Steve Jobs, Bill Gates, and the PC
and
Course Review

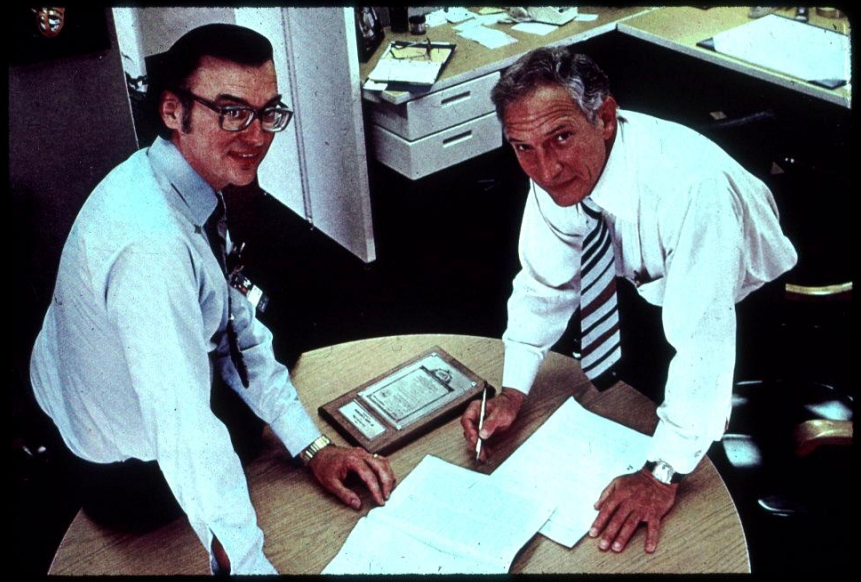
Radical Innovation and the Transformation of Daily Life

CEE 102: Prof. Michael G. Littman
Course Administrator: Jack Reilly jpr2@princeton.edu

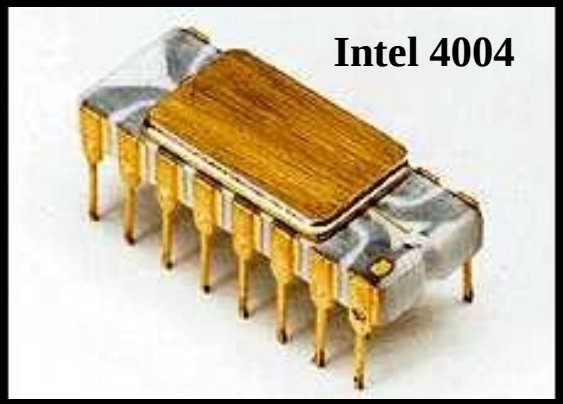
Computers for NOTETAKING ONLY
Please - NO Cell Phones, texting, email, shopping

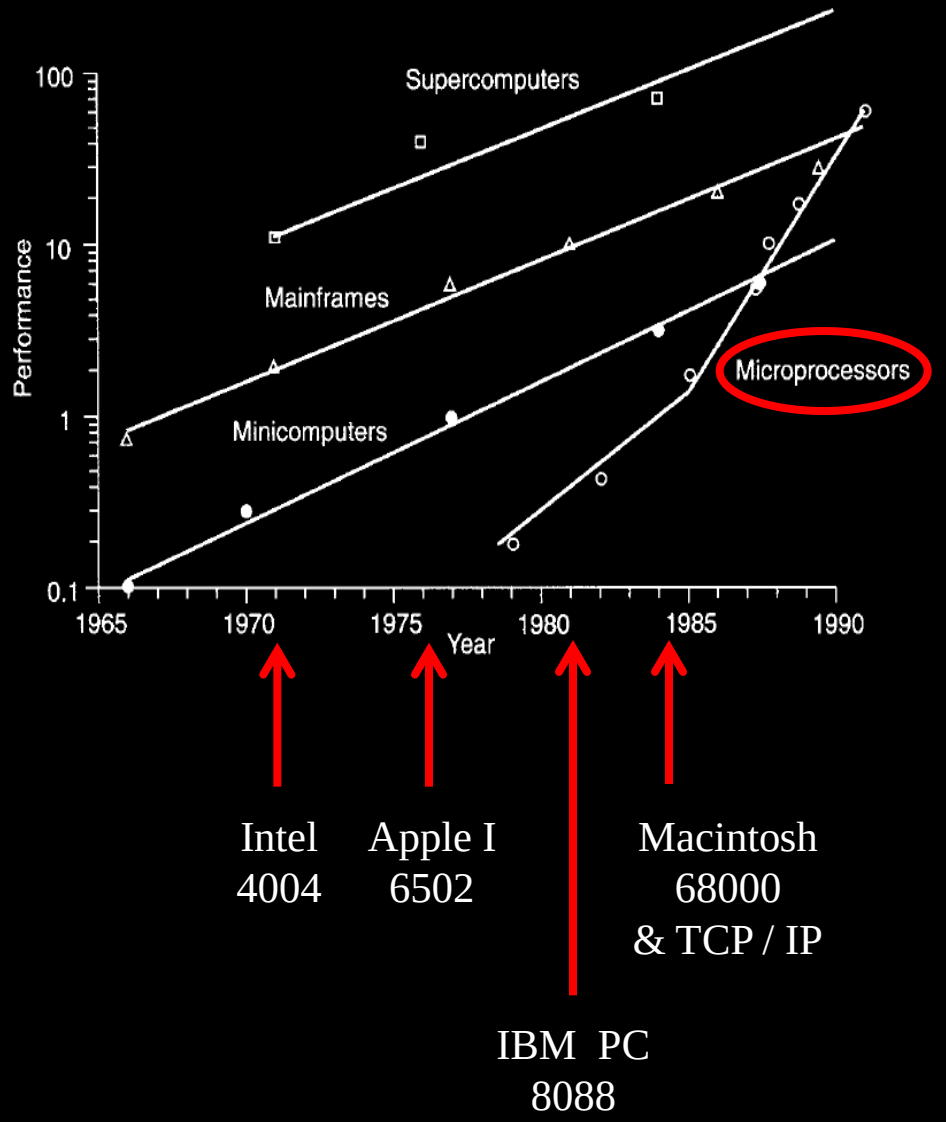
Components of Innovation

Inventor and Entrepreneur



Noyce and Hoff – 4 bit Microcomputer





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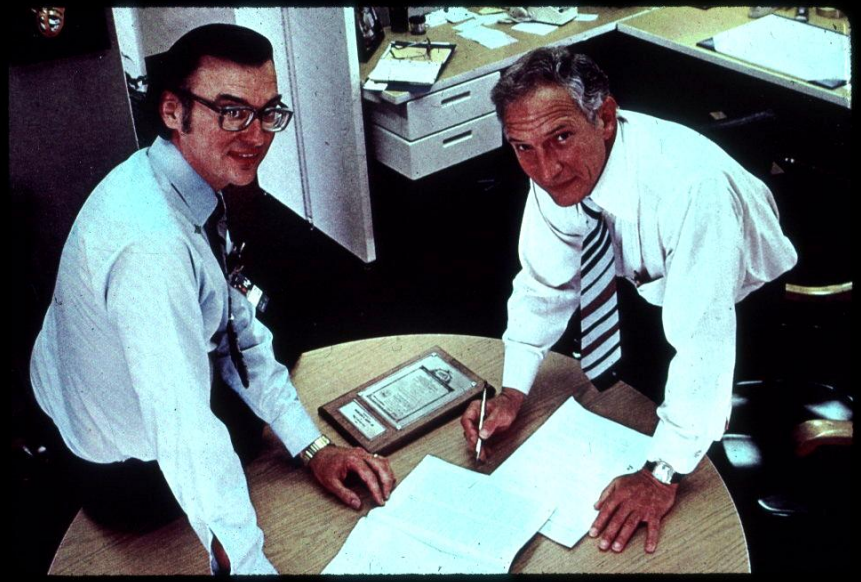

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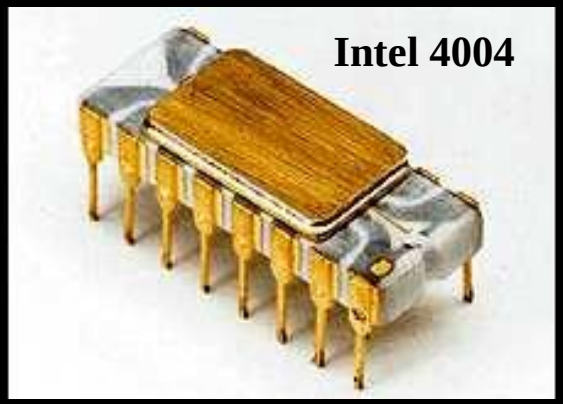

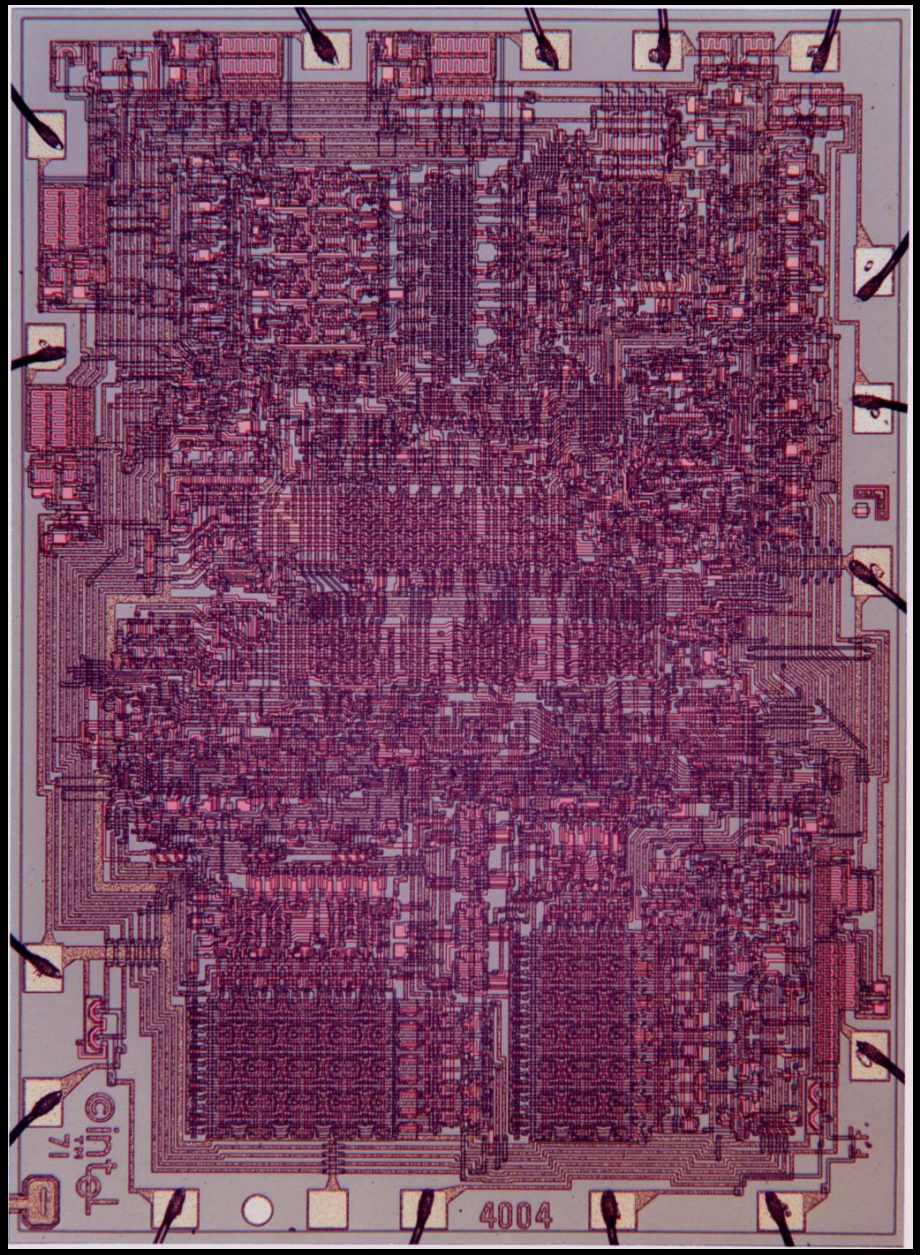

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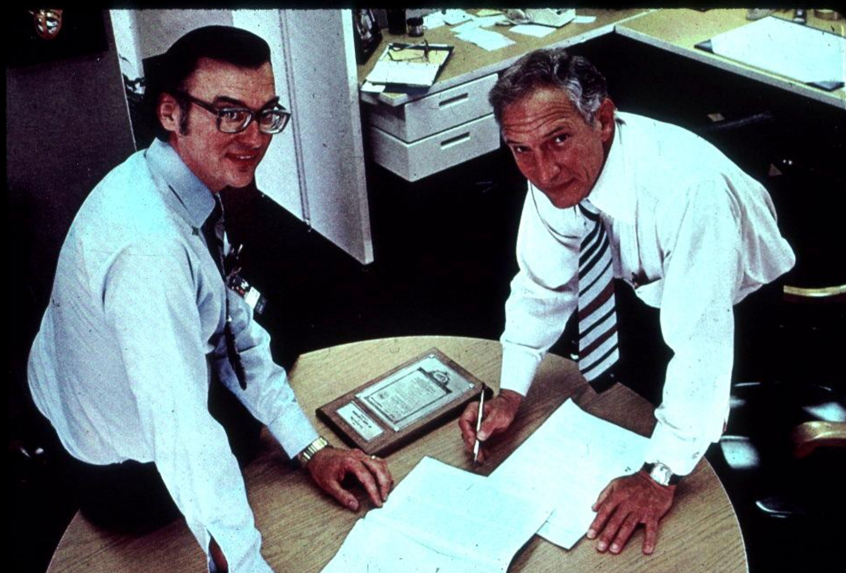

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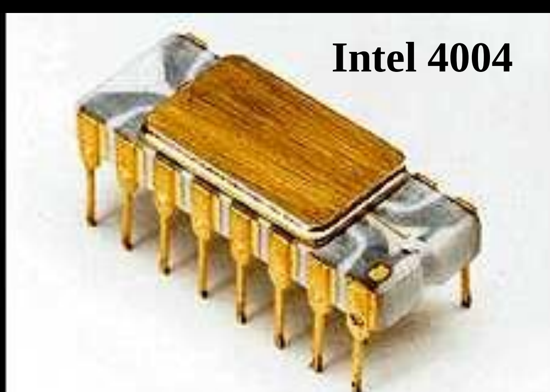

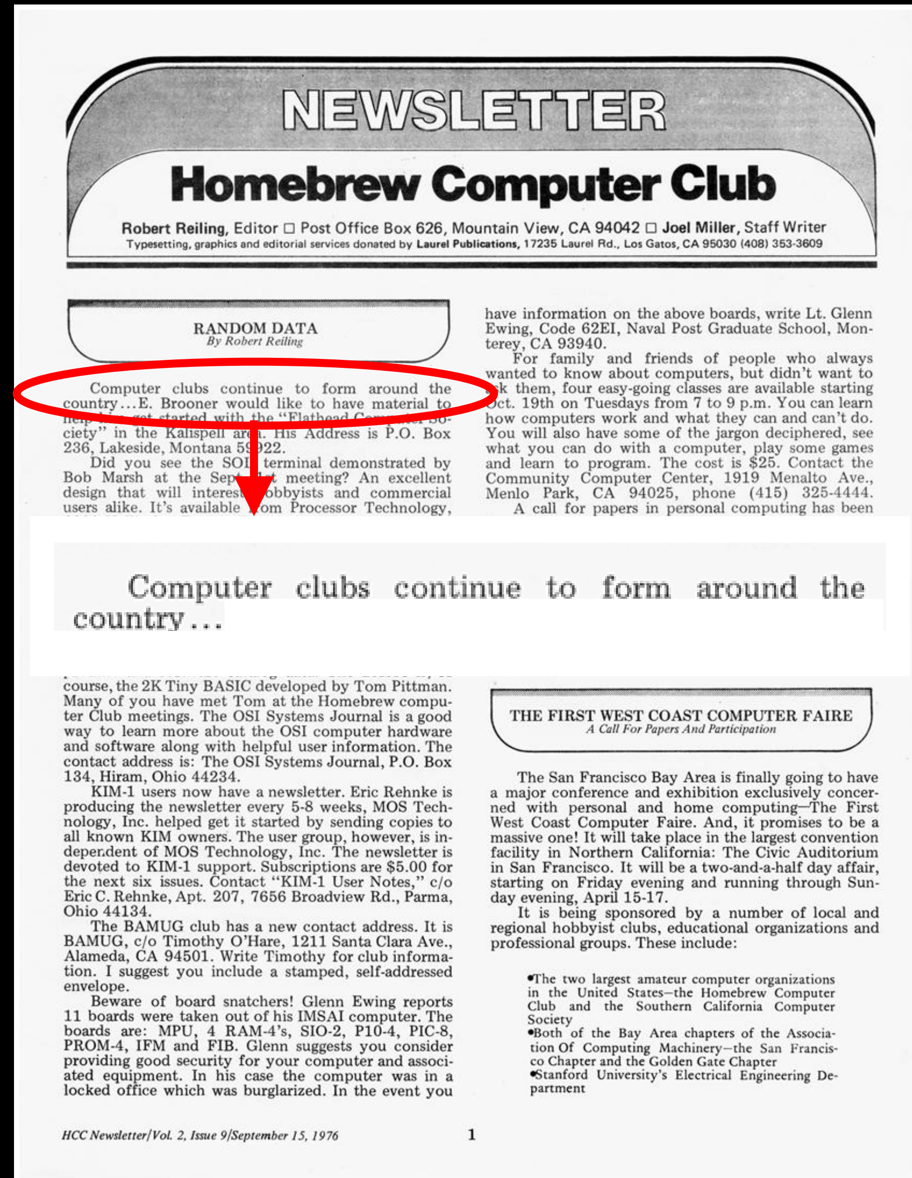

NEWSLETTER

Homebrew Computer Club

Robert Reiling, Editor □ Post Office Box 626, Mountain View, CA 94042 □ **Joel Miller**, Staff Writer

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For family and friends of people who always wanted to know about computers, but didn't want to ask them, four easy-going classes are available starting Oct. 19th on Tuesdays from 7 to 9 p.m. You can learn how computers work and what they can and can't do. You will also have some of the jargon deciphered, see what you can do with a computer, play some games and learn to program. The cost is $25. Contact the Community Computer Center, 1919 Menalto Ave., Menlo Park, CA 94025, phone (415) 325-4444.

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THE FIRST WEST COAST COMPUTER FAIRE

A Call For Papers And Participation

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Homebrew Computer Club

Silicon Valley 1975

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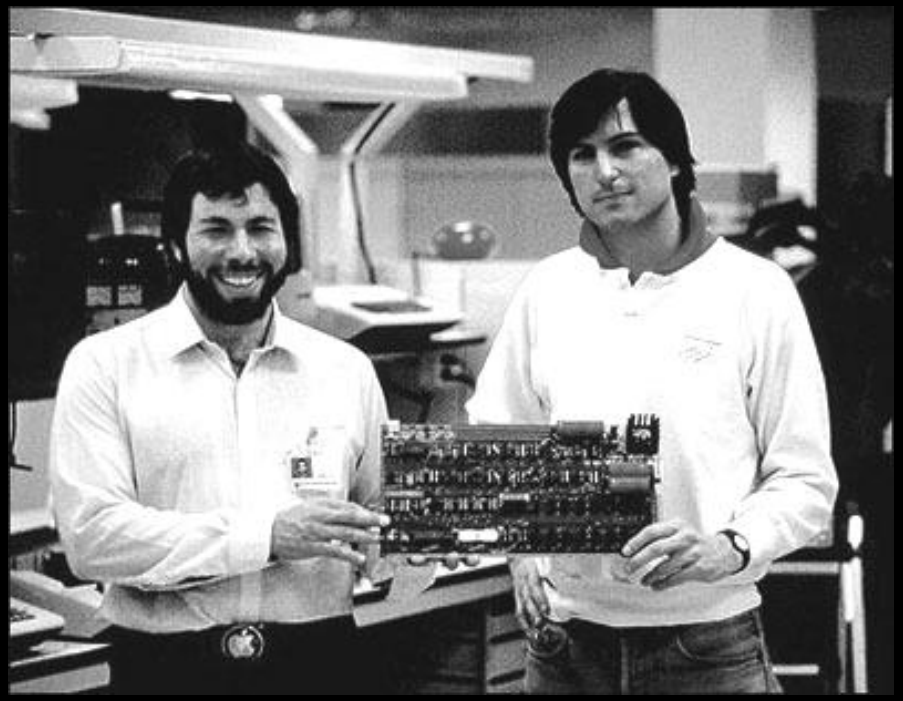

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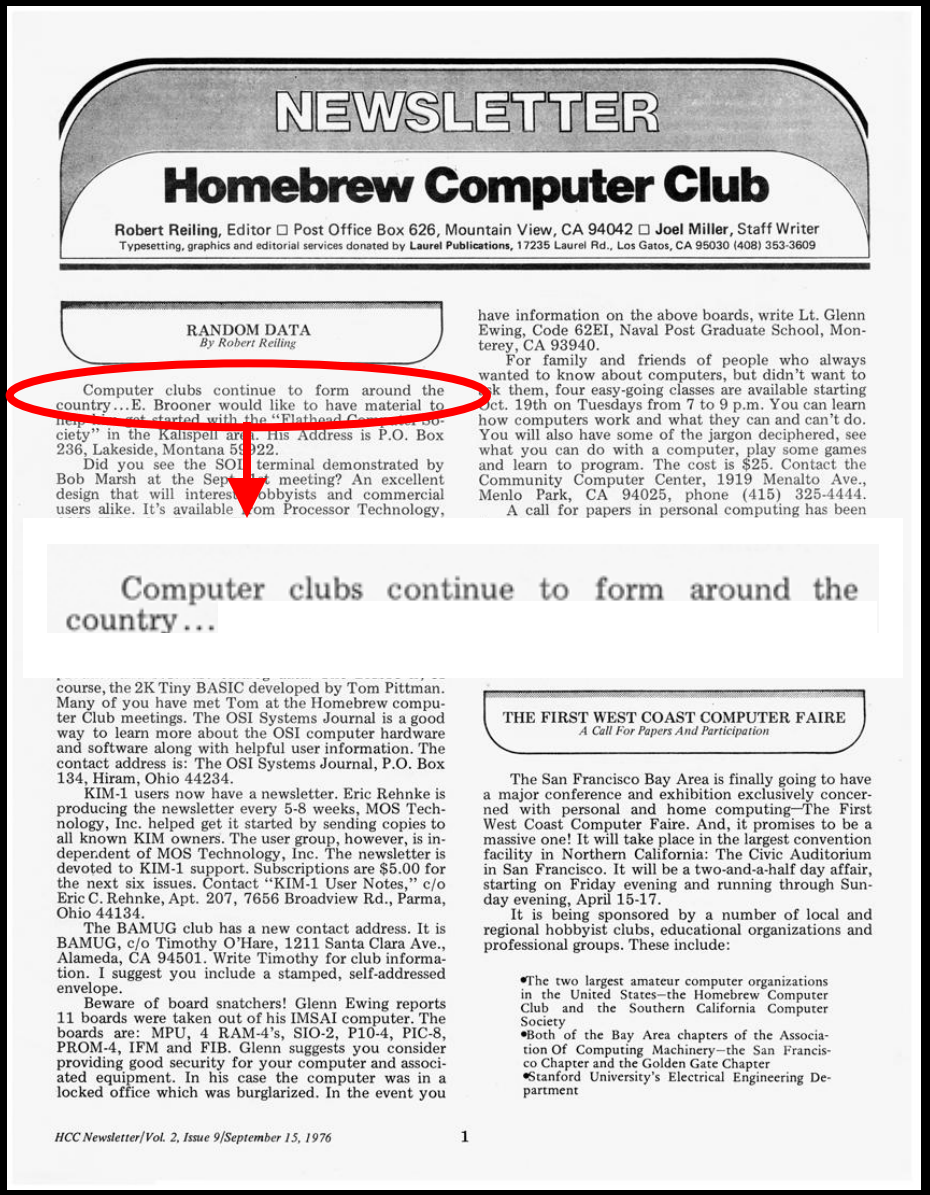

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HCC Newsletter/Vol. 2, Issue 9/September 15, 1976 1

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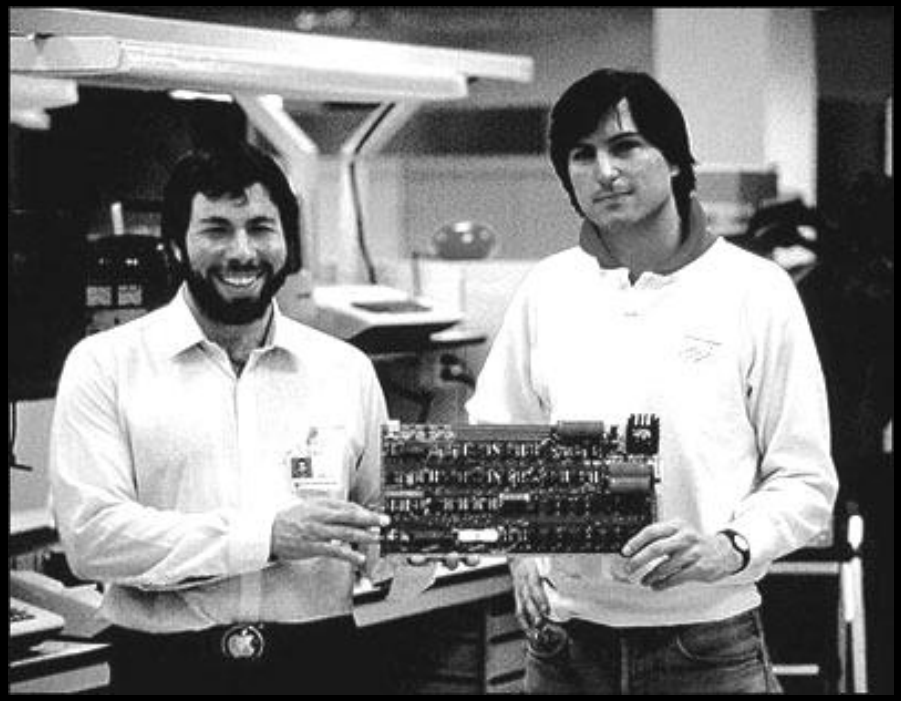

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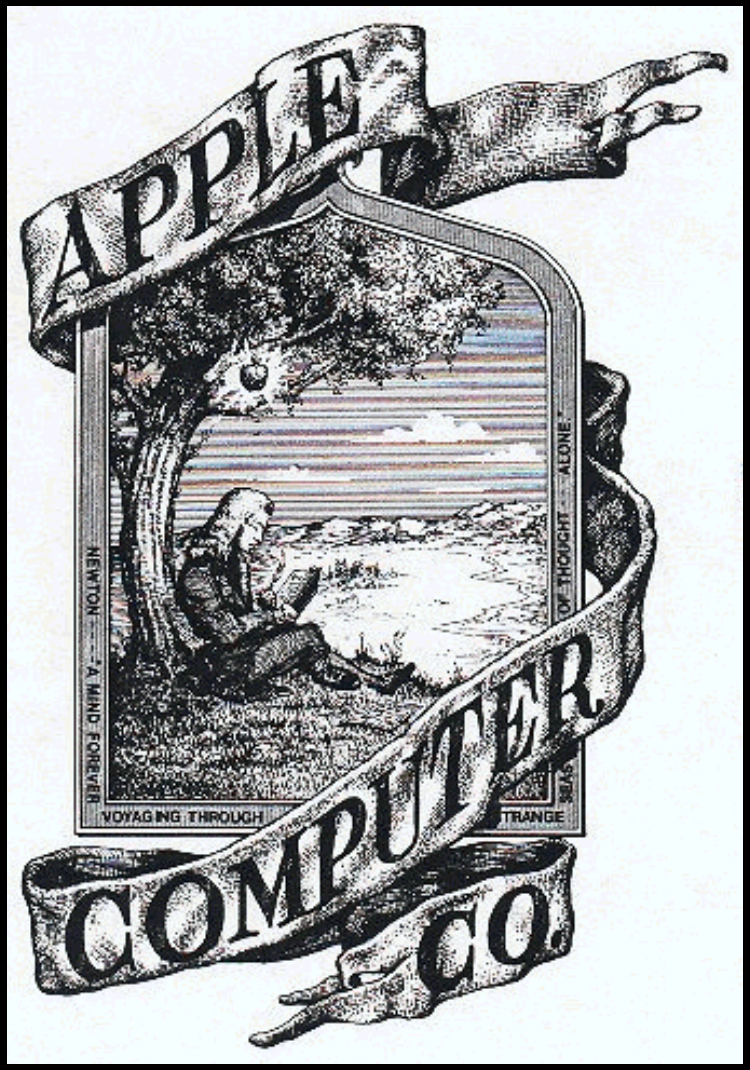
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NEWTON —— "A MIND FOREVER
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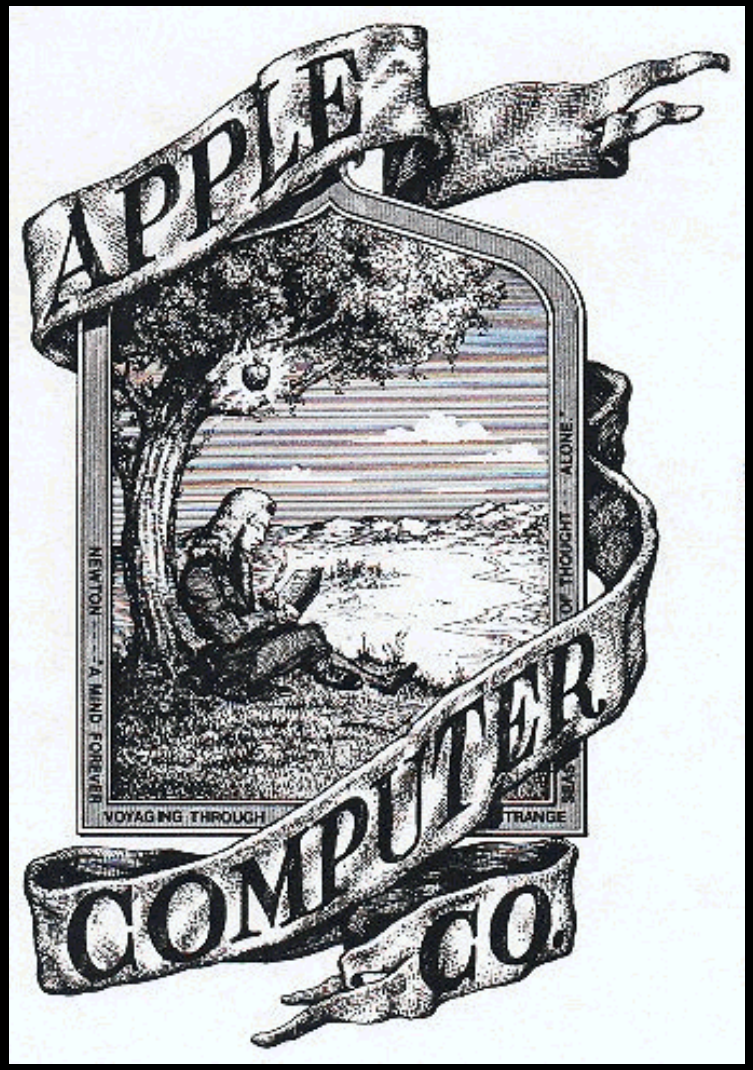


Think different.

Apple Introduces the First Low Cost Microcomputer System with a Video Terminal and 8K Bytes of RAM on a Single PC Card.

The Apple Computer. A truly complete microcomputer system on a single PC board. Based on the MOS Technology 6502 microprocessor, the Apple also has a built-in video terminal and sockets for 8K bytes of on-board RAM memory. With the addition of a keyboard and video monitor, you'll have an extremely powerful computer system that can be used for anything from developing programs to playing games or running BASIC.

Combining the computer, video terminal and dynamic memory on a single board has resulted in a large reduction in chip count, which means more reliability and lowered cost. Since the Apple comes fully assembled, tested & burned-in and has a complete power supply on-board, initial set-up is essentially "hassle free" and you can be running within minutes. At $666.66 (including 4K bytes RAM!) it opens many new possibilities for users and systems manufacturers.

You Don't Need an Expensive Teletype.

Using the built-in video terminal and keyboard interface, you avoid all the expense, noise and maintenance associated with a teletype. And the Apple video terminal is six times faster than a teletype, which means more throughput and less waiting. The Apple connects directly to a video monitor (or home TV with an inexpensive RF modulator) and displays 960 easy to read characters in 24 rows of 40 characters per line with automatic scrolling. The video display section contains its own 1K bytes of memory, so all the RAM memory is available for user programs. And the Keyboard Interface lets you use almost any ASCII-encoded keyboard.

The Apple Computer makes it possible for many people with limited budgets to step up to a video terminal as an I/O device for their computer.

No More Switches, No More Lights.

Compared to switches and LED's, a video terminal can display vast amounts of information simultaneously. The Apple video terminal can display the contents of 192 memory locations at once on the screen. And the firmware in PROMS enables you to enter, display and debug programs (all in hex) from the keyboard, rendering a front panel unnecessary. The firmware also allows your programs to print characters on the display, and since you'll be looking at letters and numbers instead of just LED's, the door is open to all kinds of alphanumeric software (i.e., Games and BASIC).

8K Bytes RAM in 16 Chips!

The Apple Computer uses the new 16-pin 4K dynamic memory chips. They are faster and take ¼ the space and power of even the low power 2102's (the memory chip that everyone else uses). That means 8K bytes in sixteen chips. It also means no more 28 amp power supplies.

The system is fully expandable to 65K via an edge connector which carries both the address and data busses, power supplies and all timing signals. All dynamic memory refreshing for both on and off-board memory is done automatically. Also, the Apple Computer can be upgraded to use the 16K chips when they become available. That's 32K bytes on-board RAM in 16 IC's—the equivalent of 256 2102's!

A Little Cassette Board That Works!

Unlike many other cassette boards on the marketplace, ours works every time. It plugs directly into the upright connector on the main board and stands only 2" tall. And since it is very fast (1500 bits per second), you can read or write 4K bytes in about 20 seconds. All timing is done in software, which results in crystal-controlled accuracy and uniformity from unit to unit.

Unlike some other cassette interfaces which require an expensive tape recorder, the Apple Cassette Interface works reliably with almost any audio-grade cassette recorder.

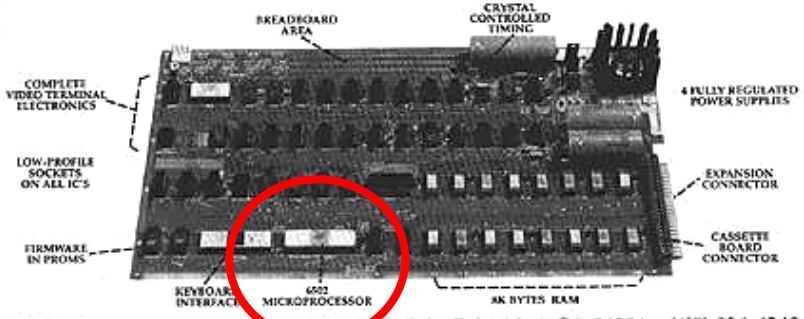
Software:

A tape of **APPLE BASIC** is included free with the Cassette Interface. Apple Basic features immediate error messages and fast execution, and lets you program in a higher level language immediately and without added cost. Also available **now** are a dis-assembler and many games, with many software packages, (including a macro assembler) in the works. And since our philosophy is to provide software for our machines free or at minimal cost, you won't be continually paying for access to this growing software library.

The Apple Computer is in stock at almost all major computer stores. (If your local computer store doesn't carry our products, encourage them or write us direct). **Dealer inquiries invited.**

Byte into an Apple $666.66*

*Includes 4K bytes RAM



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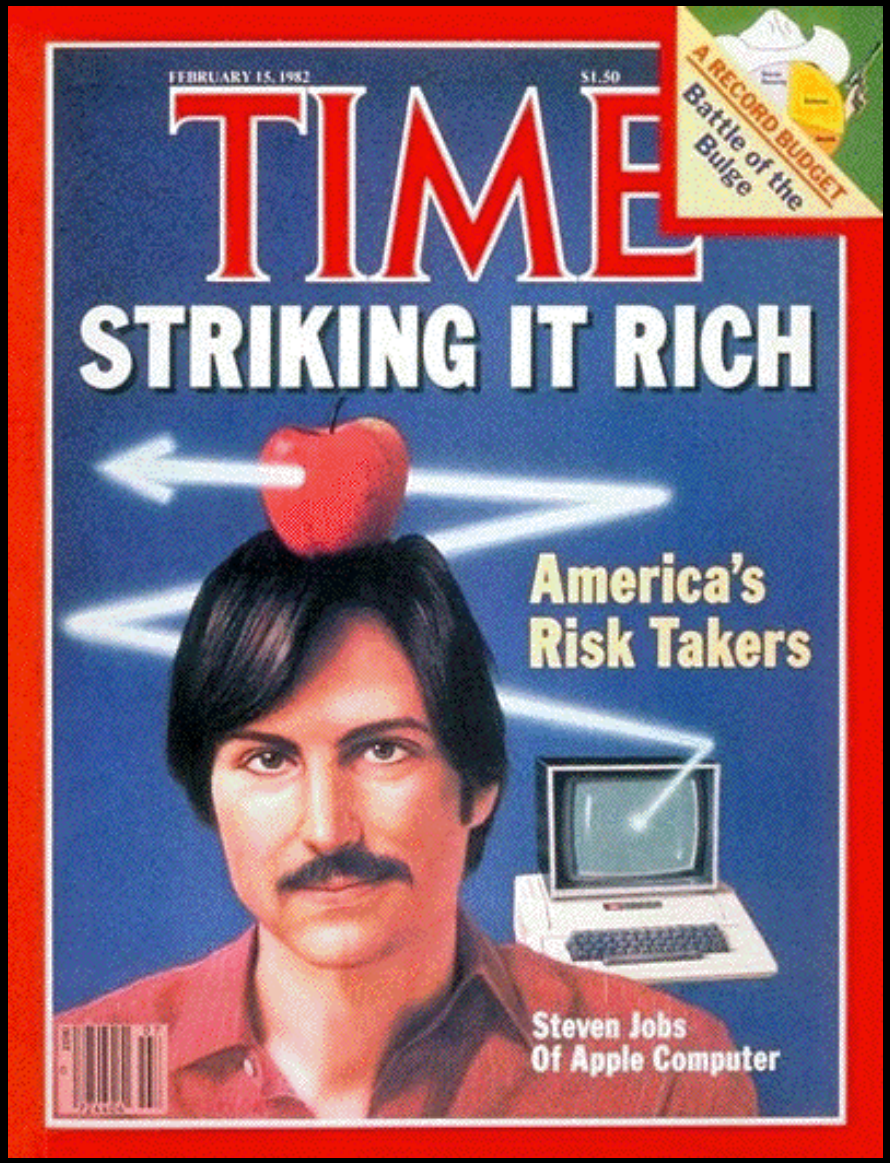
Think different.



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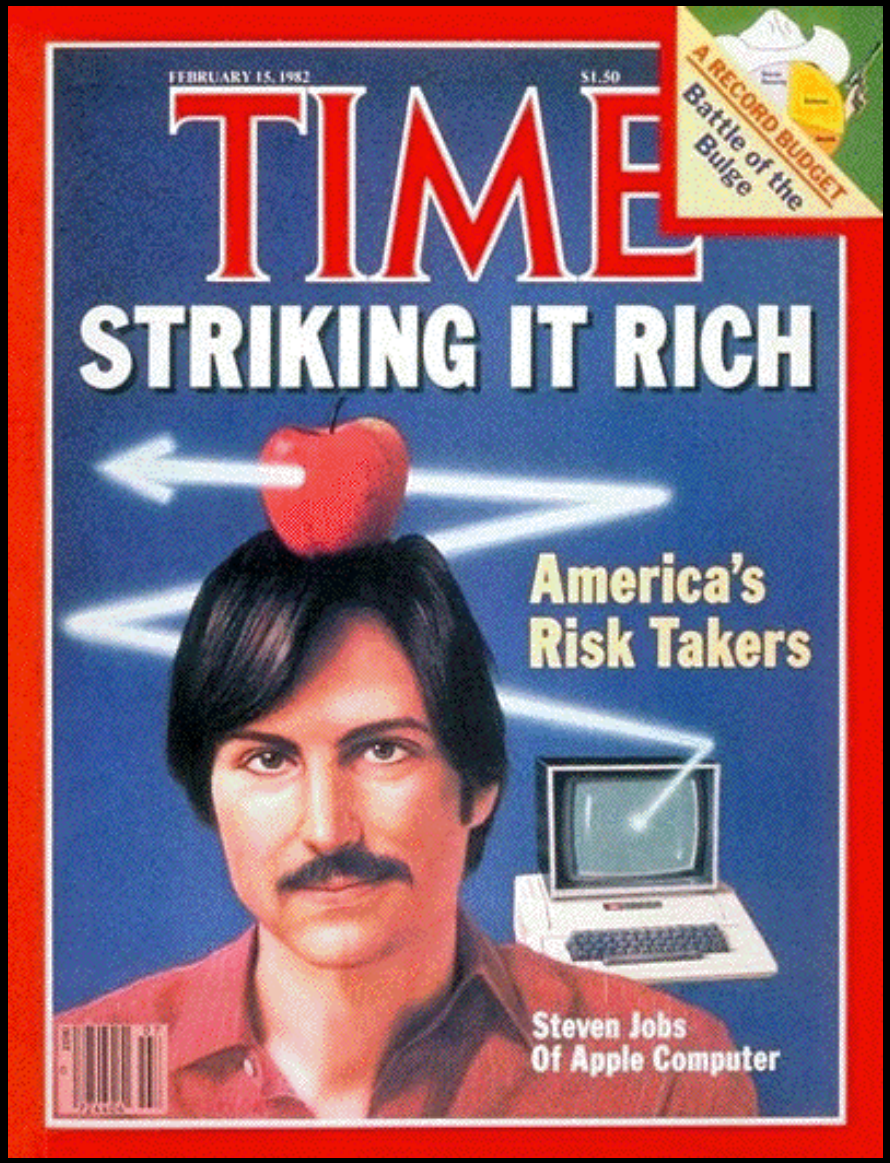
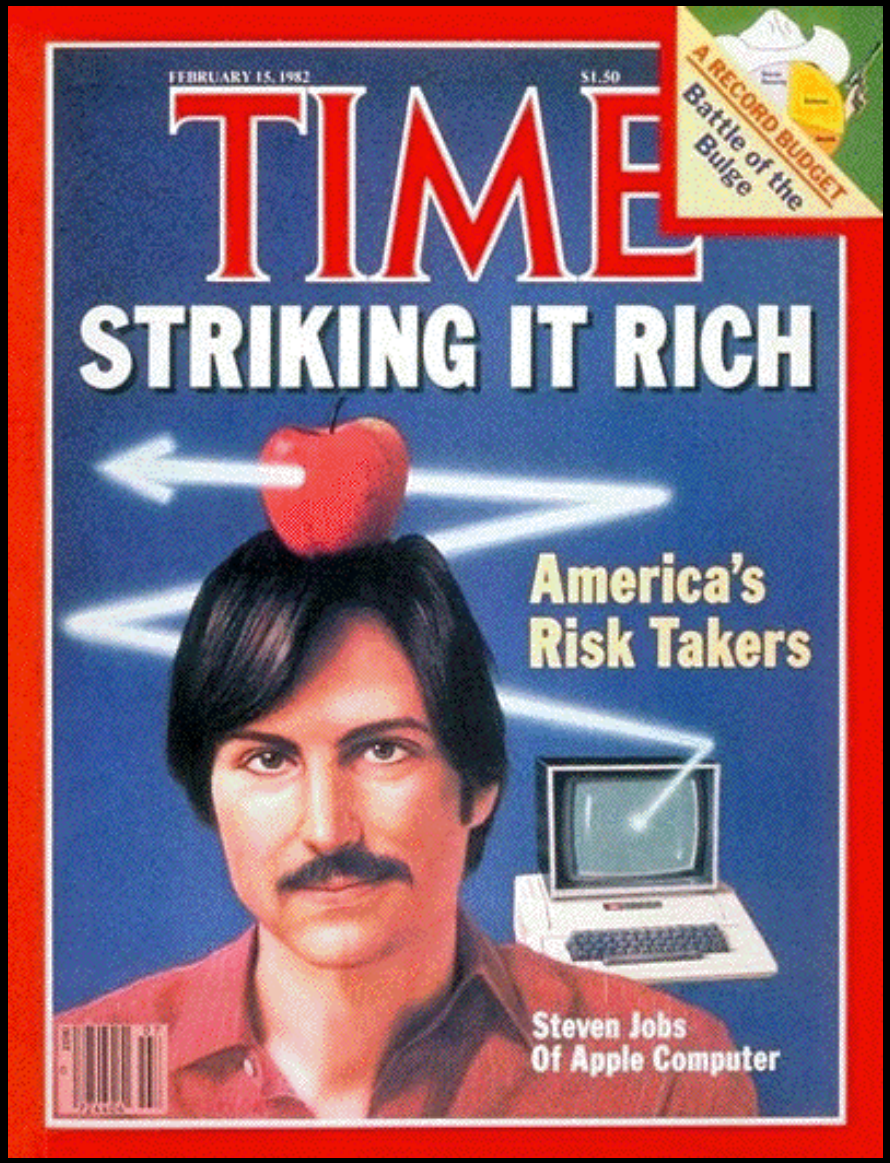


Macintosh 128K – 1984
(Motorola 68000 – 16 bit)
Graphical User Interface
DEMONSTRATION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Battle of the Bulge
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America's Risk Takers
Steven Jobs
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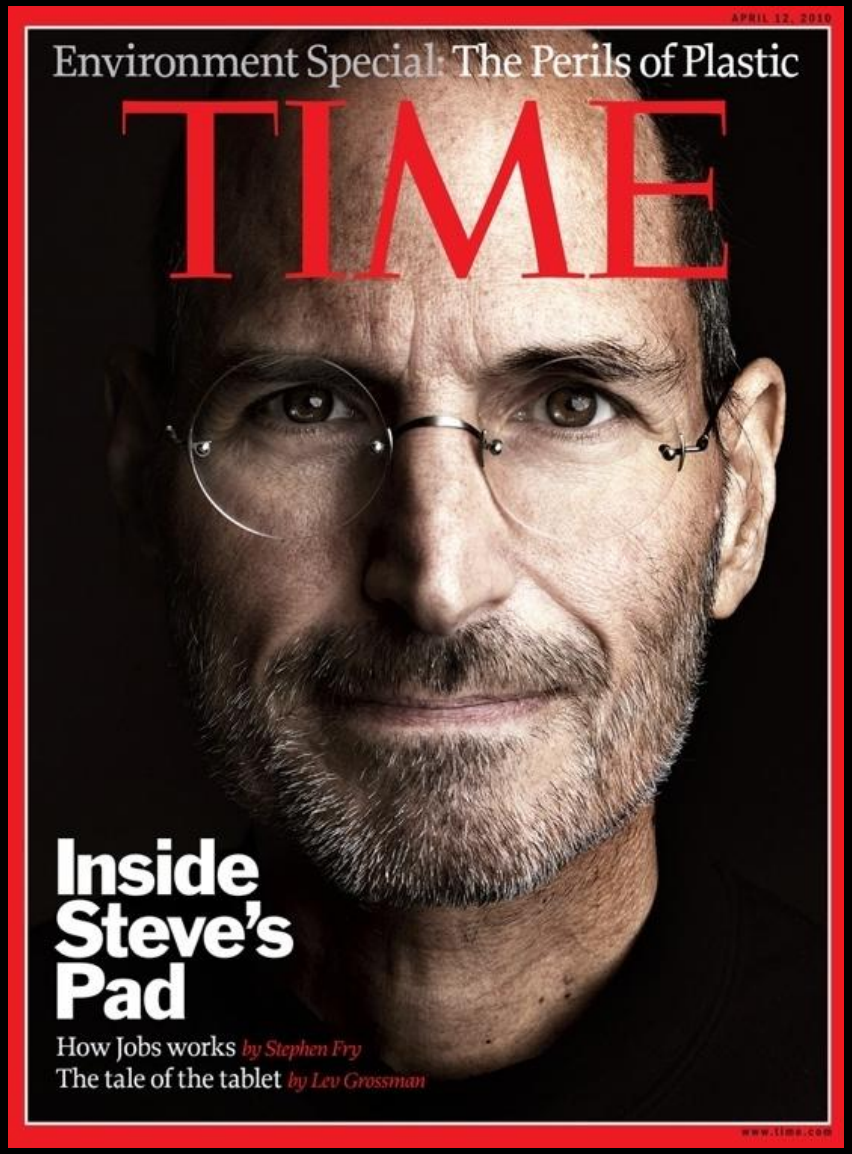
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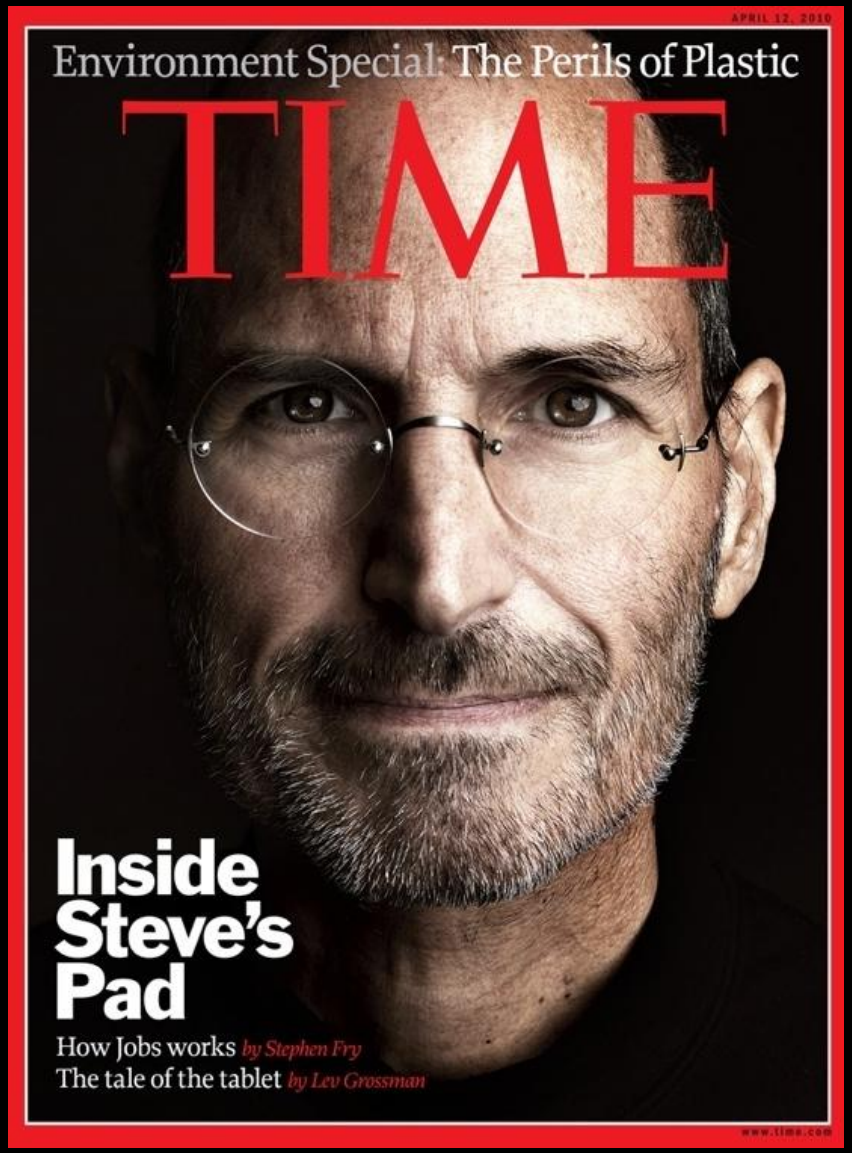
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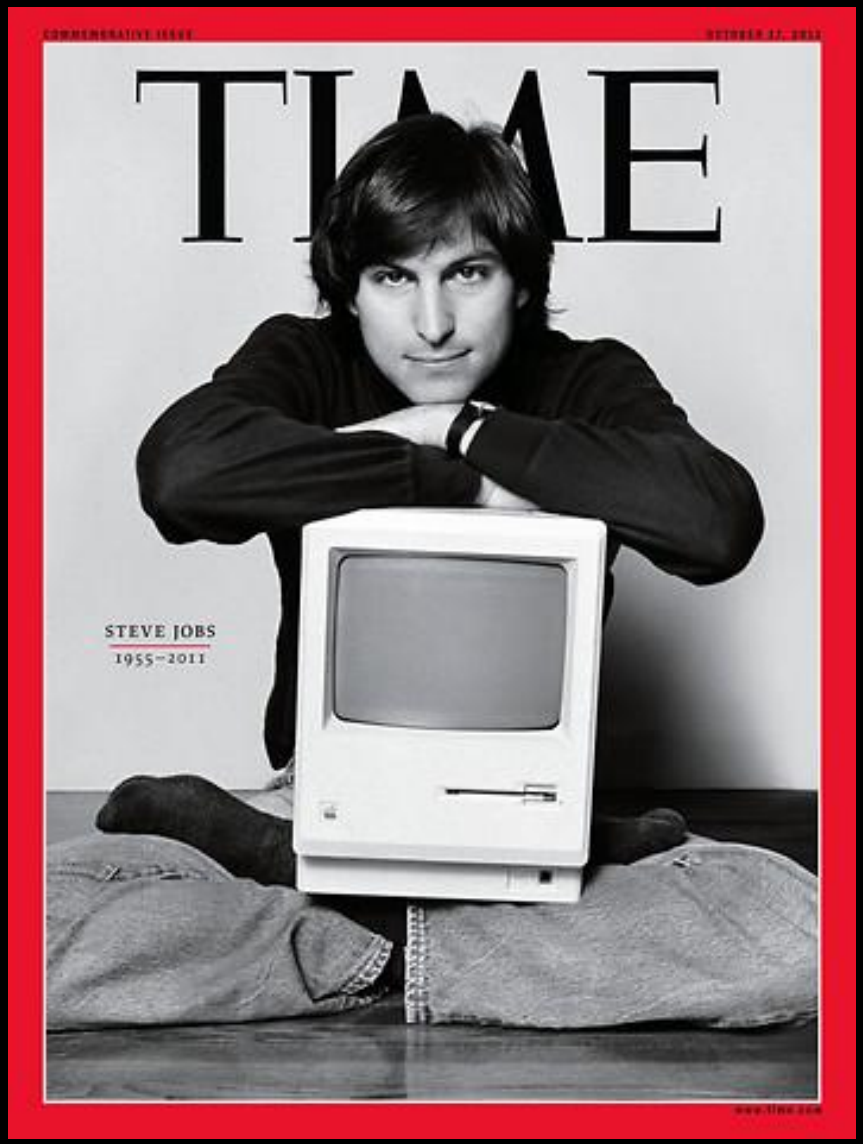
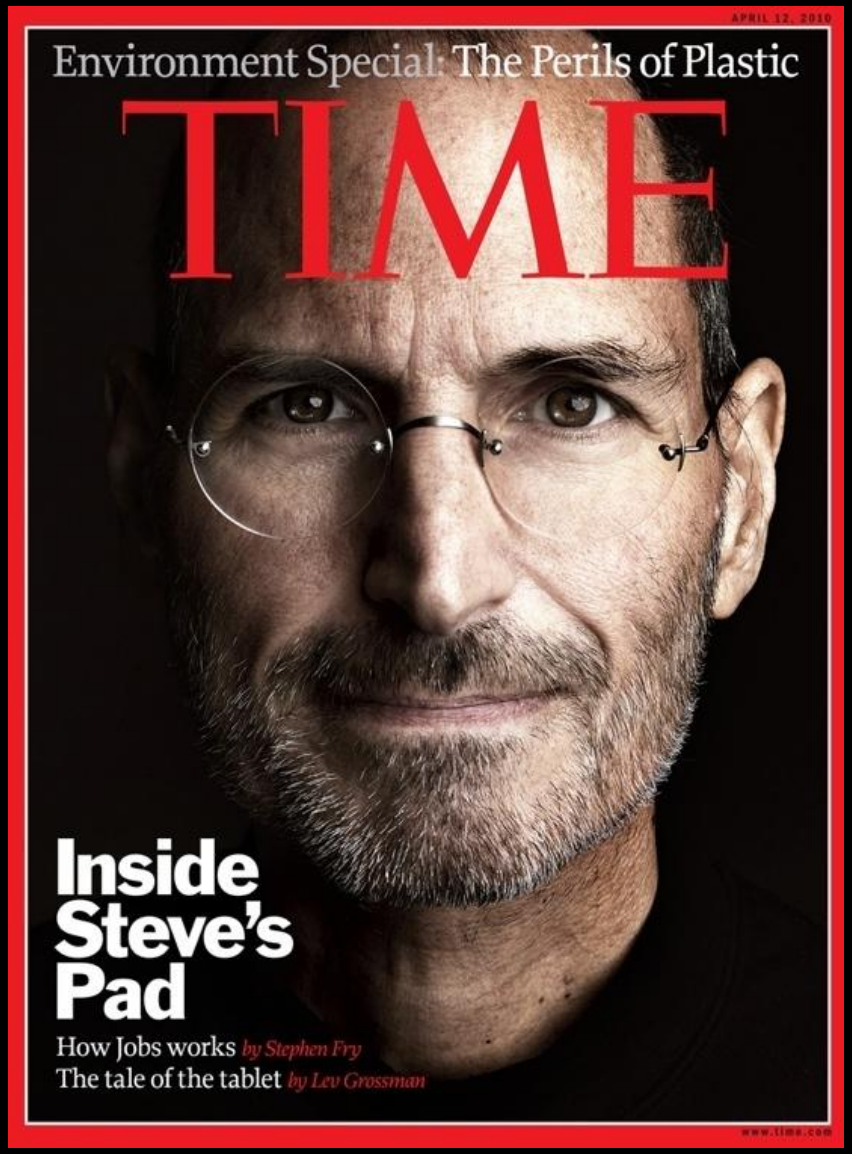

COMMEMORATIVE ISSUE
TIME
STEVE JOBS
1955–2011



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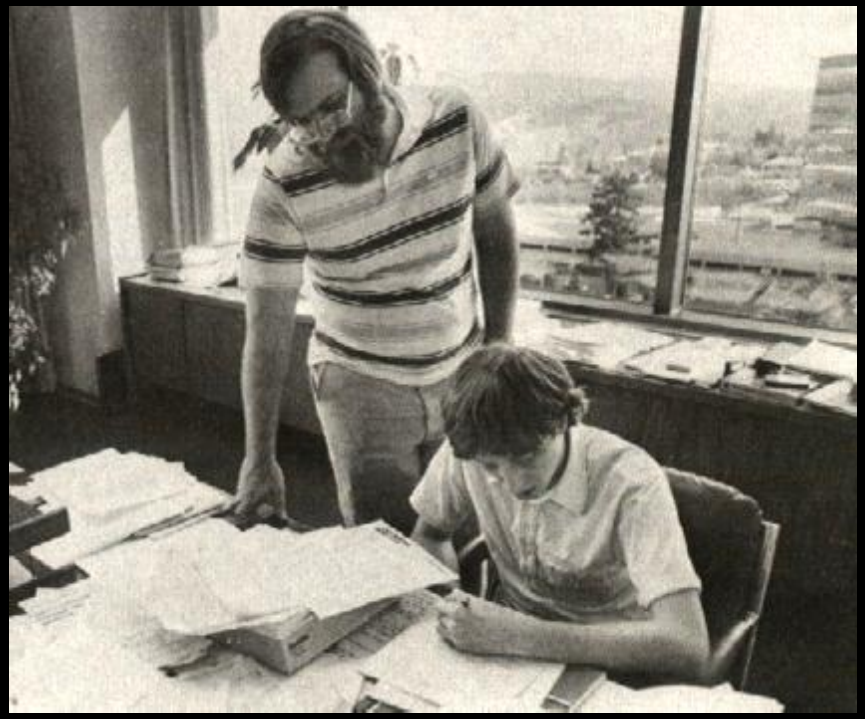

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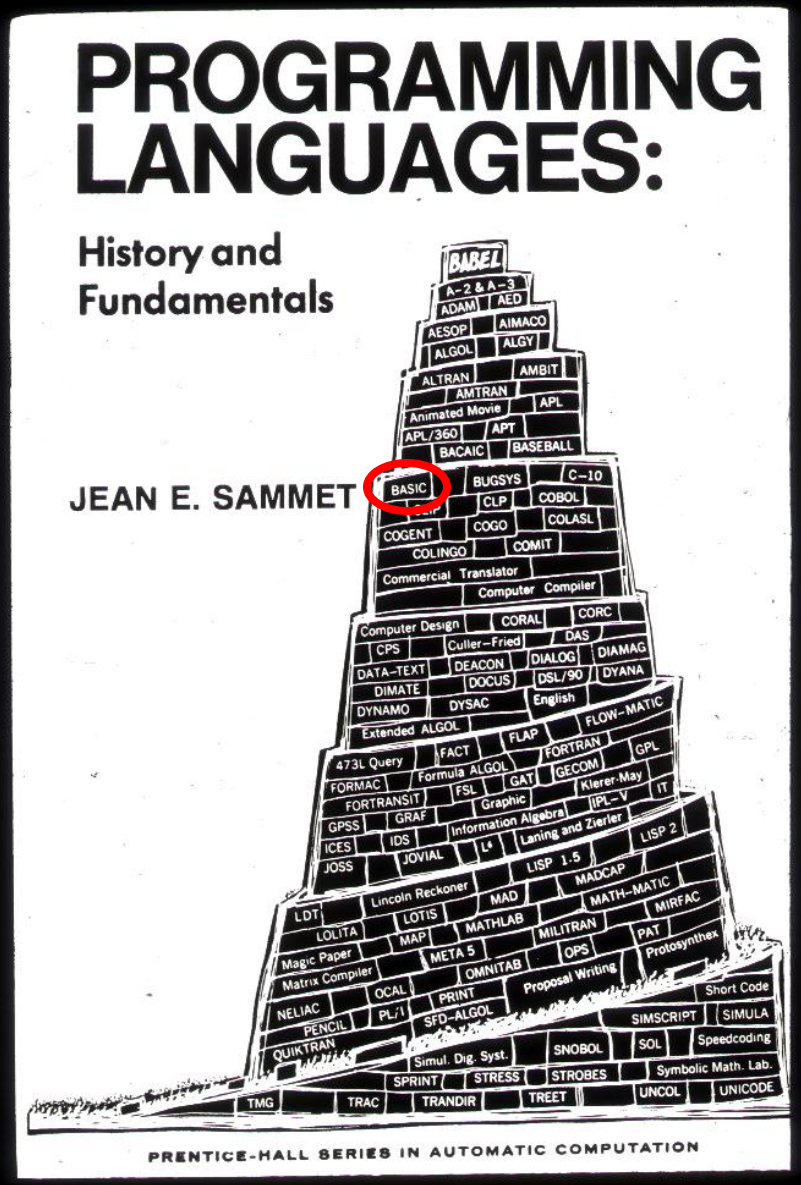
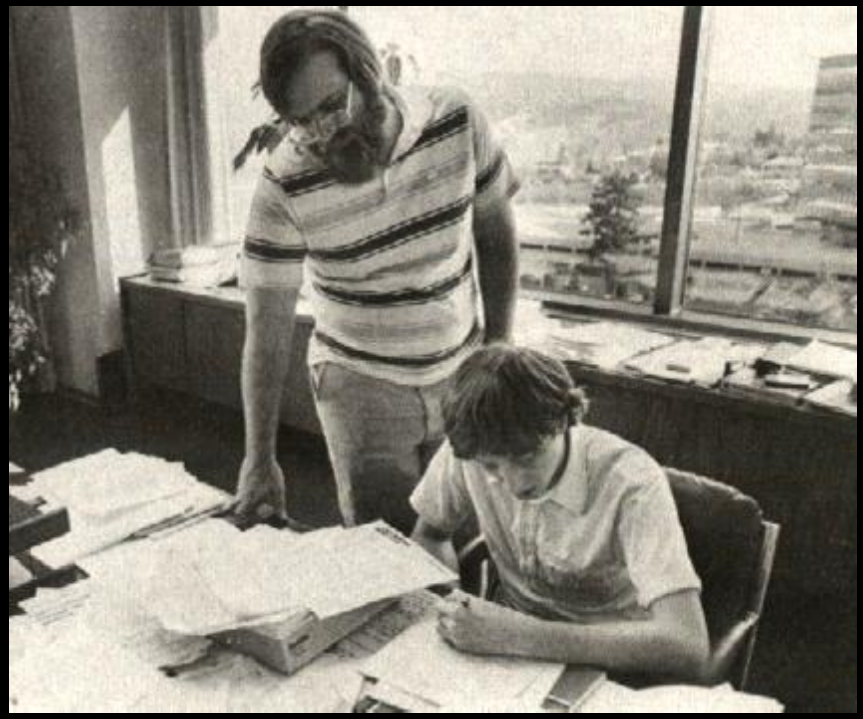




Bill Gates and Paul Allen – Micro-Soft
Basic for Altair 8800 in 1975 (Intel 8080)

February 3, 1976

An Open Letter to Hobbyists

To me, the most critical thing in the hobby market right now is the lack of good software courses, books and software itself. Without good software and an owner who understands programming, a hobby computer is wasted. Will quality software be written for the hobby market?

Almost a year ago, Paul Allen and myself, expecting the hobby market to expand, hired Monte Davidoff and developed Altair BASIC. Though the initial work took only two months, the three of us have spent most of the last year documenting, improving and adding features to BASIC. Now we have 4K, 8K, EXTENDED, ROM and DISK BASIC. The value of the computer time we have used exceeds $40,000.

The feedback we have gotten from the hundreds of people who say they are using BASIC has all been positive. Two surprising things are apparent, however. 1) Most of these "users" never bought BASIC (less than 10% of all Altair owners have bought BASIC), and 2) The amount of royalties we have received from sales to hobbyists makes the time spent of Altair BASIC worth less than $2 an hour.

Why is this? As the majority of hobbyists must be aware, most of you steal your software. Hardware must be paid for, but software is something to share. Who cares if the people who worked on it get paid?

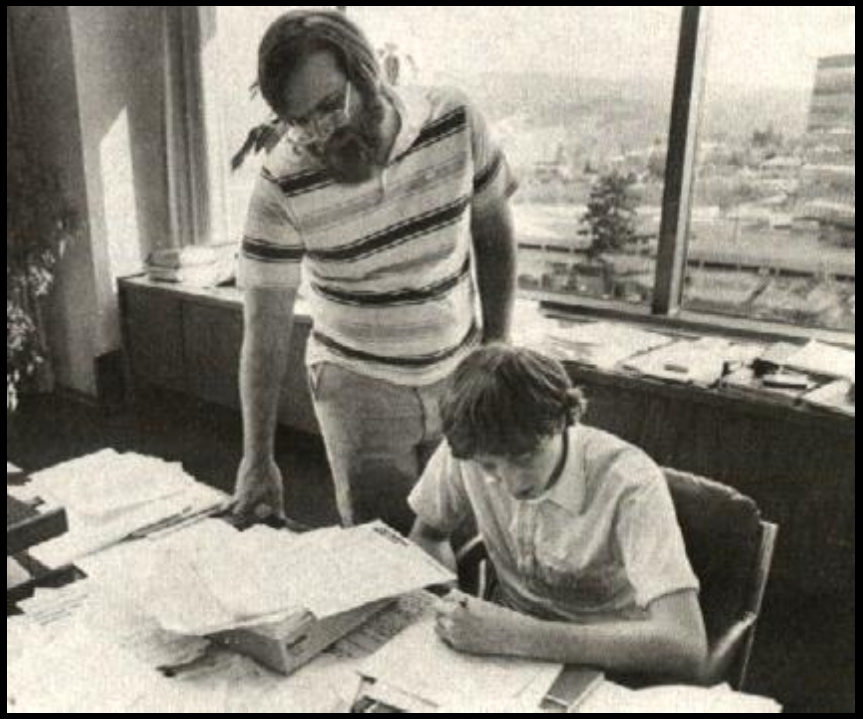
Is this fair? One thing you don't do by stealing software is get back at MITS for some problem you may have had. MITS doesn't make money selling software. The royalty paid to us, the manual, the tape and the overhead make it a break-even operation. One thing you do do is prevent good software from being written. Who can afford to do professional work for nothing? What hobbyist can put 3-man years into programming, finding all bugs, documenting his product and distribute for free? The fact is, no one besides us has invested a lot of money in hobby software. We have written 6800 BASIC, and are writing 8080 APL and 6800 APL, but there is very little incentive to make this software available to hobbyists. Most directly, the thing you do is theft.

What about the guys who re-sell Altair BASIC, aren't they making money on hobby software? Yes, but those who have been reported to us may lose in the end. They are the ones who give hobbyists a bad name, and should be kicked out of any club meeting they show up at.

I would appreciate letters from any one who wants to pay up, or has a suggestion or comment. Just write me at 1180 Alvarado SE, #114, Albuquerque, New Mexico, 87108. Nothing would please me more than being able to hire ten programmers and deluge the hobby market with good software.

Bill Gates

Bill Gates
General Partner, Micro-Soft



Bill Gates and Paul Allen – Micro-Soft Basic for Altair 8800 in 1975 (Intel 8080)

February 3, 1976

An Open Letter to Hobbyists

To me, the most critical thing in the hobby market right now is the lack of good software courses, books and software itself. Without good software and an owner who understands programming, a hobby computer is wasted. Will quality software be written for the hobby market?

Almost a year ago, Paul Allen and myself, expecting the hobby market to expand, hired Monte Davidoff and developed Altair BASIC. Though the initial work took only two months, the three of us have spent most of the last year documenting, improving and adding features to BASIC. Now we have 4K, 8K, EXTENDED, ROM and DISK BASIC. The value of the computer time we have used exceeds $40,000.

The feedback we have gotten from the hundreds of people who say they are using BASIC has all been positive. Two surprising things are apparent, however. 1) Most of these "users" never bought BASIC (less than 10% of all Altair owners have bought BASIC), and 2) The amount of royalties we have received from sales to hobbyists makes the time spent of Altair BASIC worth less than $2 an hour.

Why is this? As the majority of hobbyists must be aware, most of you steal your software. Hardware must be paid for, but software is something to share. Who cares if the people who worked on it get paid?

Is this fair? One thing you don't do by stealing software is get back at MITS for some problem you may have had. MITS doesn't make money selling software. The royalty paid to us, the manual, the tape and the overhead make it a break-even operation. One thing you do do is prevent good software from being written. Who can afford to do professional work for nothing? What hobbyist can put 3-man years into programming, finding all bugs, documenting his product and distribute for free? The fact is, no one besides us has invested a lot of money in hobby software. We have written 6800 BASIC, and are writing 8080 APL and 6800 APL, but there is very little incentive to make this software available to hobbyists. Most directly, the thing you do is theft.

What about the guys who re-sell Altair BASIC, aren't they making money on hobby software? Yes, but those who have been reported to us may lose in the end. They are the ones who give hobbyists a bad name, and should be kicked out of any club meeting they show up at.

I would appreciate letters from any one who wants to pay up, or has a suggestion or comment. Just write me at 1180 Alvarado SE, #114, Albuquerque, New Mexico, 87108. Nothing would please me more than being able to hire ten programmers and deluge the hobby market with good software.

Bill Gates

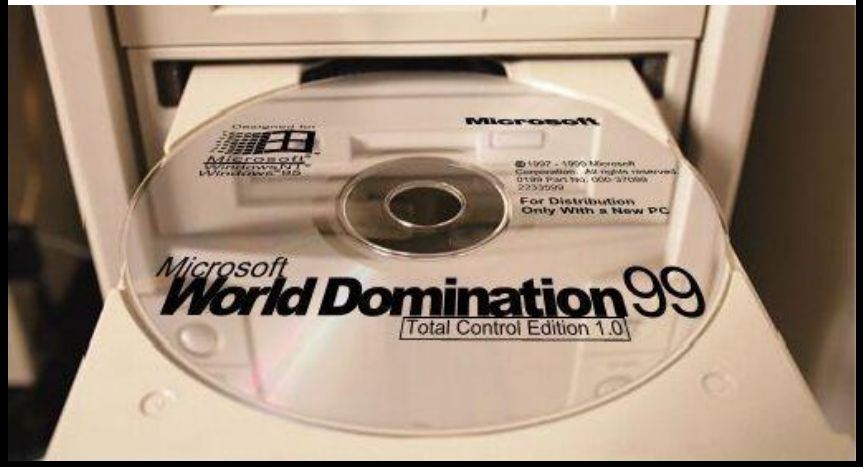
Bill Gates
General Partner, Micro-Soft

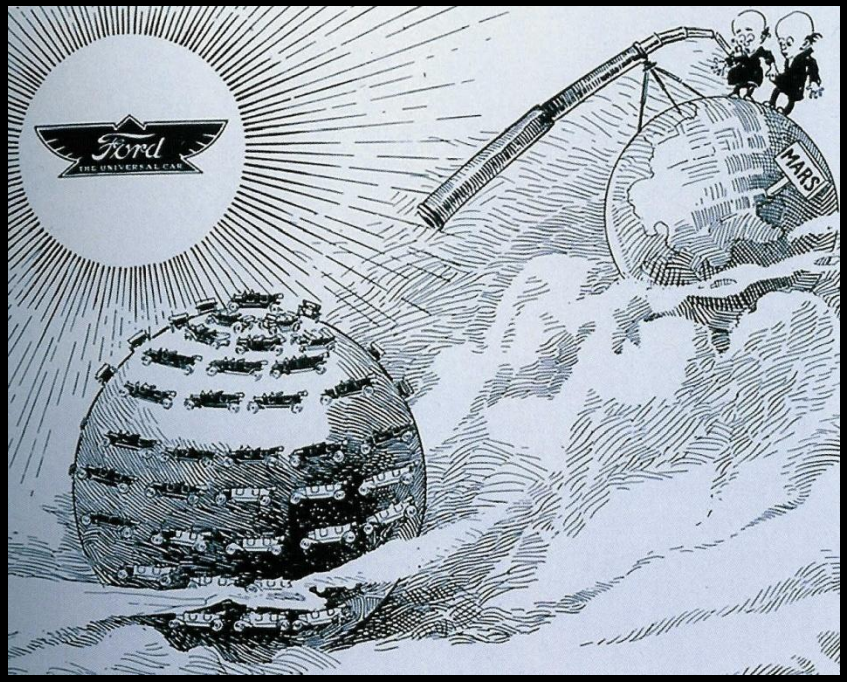
Bill Gates and Paul Allen – MiCROSOFT
MS- DOS for IBM PC in 1981

IBM Personal Computer
(Intel 8088)
Command Line Interface
DEMONSTRATION

Bill Gates and Paul Allen – MiCROSOFT
MS- DOS for IBM PC in 1981

8086, 80186, 80286, 80386, 80486 16-bit
Pentium 32-bit and 64-bit





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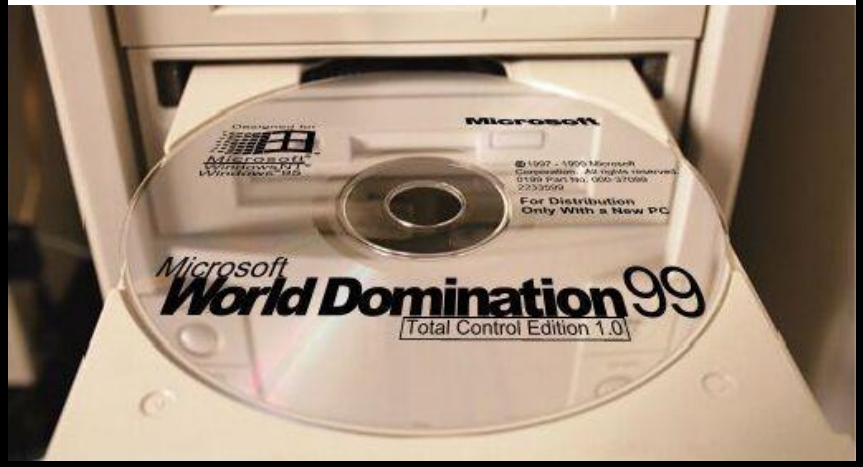
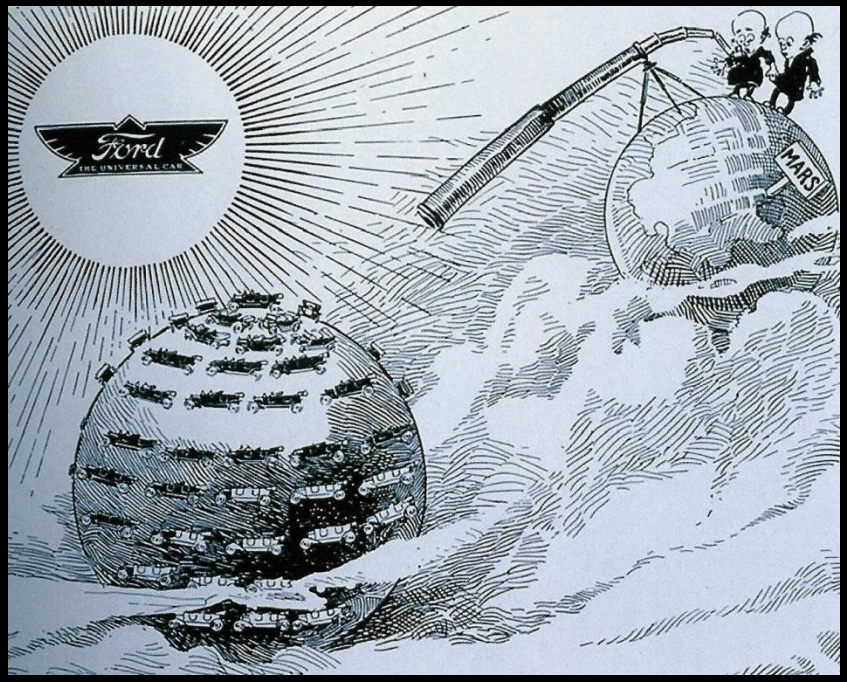




Key Ideas

Scientific :

- Computer on a Chip
- Graphical User Interface

Social and Personal :

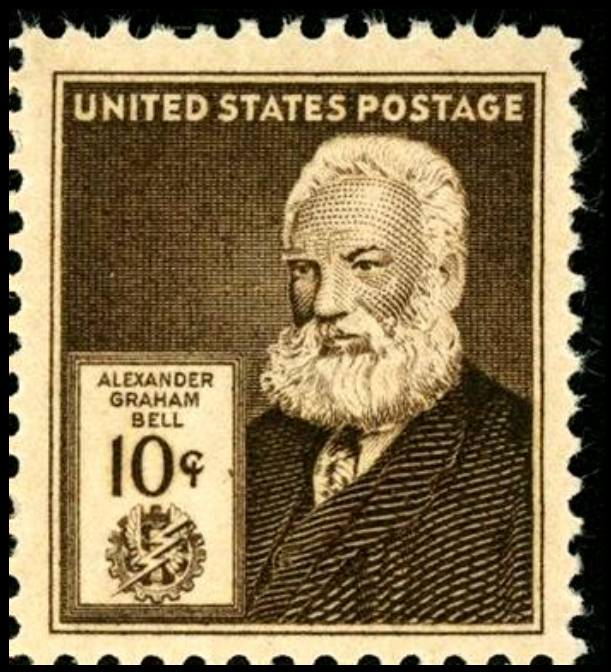
- Computation
- Communication
- Commerce

Symbolic :

- Individual Genius

Immigrants

Alexander Graham Bell
Andrew Carnegie
John Von Neumann
Othmar Ammann



Telephone

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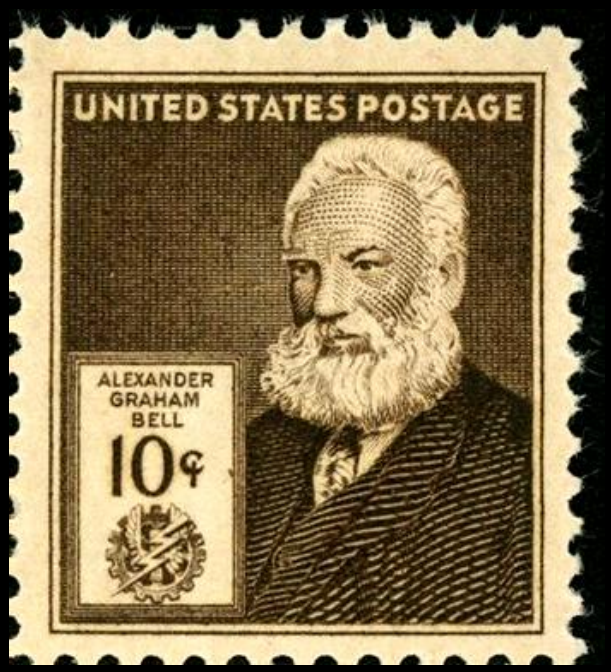
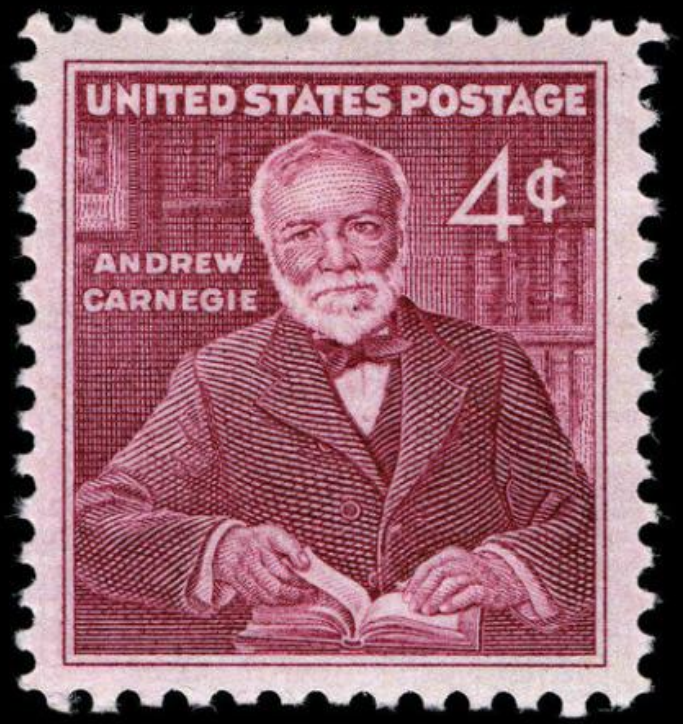
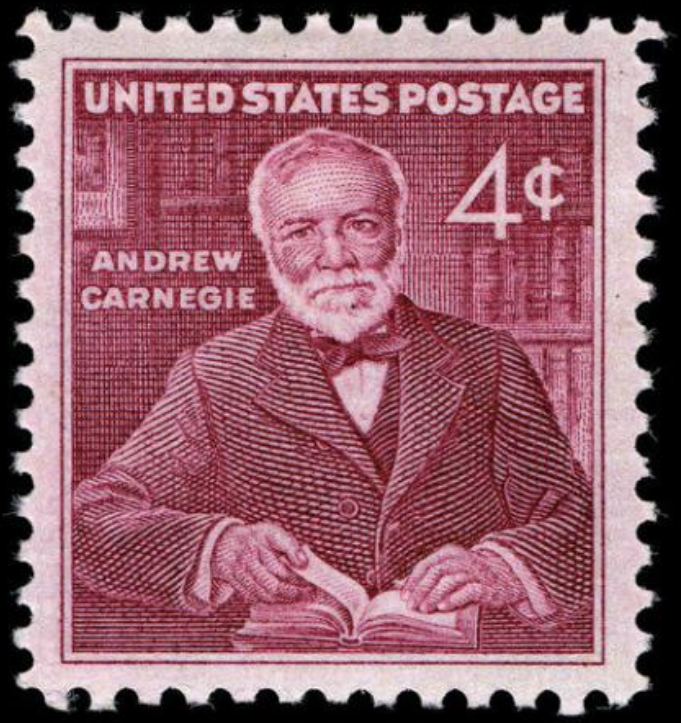


Telephone



Steel for Railroads,
Bridges, and Buildings

Iconic NY Bridges for Cars



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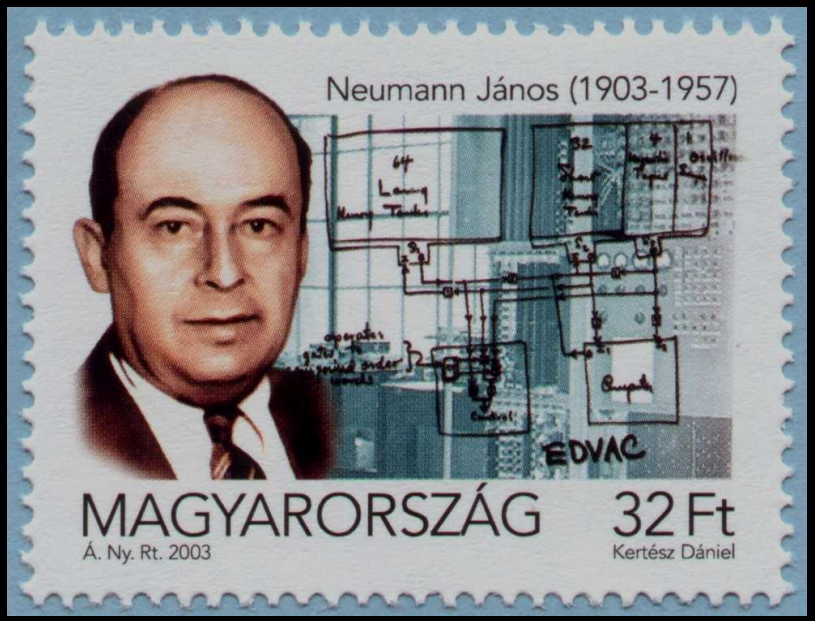
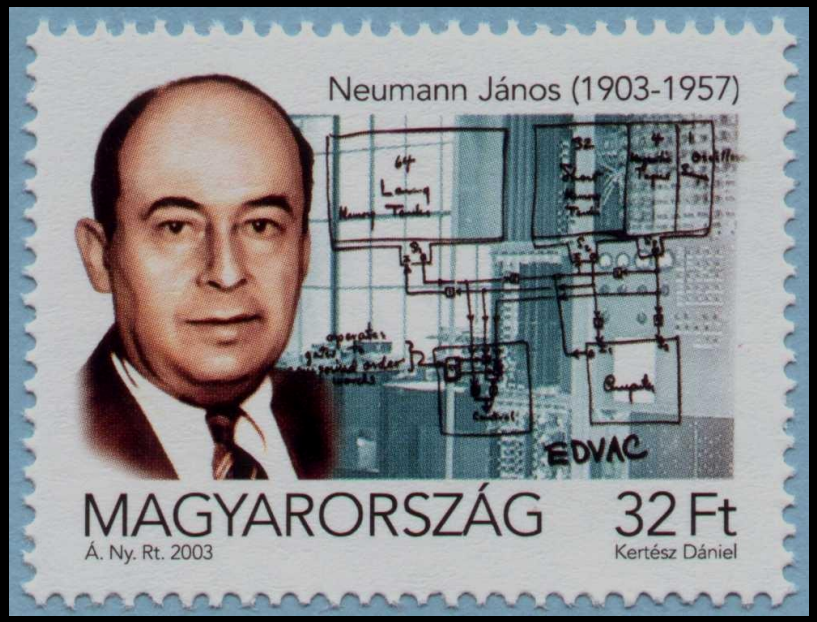


Digital Machine for Calculations

Inventors

Thomas Telford	Flat Bridge
Wright Brothers	Flying Machine
Thomas Edison	Remote Power
Henry Bessemer	Strong Material



Digital Machine for Calculations

$$H = \frac{1}{8} qL \frac{L}{d}$$

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$$L = 0.00257\ V^2\ C_L\ A$$

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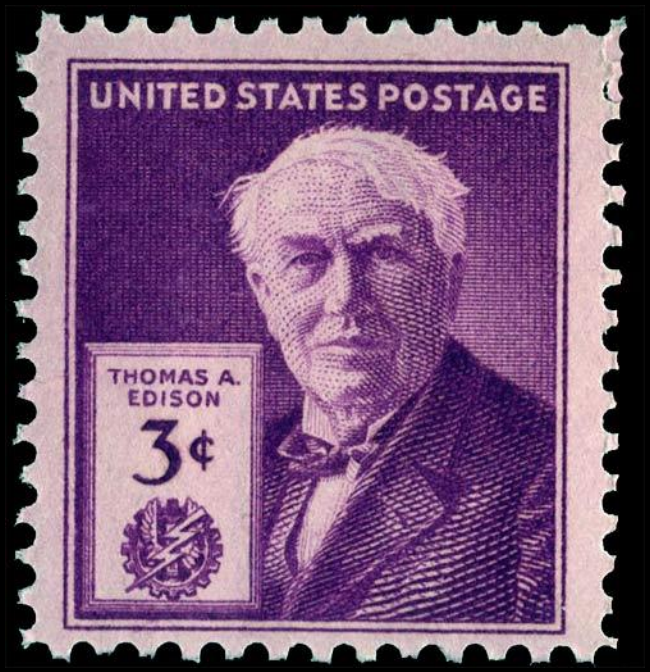

$$P_L = I^2 R$$

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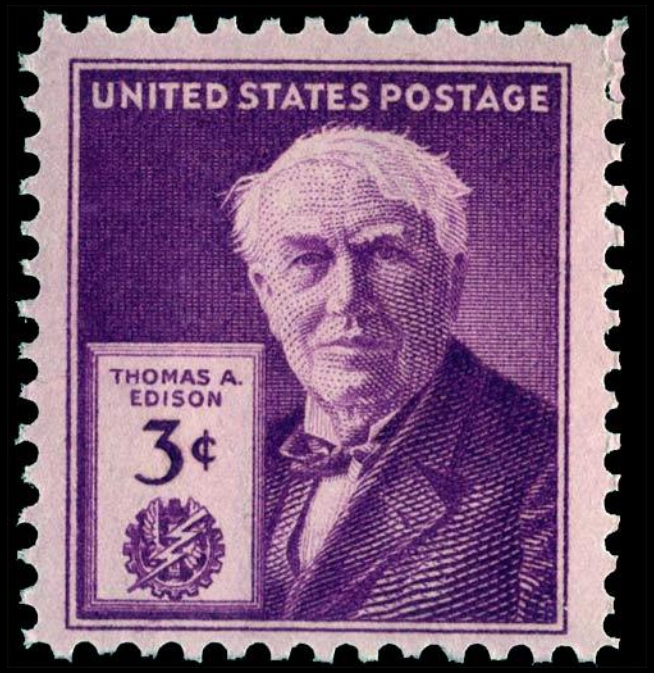


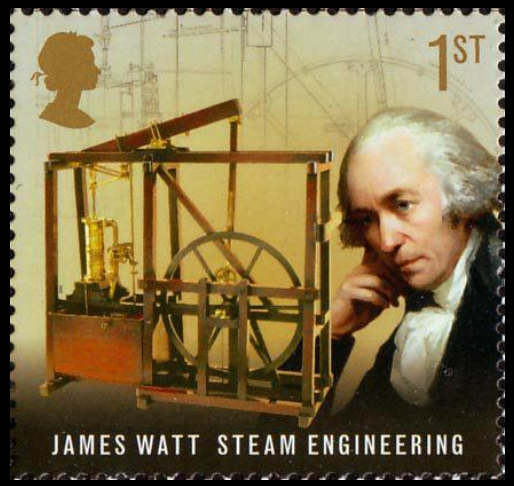
$$P_L = I^2 R$$

$$\text{Safety Factor} = \frac{f_B}{f}$$

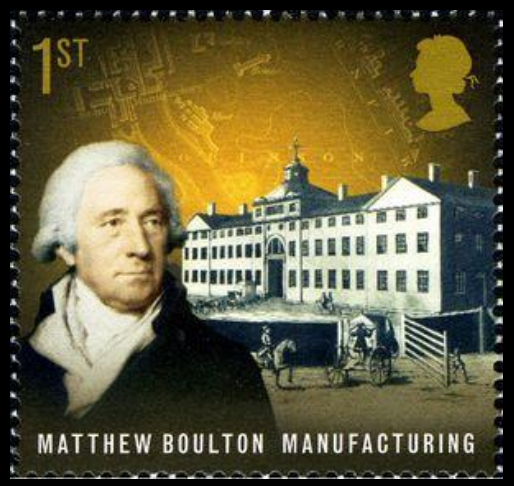
Partnerships

James Watt – Mathew Boulton
Robert Fulton – Robert Livingston

INVENTOR



ENTREPRENEUR



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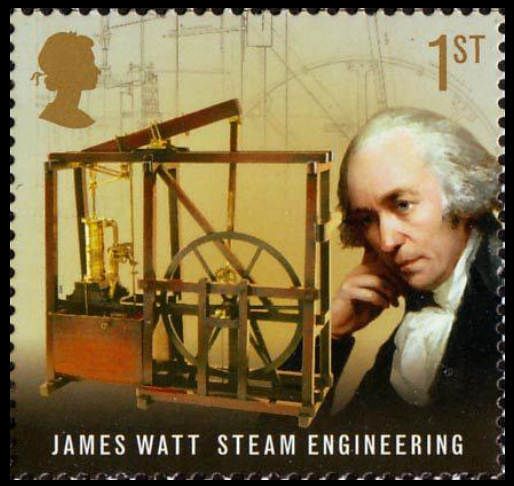

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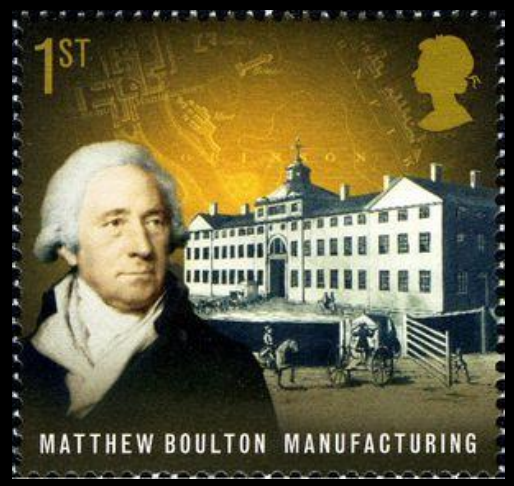

ENTREPRENEUR

Patents

Steamboat
Telephone
Electric Light
Airplane
Radio
Rocket
Transistor
Integrated Circuit

What are positive and negative effects of patents ?

INVENTOR

ENTREPRENEUR

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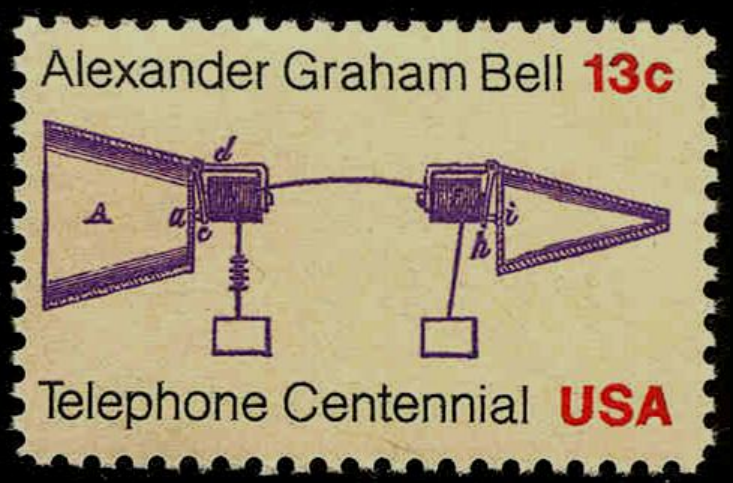
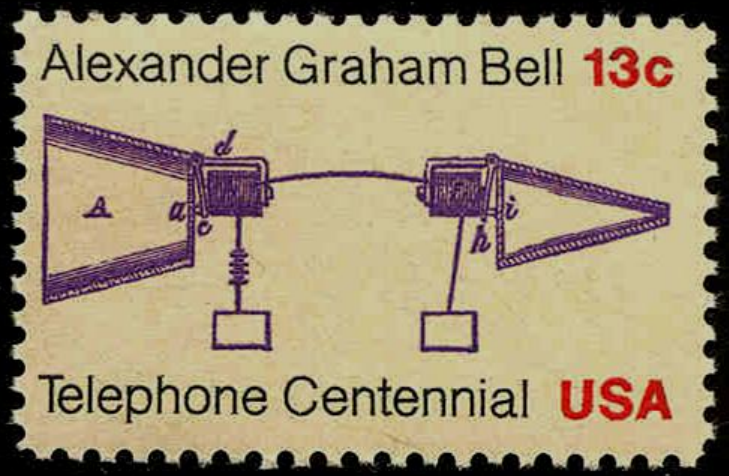


delays competition

Bell Telephone wins
Edison patents captured
from Western Union



“War of the Currents”

delays competition
AC wins

delays competition

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Wright Brothers patent
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WWI – patent suspended in
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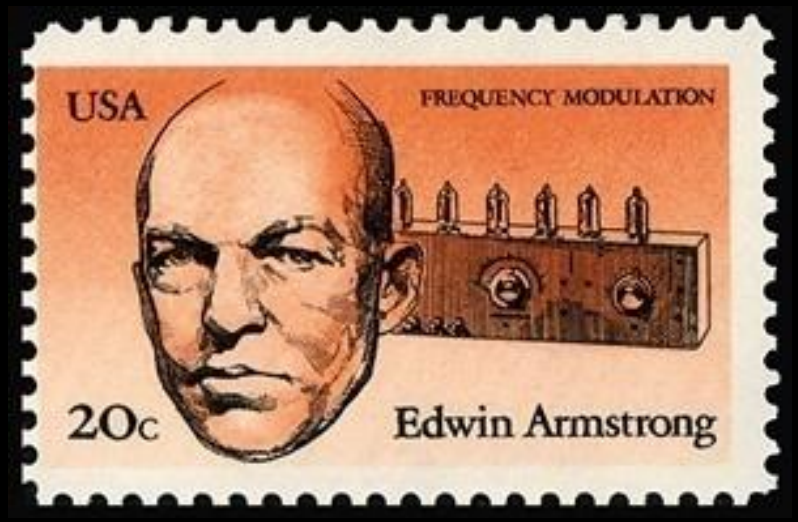

Sarnoff fights FM patent

Armstrong suicide
Armstrong's widow wins

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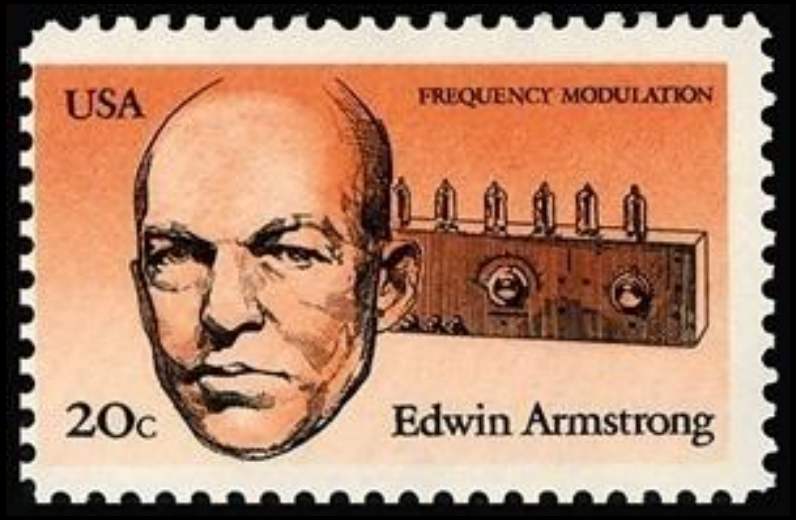

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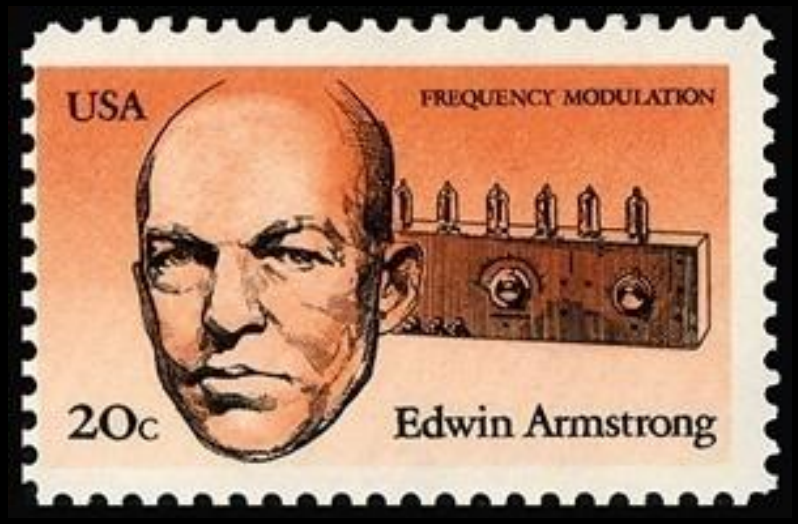
1964 – 50th Anniversary
of multi-stage patent

Goddard not taken
seriously until after WWII



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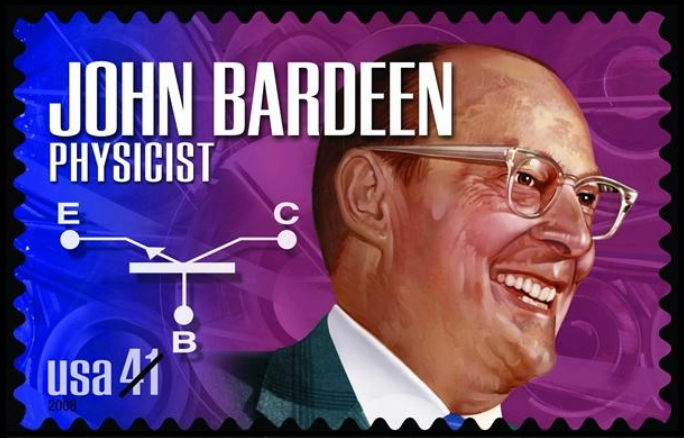
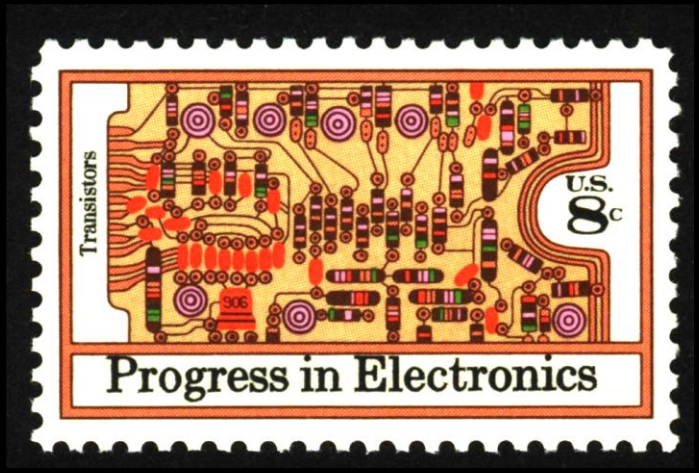
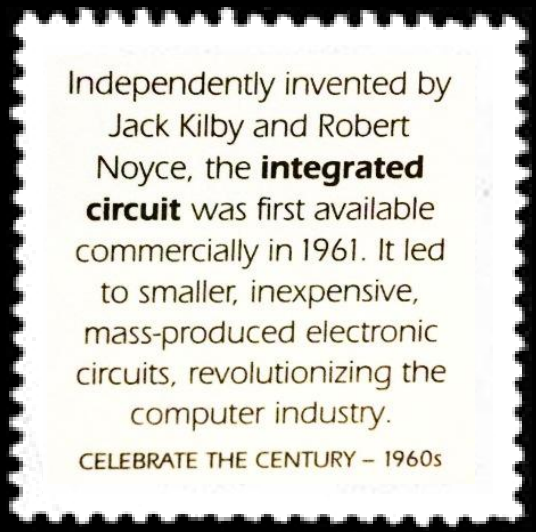


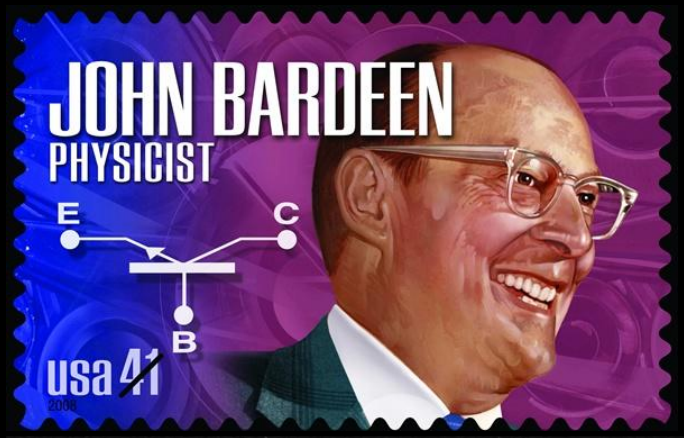


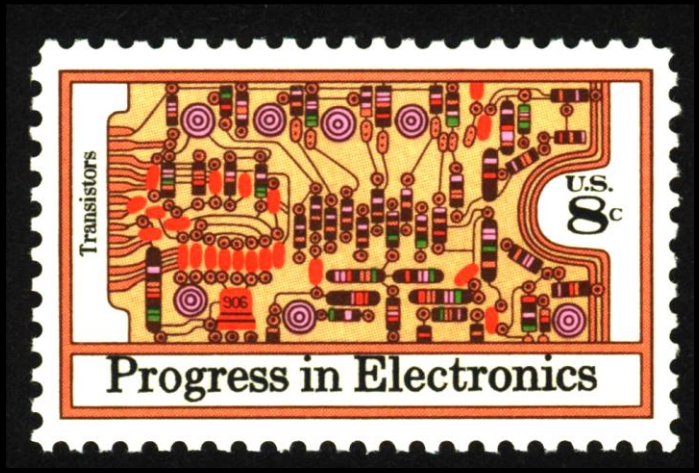
1956 Nobel Prize

Revolutionizes telephone, radio, computers, satellites



Kilby and Noyce
share credit and revenue





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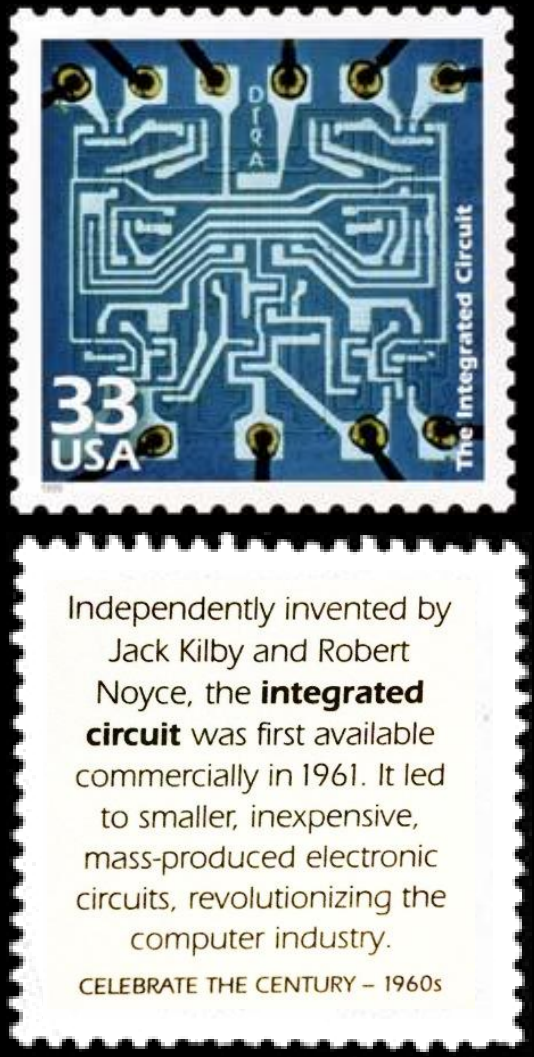
Artist as Engineer

Telford
Morse
Ammann



Kilby and Noyce
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Elegant bridge replaces the ferry

Artist as Engineer

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Intelligence at a distance

Elegant bridge replaces the ferry

Intelligence at a distance

Structural Artist
and Entrepreneur

Political Entrepreneurs

Amman
Livingston
Norris
Hoover

Livingston

Monroe

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TVA – REA architect
Advocate for Public Power

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Colorado River Compact

TVA – REA architect
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Focus on Whole System

Edison
Ford
Marconi

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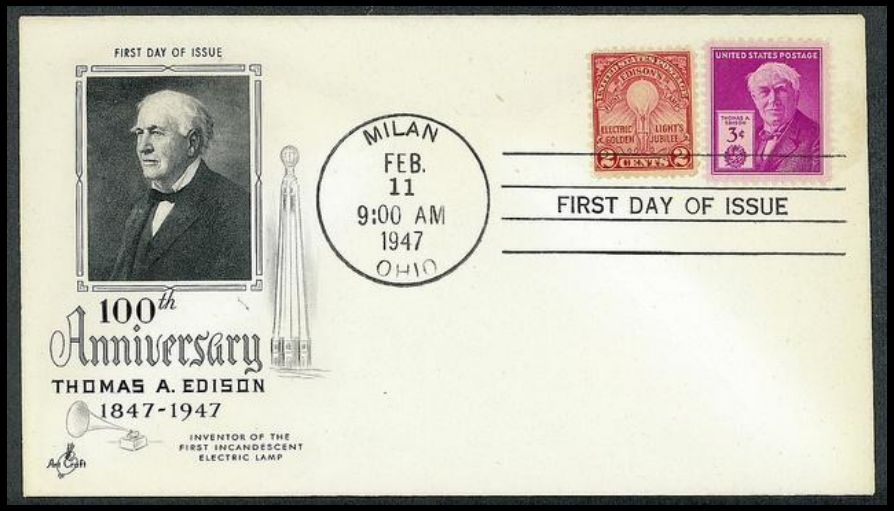

Competition with Gas Lighting

Focus on Whole System

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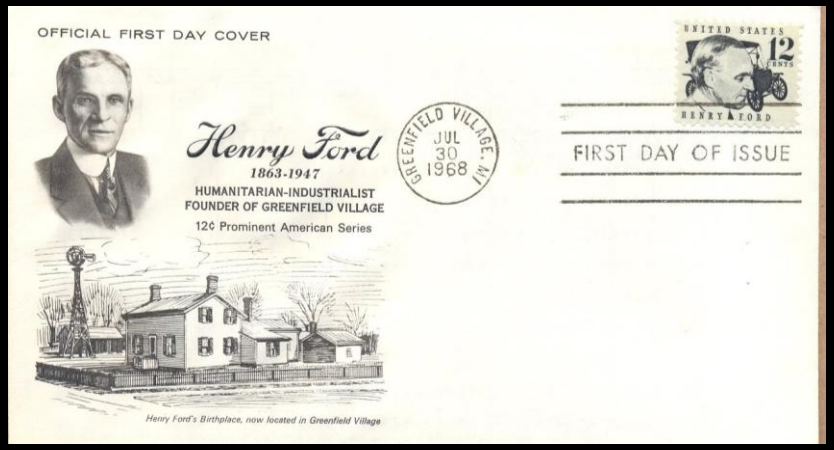
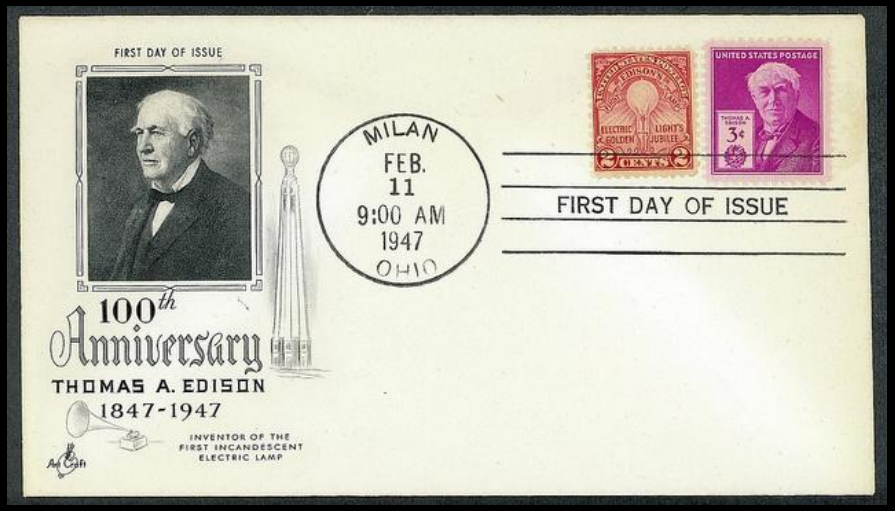


Assembly Line
Integrated Factory



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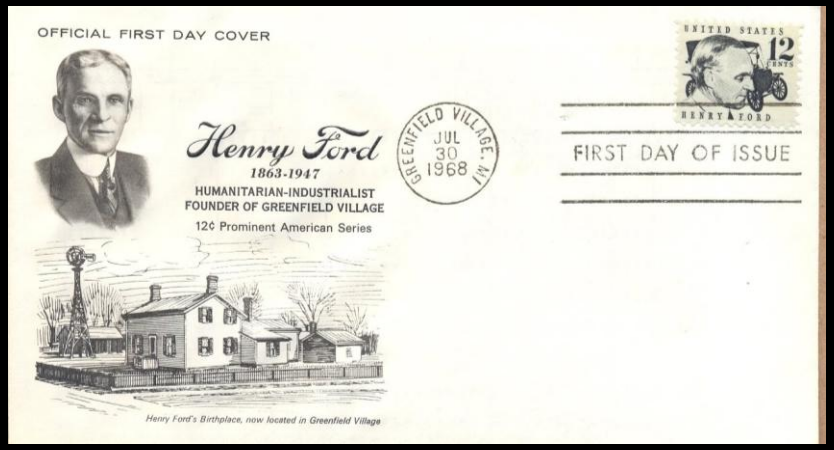
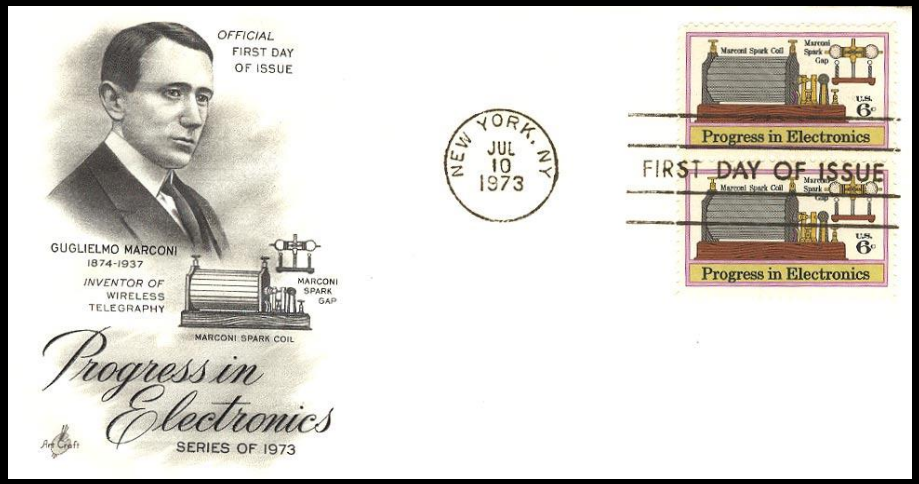


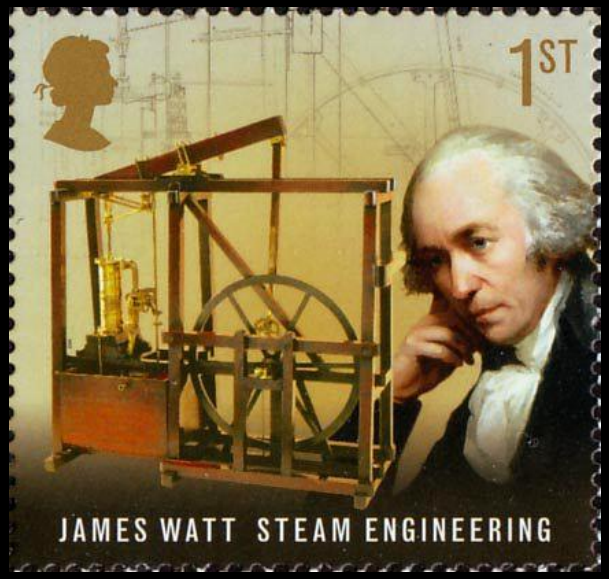


Assembly Line
Integrated Factory

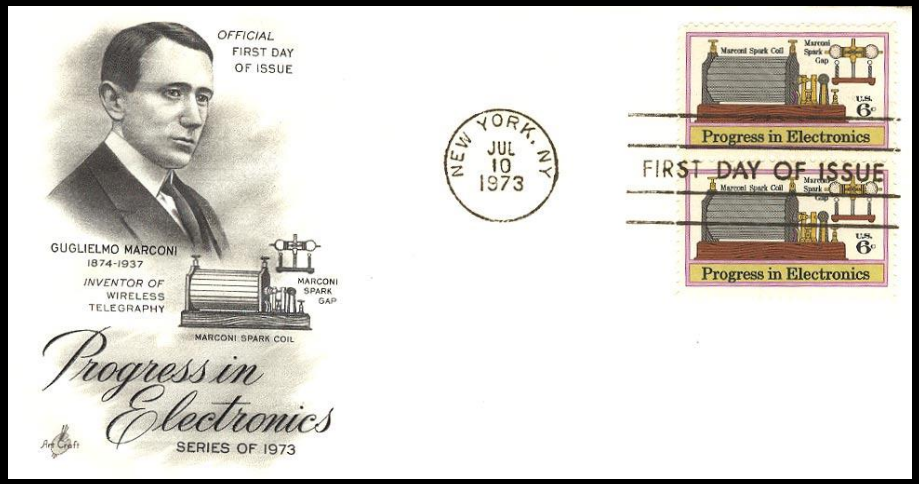
Global Wireless Network

Energy Conversion

Steam Engine
IC Engine
Jet Engine
Rocket Motor



Machine replaces Horse
External Combustion



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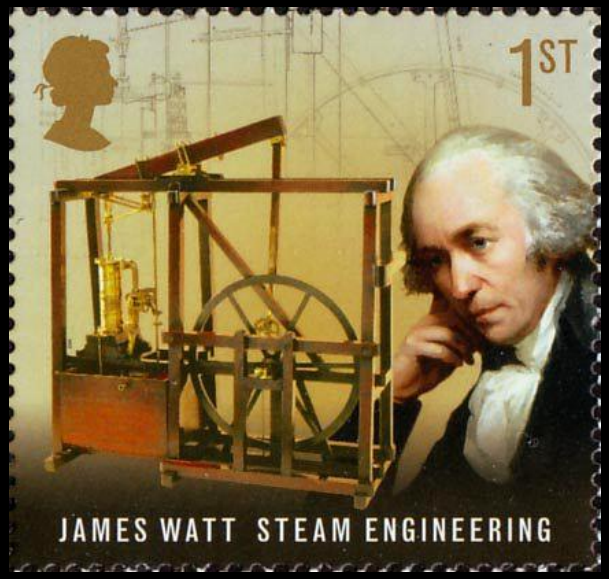

Machine replaces Horse
External Combustion

Compact and Efficient Machine
Internal Combustion

Turbojet Engine
Batch to Continuous

Compact and Efficient Machine
Internal Combustion

Turbojet Engine
Batch to Continuous

Rocket Motor carries own O_2
Thrust in the Vacuum of Space

Government Fixes

Port Authority
Valley Authority
River Compact

Congested
Depressed
Undeveloped

Port Authority Bridge
Automobiles

Rocket Motor carries own O_2
Thrust in the Vacuum of Space

Government Fixes

Port Authority
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Congested
Depressed
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Port Authority Bridge
Automobiles

Valley Authority Dam
Electric Power

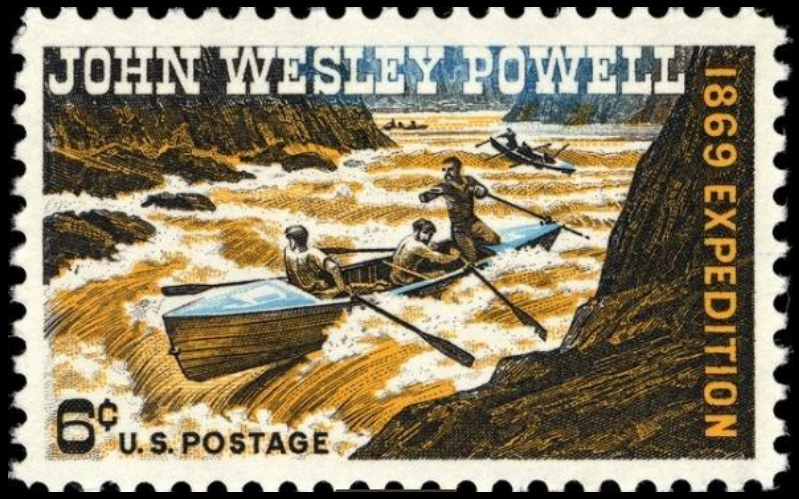
River Compact Dam
Flood Control and Electric Power

Valley Authority Dam
Electric Power

Daring ‘Firsts’

Water
Air
Space

River Compact Dam
Flood Control and Electric Power

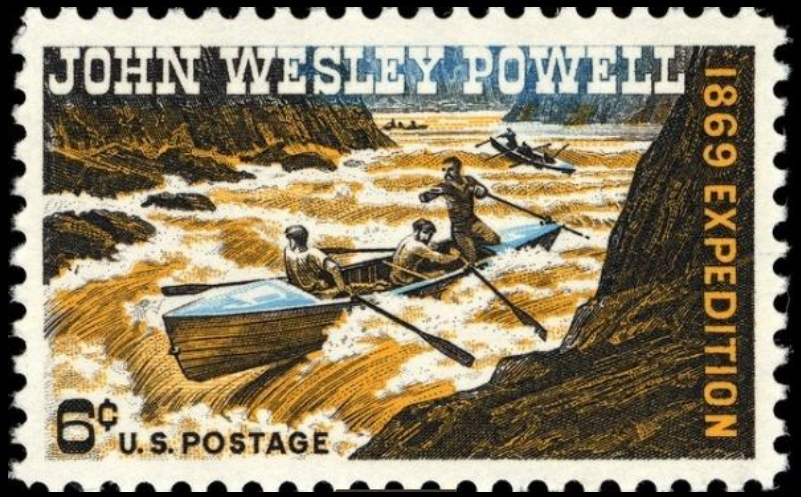


First Trip - Colorado River

Daring ‘Firsts’

Water
Air
Space

First Flight - Heavier than Air



First Trip - Colorado River

First Flight - Heavier than Air

Faster than Sound
bullet-shaped rocket plane

First Earth Orbit

Faster than Sound
bullet-shaped rocket plane

First Earth Orbit

1969

Transformation of Daily Life

Railroad
Telephone
Electricity
Automobile
Airplane
Computer

Continent Crossed - 1869
Iron Road

1969

Transformation of Daily Life

Railroad
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Continent Crossed - 1869
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Nation Illuminated – 1879
Continent Crossed – 1915
Copper Transmission Lines

Atlantic Ocean Crossed - 1927
made of Aluminum
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Coast to Coast w/o Lights - 1956
Asphalt, Concrete, and Steel

Information Age born in 1946
Germanium, Silicon, and Glass

Coast to Coast w/o Lights - 1956
Asphalt, Concrete, and Steel

Information Age born in 1946
Germanium, Silicon, and Glass

Innovations

How do they happen?
Why are they important?

Scientific :

- applied science

Social :

- transformation - context
  - economics
  - politics
  - culture

Symbolic :

- individual genius