tokyo time), Compuserve provided a free interactive satelite link between the Museum and the Department store. At the Museum, students from a computer camp conversed directly with young visitors in Tokyo via computer. The conversation quickly changed from their favorite computer programs to their favorite rock music.

Gwen Bell, who went over for the opening, observed that personal computers are not yet used as an educational and learning tool by most Japanese children, but primarily as a source of entertainment.

The exhibit was cosponsored by Dentsu, The Asahi Shinbun, ASCII and Seibu Department Store. Educational events for Tokyo's youth are jointly sponsored during the August school vacation, providing alternative learning environments within a commercial setting.

Artificial Intelligence and Robots

A new major exhibition

The exhibit, opening in June 1987, will be the first to display both state-of-the-art technology and the history and key artifacts of artificial intelligence and robotics. It is planned to make a significant contribution to the education and inspiration of the public in the realm of AI and robotics.

Your participation in this project in the form of ideas, hardware, software and effort is invited. Donations have been made by Carnegie Mellon University, Denning Mobile Robotics, Dragon, Hewlett Packard, Infomart, MIT, Stanford University, SRI International, SUN, Symbolics, Symantec, Texas Instruments, and Xerox, but much is still left to be accomplished.

Ideas, equipment, programs, artifacts, and hardware are needed to illustrate:

- Giving senses to machines;
- Robots and their evolution in fact and fiction;
- Expert systems;
- Game-playing;
- Natural language;
- AI Techniques; and
- Classic Machine Feats of Problem Solving!

Call or write Oliver Strimpel or Leah Hutten at The Computer Museum. And mark June 25th on your Calendar for the opening. *Your Participation is Invited!*

Software Archive Study

A planning study for a software archive, funded by Mitchell Kapor, is being undertaken by David Bearman President, Archives, Libraries and Museum Services Inc., Pittsburgh. This study, to be completed in June 1987, will lead to the inauguration of a software archive at the Museum.

The planning study will focus on the following issues:

- The criteria to identify the important events in the history of software and their application to a collection strategy;
- The constitution of an adequate record of software and its proper retention;
- The kinds of research that might be supported by the software archive;
- The relation between software and hardware ;
- The legal constraints, financial liabilities, physical budgets, and conceptual barriers to establishing a software archive.

This project will be reviewed by a panel including, Paulyn Heinmiller, Lotus Development Corporation, Professor Michael Mahoney, Princeton University, Arthur Mollela, The Smithsonian Institution, Arthur Norberg, The Charles Babbage Institute, and Helen Samuels, MIT Archives.

Members are invited to submit comments to David Bearman at The Computer Museum.

Calendar *Winter/Spring 1987*

Sundays at 4pm

January 25	**Harold Cohen** *How to draw three people in a botanical garden: An Artificial Intelligence Program for Drawing*
February 15	**Washington's Birthday Weekend** *Design and print your own fractal snowflake*
21-22	**All Day: Kid's Computer Fair** *Explore and experiment with new personal computer software for family education and entertainment.*
March 8	**Marc Raibert** *Creating Legged Robots that Run*
15	**25th Anniversary of SpaceWar! The first interactive computer game** *Challenge the originators on the PDP-1*
22	**SIGGRAPH '86-Part 1** *Boston Public Premier of the new computer - generated animation and graphics*
29	**SIGGRAPH '86-Part 2** *Boston Public Premier of the new computer - generated animation and graphics*
April 11-12	**Museum Goers Month:** *Celebrate families from Whirlwind to the present; tours and handouts.*

COMING EVENTS

May A Spring Computer Circus and Auction

Talk by Jean Louis Gasse, Apple Computer

June Opening of the Artificial Intelligence and Robotics Exhibition

YES! I want to become a Member of The Computer Museum.

- [ ] **$20 Student**
- [ ] **$30 Individual**
- [ ] **$ 45 Family**
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Members receive free admission for one full year, invitations to exhibit previews, advance notice of exhibitiions and lectures, invitations to members-only events, a subscription to our exciting quarterly magazine, The Computer Museum Report, and a 10% discount in the Museum Store.

Enclosed is my check ,made payable to **The Computer Museum** for $ ____________

or charge to: [ ] VISA [ ] MasterCard [ ] American Express

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Membership contributions are an important part of the funds that support the daily operations of the Museum. These contributions are tax-deductible to the extent provided by the law.
The Computer Museum, 300 Congress Street, Boston, MA 02210

The Computer Museum

The Computer Museum is a non-profit 501(c)3 foundation that chronicles the evolution of information processing through exhibitions, archives, publications, research and programs.

Museum Hours: *Summer:* Open daily 10–6, Friday 10-9. *Winter:* Open Tuesday–Sunday 10-6, Friday 10-9. Open Mondays during Boston school vacation weeks, 10-6. Closed Thanksgiving, Christmas, and New Years Day. Hours are subject to change.

Membership All members receive a membership card, free subscription to the Computer Museum Report, a 10% discount on merchandise from the Computer Museum Store, free admission and invitations to Museum previews. For more information contact Membership Coordinator at the Computer Museum, 300 Congress Street, Boston, MA 02210. Telephone (617) 426-2800.

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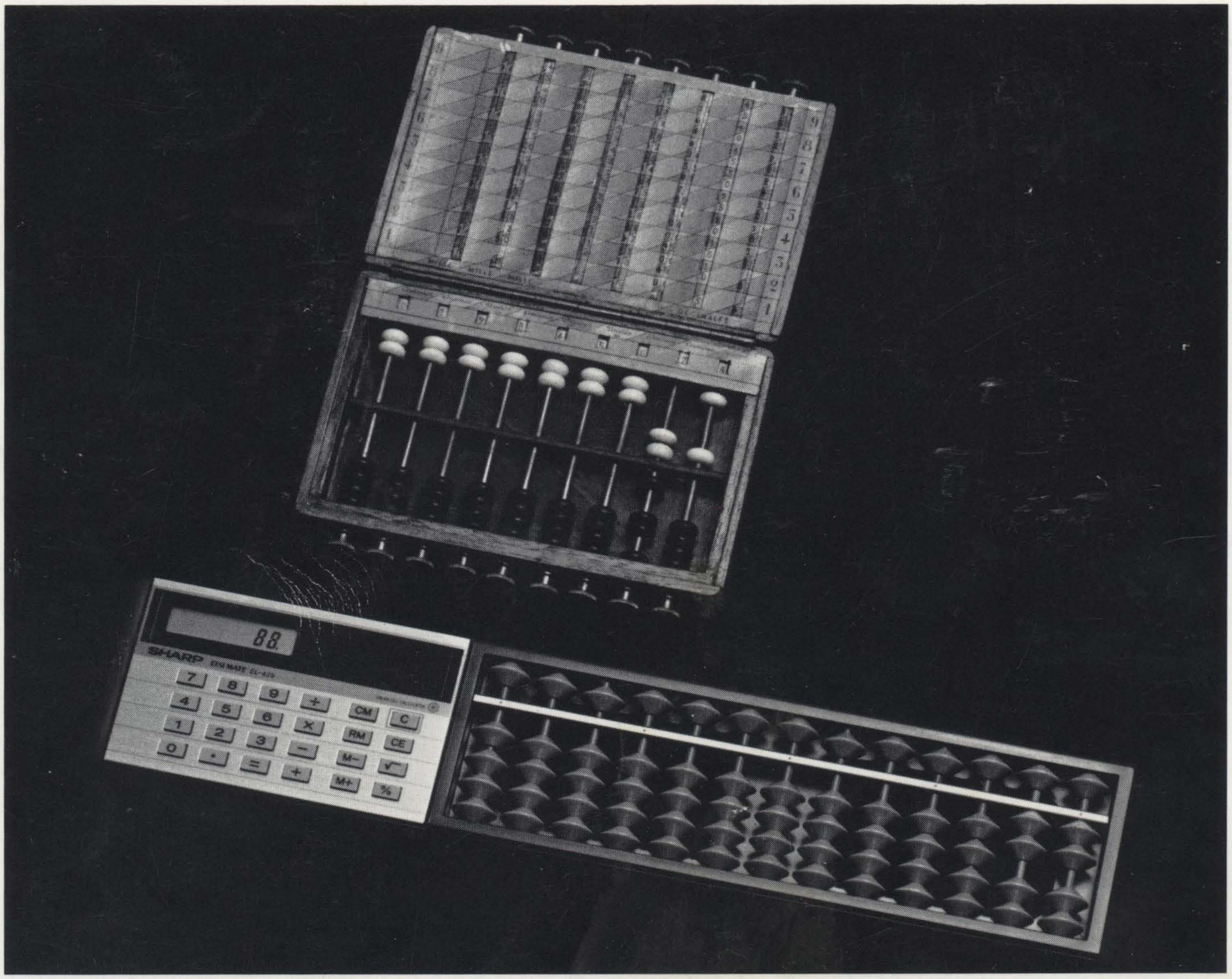
The End Bit 0000000000000001

East meets West. The tradition of dual processors extends back to this French pocket calculator, circa 1800, that combines a set of Napier's Rods (not bones) and an abacus. The abacus could be used to add up the multiplications read from the rods. From the collection of the IBM Corporation. The Sharp EL-429 combines a traditional soroban with a modern, solar-powered electronic calculator. Gift of Sharp Electronics Corporation.



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