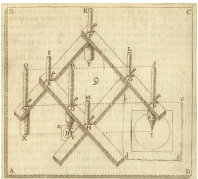


The Pantograph Demythologized

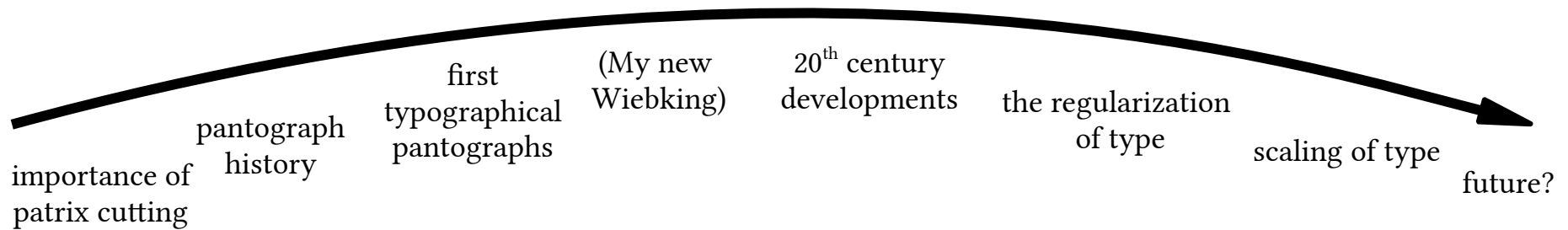
Or,

Half an Hour of Heresy

Dr. David M. MacMillan
Circuitous Root
Mineral Point, Wisconsin



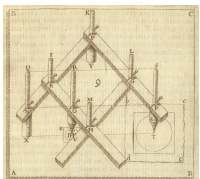
A large-scale argument questioning the accepted history of the mechanization of type-making



120+ slides
(Yikes!)

Way too much for a half-hour talk

This is the abbreviated version for the talk.
Both it and the full version are online.



www.CircuitousRoot.com/artifice/letters/pantocut/index.html

A Different Perspective

Mine is an outsider's view.

I was not trained in printing or the graphic arts, but in literature (Ph.D.) and computer programming (the family profession for sixty years).

So I have had no instructor in type.

I've never had to give the correct answer on a test.

I just read the books and examine the evidence.

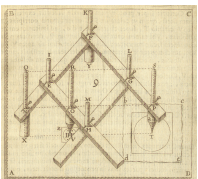
Frequently, I find that they do not match.



BASIC PROGRAMMER TRAINING CLASS #3

POUGHKEEPSIE, NEW YORK

1960. My father, Vernon MacMillan (1937–2012), is fifth from the left.



The myth
oversimplifies

One Such Area

I'd like to
Overcomplicate

The Mechanization of Matrix-Making

Two random modern examples of the canonical story:

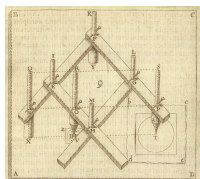
Punch-cutting was finally mechanized in 1885 with the invention of Linn Boyd Benton's punch-cutting pantograph.

- Simon Eliot. *A Companion to the History of the Book*. (2011)

In 1885 Linn Boyd Benton ... invented ... the Benton punchcutting machine ... it did not cut punches but instead engraved matrices ... via pantograph.

- Paul Shaw. *Revival Type*. (2017)

The problem: Everything in these statements is false.



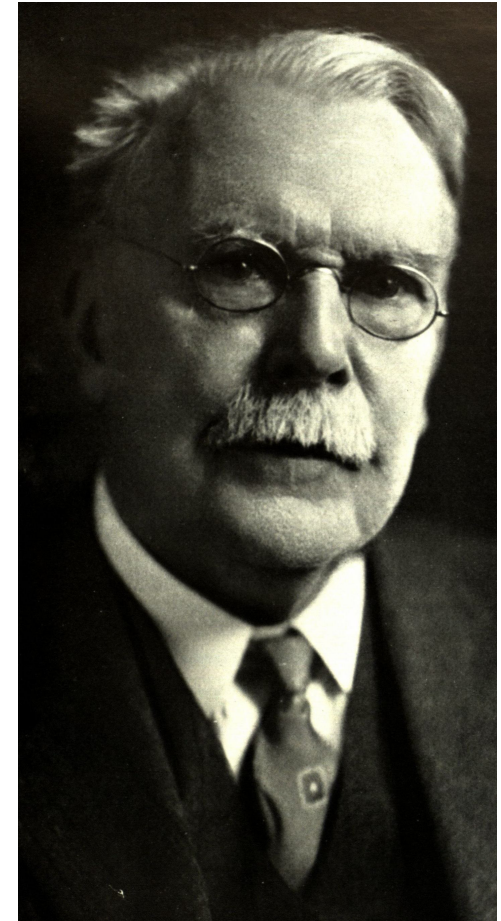
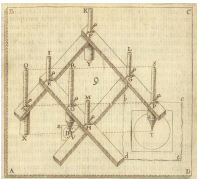
An Important Disclaimer

Many times I'll say "Benton didn't..." or "Benton wasn't..."

I'm not Benton-bashing. His work was extraordinary, important, and extremely influential.

It's just that there was so much more and so much before.

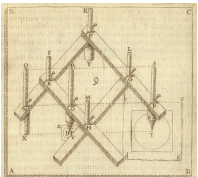
To tantalize: By the time the evidence shows that Benton was engraving matrices, you could purchase matrix engraving services on the open market and a number of important faces had already been cut.



Linn Boyd Benton. 1844–1932
The Inland printer. Vol. 89, No. 5 (Aug. 1932).

Why Look at Patrix Cutting First?

- ▶ It is an extremely important aspect of the general mechanization of matrix making in the 19th century.
- ▶ If we don't understand just how common hand patrix cutting was, we will:
 - ◆ Underestimate the pre-1880s production capacity for matrices.
 - ◆ Misunderstand the use of some of the earliest pantographs (especially Benton's) for cutting both punches and patrices.



Quick Technical Review

(Simplified)

Three major methods of creating a matrix from a new design:

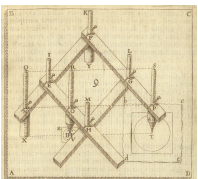
Engrave a **punch** in steel, harden the steel punch,
then **strike** (or press) a matrix (and then **justify** it).
With or without the use of **counterpunches**, depending on your tradition.
Cutting/engraving either by hand or by rotary-spindle pantograph.

Engrave a **patrix** (pattern letter) in soft metal (near-typemetal, or brass),
then **electroform** (aka “electrotype”) a matrix.
Cutting/engraving either by hand or by rotary-spindle pantograph.
(A patrix is very much like a punch, but in soft metal.)

Engrave a **matrix** directly,
Done only by rotary-spindle pantograph, not by hand.

Other methods not considered here:

- Sand casting (for large letters, 18th century and earlier)
- Hand cut punches, intermediate lead matrices, and sand-cast brass matrices finished by repunching (for large types; see Nelson & Mosley)
- “Sanspareil” matrices (hand-cut and assembled, late 18th century)
- Composite methods (Rimmer: Punch, cast type, trim beard, electroform new mat)
- CNC matrix engraving

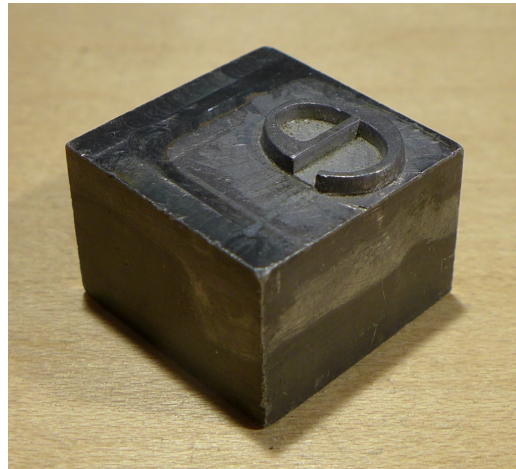


Punch, Patrix, Matrix



(2016)

A hand-cut punch



(20th c.)

Probably a patrix.
Provenance unknown.



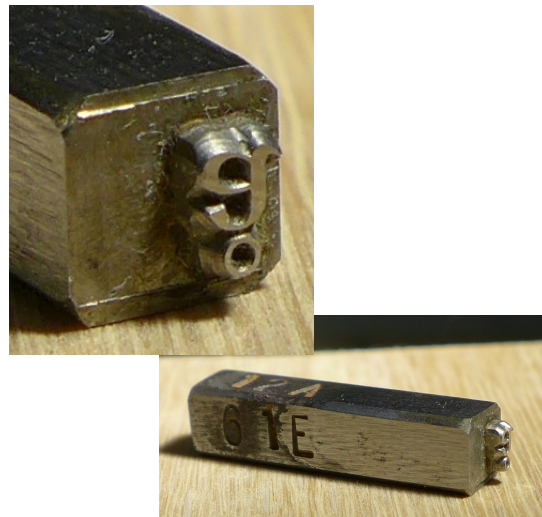
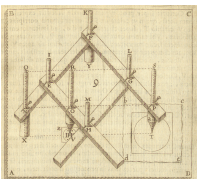
(1922)

An Electroformed Matrix.
ATF Series 476 Goudy Handtooled Italic.
60 point. For the Barth Type Caster.



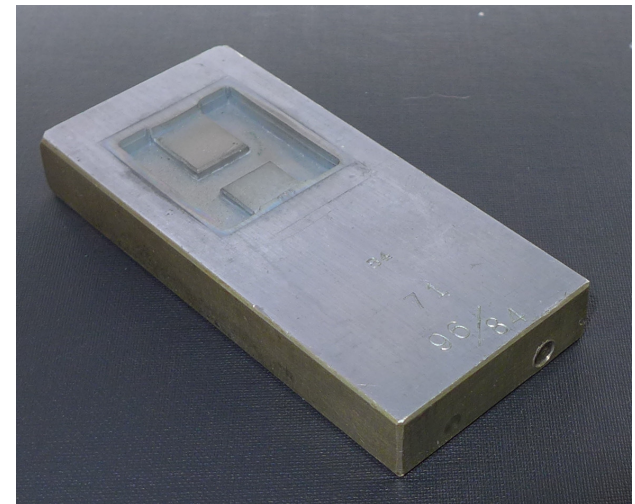
A punch, probably hand-cut.
Thompson Type Machine Co.

(Early 20th c.)



(1917)

A machine-cut punch.
Lanston series 61, Cochin.
12 pt for composition.

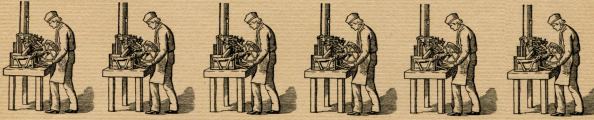


12

A Directly Engraved Matrix.
ATF Series 530 Bernhard Gothic Heavy.
96pt / 84pt titling. For a pivotal type caster.

Patrrix Cutting and Matrix Electroforming

YOU AND YOUR FRIENDS
ARE CORDIALLY INVITED TO SEE
AN EXHIBITION ON
*American Type Designers
and Their Work*
AT THE LAKESIDE PRESS GALLERIES
OF R. R. DONNELLEY & SONS COMPANY
CHICAGO, ILLINOIS

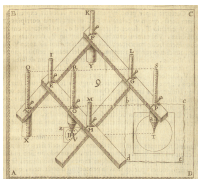
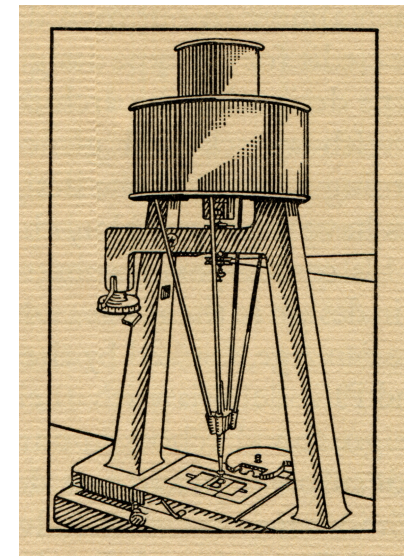


THE EXHIBITION MAY BE VIEWED FROM 9 A.M. TO 4 P.M.
MONDAYS THROUGH FRIDAYS (EXCEPT ON HOLIDAYS) FROM
NOVEMBER 3, 1947, TO FEBRUARY 27, 1948, ON THE EIGHTH
FLOOR, THREE HUNDRED FIFTY EAST TWENTY-SECOND STREET

“[in Abel Buell’s time / 1759] the making of type was entirely a hand operation. ... It was not until the invention of the Benton pantograph punch-cutting machine in 1885 that any other method was known. All type made before 1885 was therefore dependent on hand punch cutting, ...”

- Carl Purington Rollins (1947)

Rollins’ list of who designed which type remains the basis for all such lists today.*
He knew his type.
Yet he did not know that patrrix cutting existed.



* Partial earlier lists appeared in *The Inland Printer* in 1927 & 1898-1900 (Loy). 14

Widespread Use for New Types

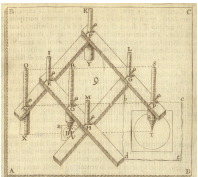
“The discovery of the electrotype process ... became an incentive to type founders to create new faces, ... This made it possible to bring out new styles at a moderate cost, as the pattern letters are cut on soft metal and electrotyped, instead of the old method of cutting everything on steel.”

- William E. Loy (1898)

“The present practice is to cut letters larger than 14-point in soft metal”

- Harry Carter (*Fournier*, 1930). Q.E.D.

See Saxe’s 2016 article for a study of the role of patrix cutting and the pivotal type caster in enabling 19th century ornamented types.



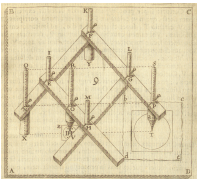
But Forgotten in the US (and England?)

Recall what Rollins said in 1947: “[no] other method was known.”

Few people in the later 20th century knew type better than Mac McGrew, but...

“WEDDING TEXT ... It is recorded that the 12-point size was cut in type metal in that year [1901], instead of cutting punches or engraving matrices directly. Electrotypes matrices were then made from these cuttings. *It is uncertain whether this new method of cutting delicate faces resulted in unusual problems and delays*, but the face was hailed as ‘new’ in 1907 and again in 1909.

- McGrew. (1993) [italics mine]



Why Forgotten?

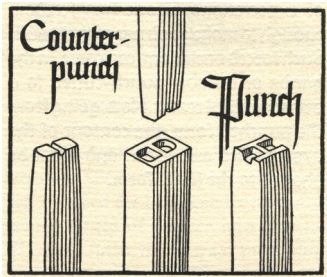
Electroforming was used for piracy; it was something the foundries didn't really want to talk about.

Type-making wasn't talked about much anyway until the 20th century. In 1898 Loy had to apologize:

“It is hoped that the publication ... may awaken an interest in the subject, ... the purpose being rather to put on record, before it is too late, such facts ... as may be worthy of record.”



R. Koch, Kredel, Chappell (1932)



Romantic

But two important 20th century reasons:

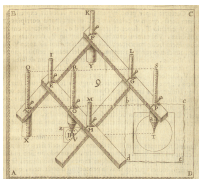
Some of the best known accounts of how type was made were written by people associated with punchcutting businesses (example: Beatrice Warde, writing in *The Dolphin*, 1935, contrasts only hand vs. machine punchcutting).

The entire emergence of type as a historically studied field, from William Morris onward, was prompted by romanticism. (See the Kochs, Hammer, Chappell, etc.) Hand punchcutting has romance written all over it. Electricity and acid baths do not.

ATF (MSJ) Foundry C (1896)



Not Romantic



Relevance to Pantographs

If we don't realize how common patrix cutting was in the 19th century, we will misinterpret the use of the typographical pantograph.

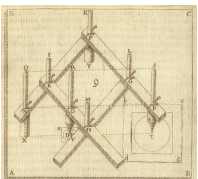
Patricia Cost's book on the Bentons is excellent and will remain the standard work on the subject for many years. But she was misled by:

- ▶ Not realizing that patrix cutting was a common technology
- ▶ Trying to integrate William Gregan's reconstructions of Benton's early work into a punch-to-pantograph worldview
- ▶ Believing Henry Lewis Bullen's fantasy about P. T. Dodge convincing Benton to try to cut punches

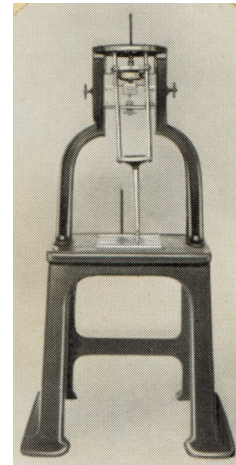
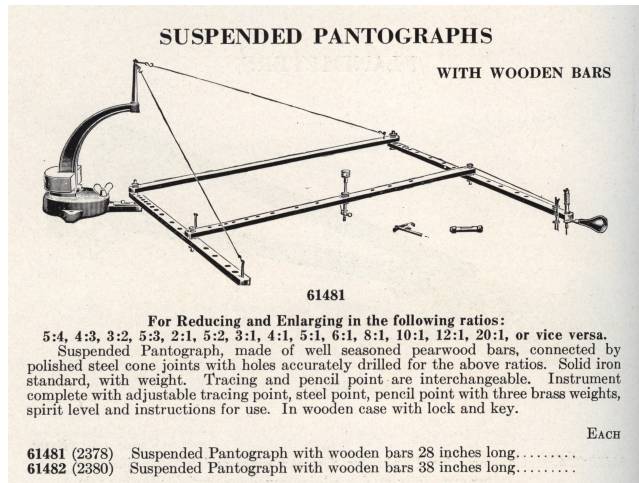
“To summarize, the first version of Benton's pantograph machine was engraving type metal originals at Benton, Waldo & Co. in Milwaukee by 1884. The second version of the machine cut the sample steel punch for Dodge. Benton received a patent for the third version in 1885.”

- Cost (2011), p. 68.

These were actually all the same machine. The real distinction is between this machine and his second vertical machine of circa 1899.

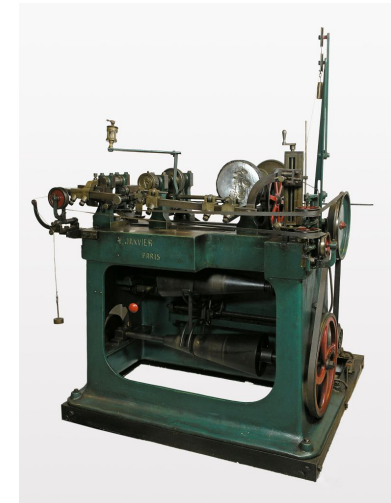


So, What Is a Pantograph? (1/2)



Benton Vertical Pantograph,
Style 2 (Matrix Engraving)

ATF 1912 specimen book



Janvier "Reducing Machine"
for making coining dies

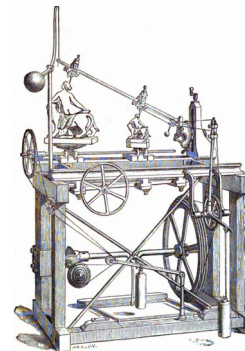
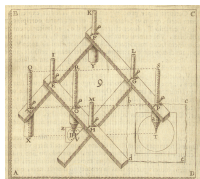
Birmingham Museums Trust

This is a pantograph Type 1: Four-Bar Machines

- ▶ Performs scaling and, optionally, transformation
- ▶ Pivot, tool, and tracer all line up for simple scaling
- ▶ Invented by Christoph Scheiner, early 17th century

B.K.Elliott Co. drafting supplies catalog, circa 1943

Both of these types
operate using a principle
of similar triangles.



Kennan, for Sculpture

1862 Exhibition catalogue

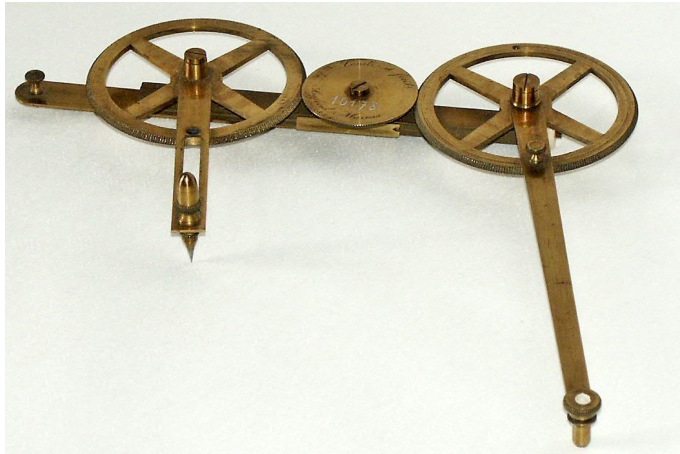


Hollerith Hand Card Punch

United States Census Bureau

Some of these were called pantographs Type 2: Single-Arm Machines

What Is a Pantograph? (2/2)



By Siegfried Marcus (Austria), 1855.

Photograph by Wikimedia Commons user "newfoundlanddog"



On the Schynige Platte railway, Switzerland

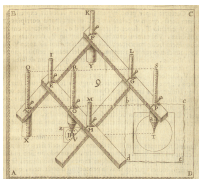
Photograph by Audrius Meskauska

Other Mechanisms of many kinds do
pantograph-like things.

Some were called "Pantographs."

Type 3: Other

This is called a pantograph, but it is not.



The German word for "pantograph" (when it isn't just "pantograph") is "storchschnabel" / "storchenschnabel" (literally "crane's / cranes' bill"). This is also a kind of geranium.

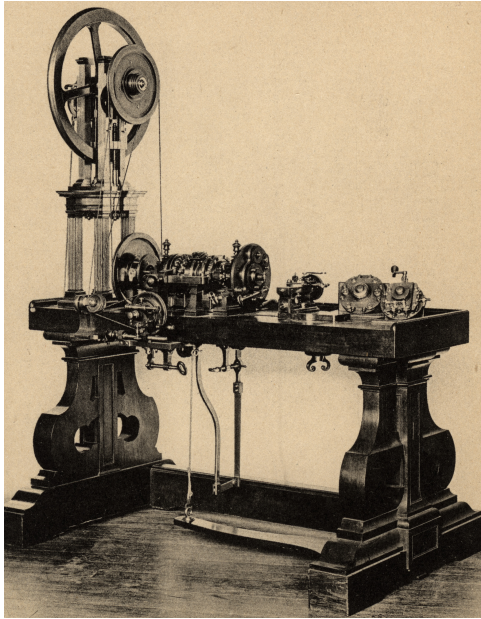


Geranium pratense /
Meadow Cranesbill /
Wiesen-Storchschnabels

Photograph by
Julie Anne Workman

The Single-Arm Pantograph, to 1884 (1/6)

The path to Benton starts a long way from Milwaukee



Origins in the Rose Engine and “Ornamental Turning” in the 16th century. This was cam-controlled geometric machining, primarily for ornamental items.

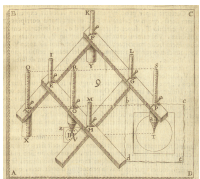
A relatively late example, constructed by Mercklein for Louis XVI prior to 1780.

From an early postcard by the CNAM

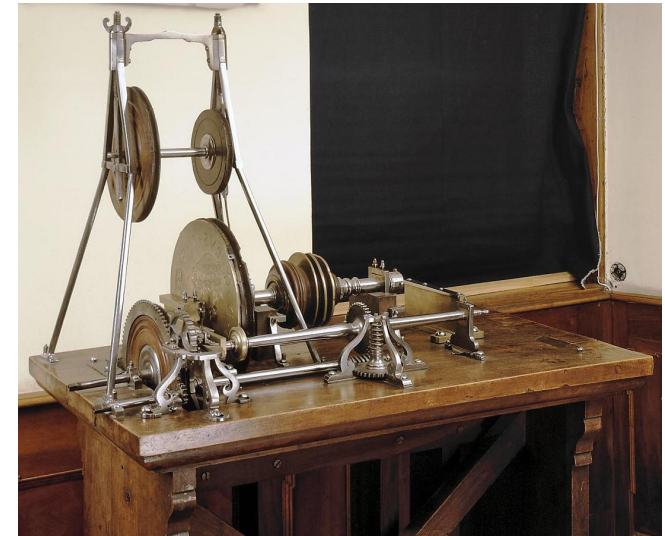
A. K. Nartov



The portrait or medallion lathe of the 18th century. Nartov (Russia, 1710s–1730s). Teubers (German, 1740). Pantograph capabilities implemented with chain and shaft mechanisms. Used to cut commemorative medals from larger patterns cut in soft materials.



Nartov’s Portrait Cutter Type 2, 1721



The images of Nartov and his lathe are copyright The State Hermitage Museum, St. Petersburg, Russia. Used here for noncommercial scholarly purposes under the terms of their permissions statement.

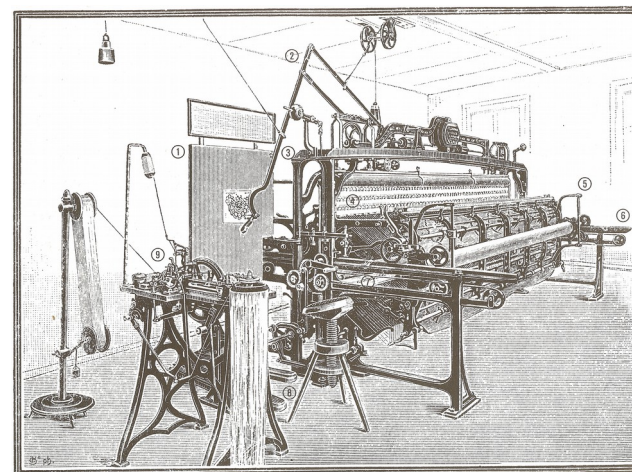
Industrial & Engraving, 1840–1880 (1/8)

Type 1 (4-Bar) & Type 2 (“Other”); Excluding Machines for Wood Type

There were a lot of them. That’s the point.

Joshua Heilmann. 1829. Handstickmaschine [Hand Embroidery Machine]. Multi-needle, 4-bar pantograph-controlled. Widespread adoption from ca. 1850; claim that 20,000 machines were in use in Switzerland in 1910.

Replaced by paper-tape controlled machines starting ca. 1890.

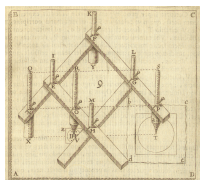


From Tanner via Wikimedia Commons

Georges Leschot (1800–1884). Watchmaking (plate drilling). Important and well-known (awarded a medal in 1845):

“En 1840 ... George Leschot modifia profondément les bases mêmes [the basic foundation] de la fabrication horlogère à Genève”
- *Journal Suisse d’Horlogerie*, 1884.

Technical notes: 4-bar, horizontal format. Spindle is supported on its own swinging frame. This is a characteristic of later Taylor-Hobson (and thence Gorton & Deckel) machines).



No freely
reproducible
images exist.

Industrial & Engraving, 1840–1880 (4/8)

A machine incorporating a 4-bar pantograph, used for engraving complex designs for printed securities. Germany, by 1864.

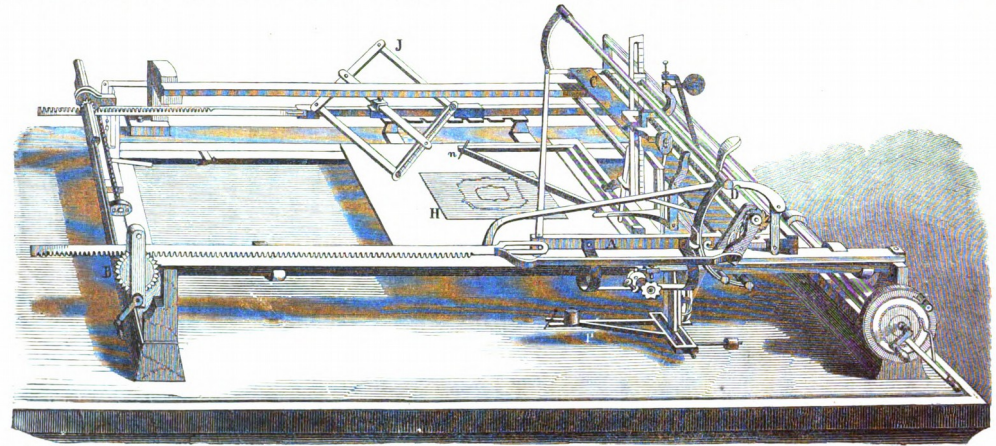
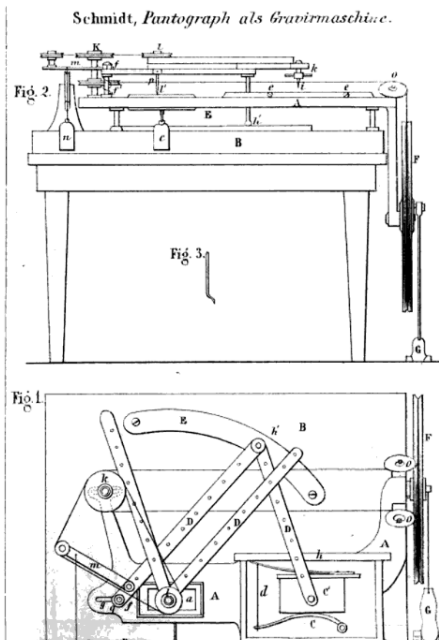


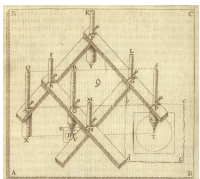
Fig. 301. Heliographmaschine von Wandorf in Braunschweig a. W.

Bobrick, E., et al., Das neue Buch der Erfindungen, Gewerbe und Industrien. [The New Book of Inventions, Trade, and Industry] 5th ed. Band 1. Leipzig: Verlagsbuchhandlung von Otto Spamer, 1864. Article: "Die graphischen Künste in kombinierter Anwendung auf die Herstellung von Wertpapieren." [The graphic arts in combined use on the manufacture of securities] Digitized by Google from the NYPL copy, via The Hathi Trust.

("Security" printing links back to Rose Engines and "ornamental turning.")



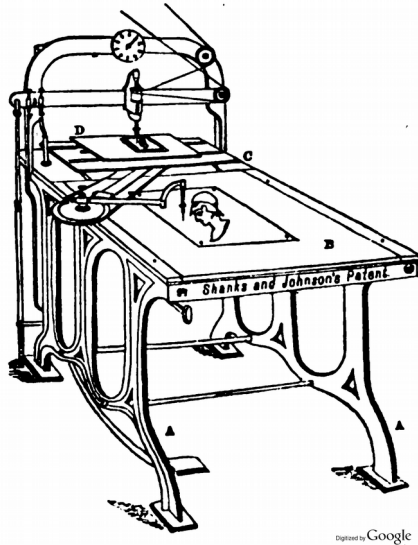
Schmidt. 1866. Germany. "Gravirmaschine."
4-bar. Not sure of its intended use.



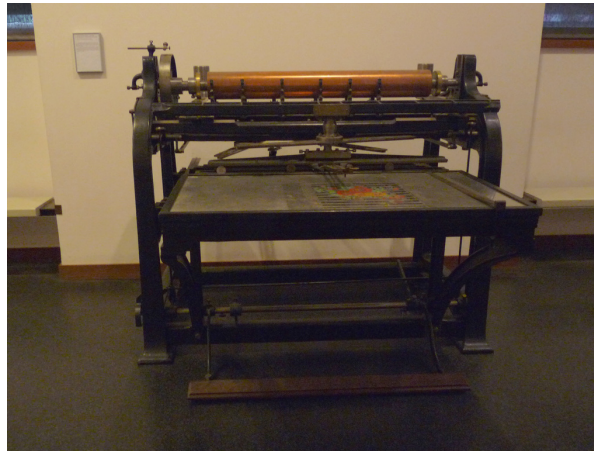
From the *Polytechnisches Centralblatt* (1866)

Industrial & Engraving, 1840–1880 (8/8)

Peter Martin Shanks. 1874
4-bar.
For wood printing plates



From *Ure's Dictionary* (Hunt, 1878), Vol. IV Supplement



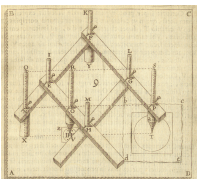
Circa 1879 English.
Very similar to Keller-Dorian (1883)



Unidentified

Two pantographs for engraving rolls for
printing calico, Musée de l'impression sur
étoffes de Mulhouse, France. By Ji-Elle, 2012

Note: Brocade Engines (developments of the portrait lathe,
really) continued in use throughout and into 20th century



Summary, Circa 1880

Well-established Victorian High-Tech

Precision pantographs dominate these industries:

- Minting/Coinmaking
- Calico printing rolls
- Wood Type

Precision pantographs are significant in these industries:

- Watchmaking
- Banknote/Securities engraving
- Optics (lens engraving)

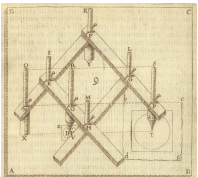
Perhaps lesser-precision pantographs dominate these industries:

- Sculpture Reproduction
- Hand embroidery (in Switzerland)

Pantographic Engraving for lettering is common

Pantographs also used for:

- Wood (relief) and copper (intaglio) printing plate making
(especially in map making and scientific work)



The First Pantograph in Metal Type Making

Not Benton. Central Type Foundry, St. Louis, 1882.

Machine made in Germany.

Imported by the Cincinnati Type Foundry in 1880.

Acquired/used by the Central Type Foundry, 1882.

Operated by William A. Schraubstadter.

Patterns made by Gustave Schroeder (how?).

First faces: Geometric (1880, but to Pica only),
Geometric Italic (1883), Scribner (1883),
Morning Glory (1884).

Horizontal machine; presumably four-bar.

Direct matrix engraving in brass.



WILLIAM SCHRAUBSTADTER.
Who originated the lining system.

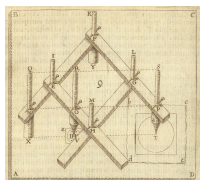
The Inland Printer (1907)

15a 10A c 24-POINT GEOMETRIC. \$5.00

HANDSOMER
Combination 18

24a 10A c 18-POINT GEOMETRIC. \$4.50

ANGULAR SHAPES
Squares Designed 36



From an 1892 Central Type Foundry specimen book

Evaluating the Evidence

How do we know this?

Loy (1898). Schroeder “made for Central the patterns for Geometric Italic, Morning Glory, and Scribner, of which matrices were cut in brass by machine.”

Nicholas Werner, writing many years later:

1925. *American Printer*. [I have not seen this yet]

Data: Schraubstadter. Matrix engraving.
Geometric, Geometric Italic, Morning Glory.

1927. *The Inland Printer*. (“St. Louis’ Place...”)

Data: Schraubstadter & Schroeder.
Direct Matrix Engraving
Geometric, Geom. Italic, Morning Glory

1931. “St. Louis in Type Founding History”

Data: Pantographs were horizontal

1932. Weibking obituary in *The Inland Printer*.

Data: Machine imported 1880
To Central T.F. in 1882
Typewriter .



NICHOLAS J. WERNER.

From Loy in *The Inland Printer* (1899)

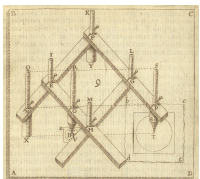
Why should we believe him?

He was there.

He later acquired this machine and used it (with Schroeder and on his own).

What he says fits with Loy’s biographies him (and of Schroeder).

Unlike Bullen, he did not tend to make things up.



Geometric. Boston T.F. showing 1880 (4 sizes, Nonpareil to Pica). US Design Patent 12,123 (1880-12-14).
Geometric Italic. *Printers Circular*, March 1883. US Design Patent 14011 1883-06-26 (drawings missing).
Morning Glory. 1882 (Werner) or 1884 (Robert Mullen). Named after Morning Glory Johnston.
Typewriter (Central). First typewriter face (Annenberg, TFOA).
Scribner. 1883 (Robert Mullen).

Benton's First Vertical Pantograph

Actually, we know very little.

Bullen's stories don't hold water:

- ▶ No evidence that Benton was ever working on a composing machine
- ▶ Not true that there were no punch/patrix engravers available
- ▶ Story of P. T. Dodge and the first punch is demonstrably false

What do we know?

1882. Patent record shows Benton working on a mold for casting leads (US 254,792)

1883. No information

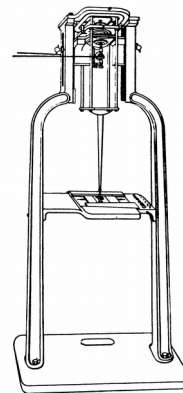
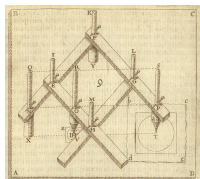
1884. Feb. 29, 1884. Pantograph patent filed (issued Dec. 22, 1885 as US 332,990)
Patent specifies only punch cutting.

1884. July. Trade Note in *The Inland Printer* claiming **the ability to cut punches in steel.**

1888. Contract punchcutting for Merg.

1889. First machines leased.

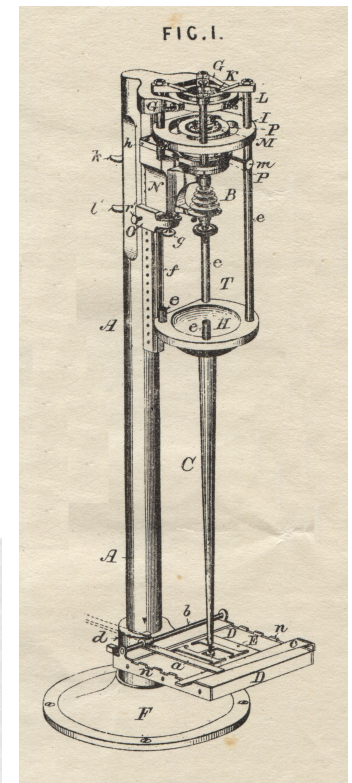
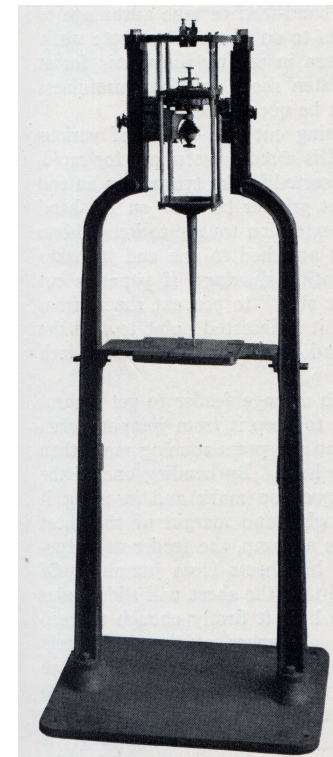
Although the two images at right are later, they look almost exactly like the one shown in the 1891 Benton-Waldo Type Foundry brochure (Cost 2011, p. 68)



The Benton punch-cutting machine.
Height, 5 feet 4 inches; floor space, 22 x 28 inches.

From DeVinne (1900)

Identifying feature: WW lathe headstock as spindle



From the English version of the 1884/5 patent
My thanks to Mark Knudsen

Question: Do any survive?

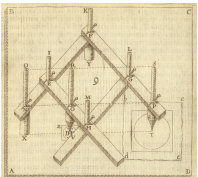
From *The Inland Printer* (1924).
Rehak (1993) has a higher-quality version of this photo.

Benton Cutting Punches in Steel

From the “Items of Interest” column in
The Inland Printer, Vol. 1, No. 10 (July 1884): 21.

BENTON, WALDO & Co., of Milwaukee, claim to have perfected a machine for cutting punches for original characters for type foundries in steel,—an invention which will much cheapen the ordinary process of cutting by hand. It will cut from the largest to the smallest punch—even to half-diamond; while as a time-saver, we may state that a piece of work now requiring four hours to perfect by the hand process can, under its operation, be turned out in *half an hour*.

This, by the way, is how we know that Bullen’s 1923 story that P. T. Dodge of Mergenthaler Linotype is false. The Mergenthaler company only became aware of Benton *after* the Blower Linotype (1886), which used (first) electroformed matrices and (later) mats from hand-cut punches. But Benton could cut punches in steel at least two years earlier.

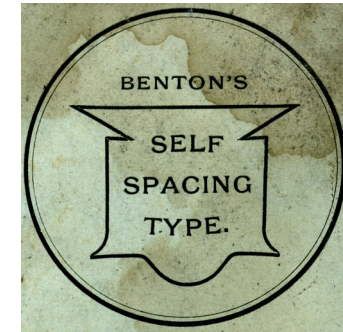


Benton's Accomplishments

- ▶ Werner (1931) attributes to Benton the first *Roman* faces cut by machine.



Benton, Waldo & Co. Typographic Specimens. (1886). Stephen O. Saxe.

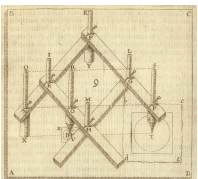


We do not know which face Werner meant, but Benton was busy cutting his “Self-Spacing” (unit-set) types during this period.

- ▶ The first *successful* pantograph of this style:
 - Single-arm in vertical format
 - Horizontal pattern and workpiece
 - Rotary spindle
 - Variable-length arm to solve problem of distortioncf. Hulot/Janvier (circular) and Hollerith (distorted)▶

- ▶ **He kept going.**

- ◆ Second vertical pantograph, for matrix engraving, circa 1899
- ◆ Decades of hard work at ATF, with M. F. Benton
- ◆ At least three other pantographs:
 - 1899 “Opto-Mechanical” machine for reverse-engineering
 - Modified machines (the “Ad-Cut”)
 - Wax plate machines
- ◆ He was a modest man who aligned himself with a very good P.R. machine



Schroeder & Werner, 1889–?

The First Matrix Engraving Service

Gustave F. Schroeder and Nicholas J. Werner.

Left the Central Type Foundry in 1899 and formed a partnership

Schroeder had another pantograph made by the Boyer Machine Company
(the same company built the prototype Burroughs adding machines)

Together they cut:

For the Central: DeVinne (first eight sizes),
Victoria Italic (first eight sizes)
Hermes, Jefferson, Novelty Script,
Multiform, Johnston Gothic (l.c.)

For the Boston: Façade Condensed

For BB&S: Era series

Schroeder left for California in 1891

Werner continued, cutting: DeVinne & Victoria Italic (finished), Quentell,
Flemish Extended (for Stephenson, Blake),
Caxton Bold (four larger sizes, for BB&S)

Werner designed and cut: DeVinne Condensed, DeVinne Italic,
Midgothic, Antique No. 6

Werner joined the Inland (1895) and for them cut at least part of:
Skinner, Gothic No. 8, Extended Woodward,
Condensed Woodward, [+2 more ca. 1898]

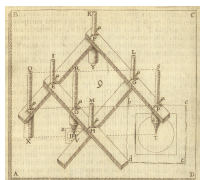
Schroeder continued, cutting: Aldus Italic (four sizes), Sierra (eight sizes),
French Old Style No. 2 (18 point),
Victoria Italic l.c. (6 to 24 pt)

Werner must have continued cutting by machine; it isn't clear if Schroeder did.



GUSTAV F. SCHROEDER.

From Loy in *The Inland Printer* (1898)



Sources: Loy's biographical sketches of Schroeder and Werner.
Werner's 1927 1931, and 1932 articles.

Wiebking/Hardinge Pantograph

The Inland Printer (1932)



ROBERT WIEBKING

Robert Wiebking
(1870–1927)

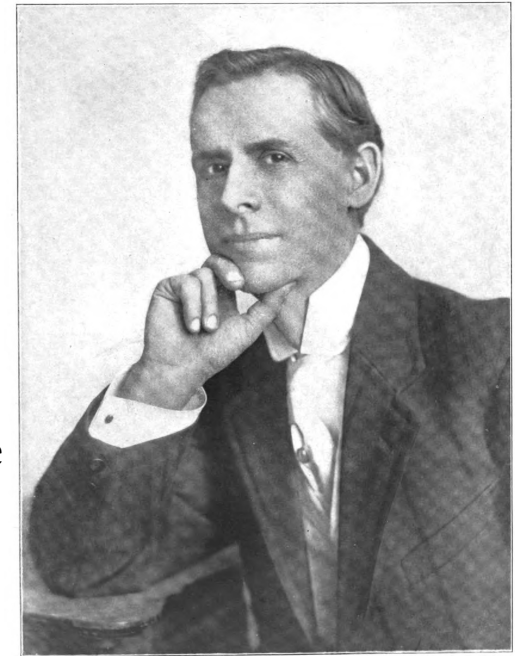
Wiebking born in Westphalia (Kingdom of Prussia). Family emigrated to USA in 1881. Apprenticed to a commercial engraver in 1884. Started in business in 1893.

Hardinge born in Ontario. Co-founded Hardinge Brothers machine tool company in 1890; left in 1895.

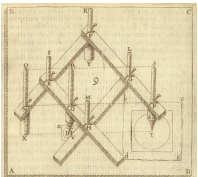
Wiebking and Hardinge build their first pantograph matrix engraver in 1894.

Wiebking designed several faces and cut many more, including Goudy's early work. Wiebking & Hardinge also have a history as typefounders (Hardinge type casting machine and the Advance Type Foundry), but that's a story for another time.

The Public (1909)

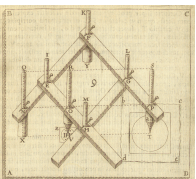
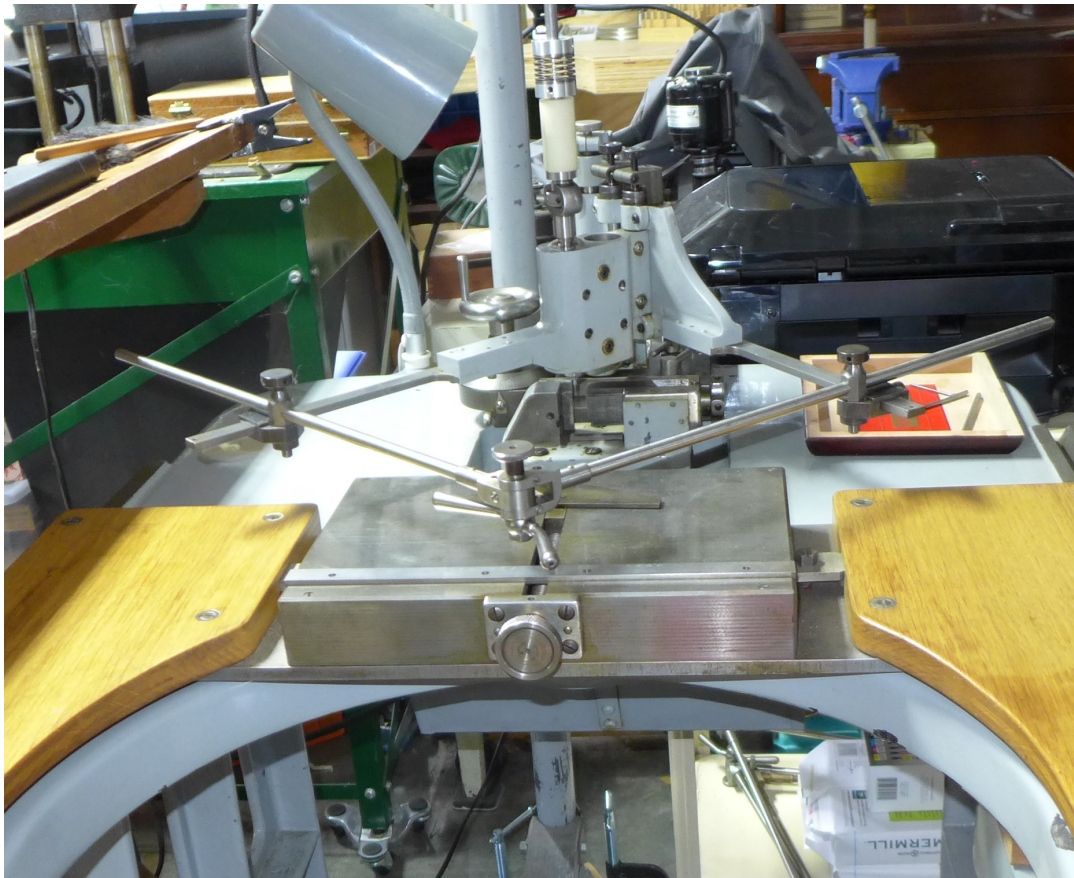


Courteously Yours
Henry H. Hardinge



One of the Survivors

The ex-Ludlow Wiebking/Hardinge Pantograph
at CircuitousRoot, August 2018



The light bulb on top glows brighter
as the motor turns faster.

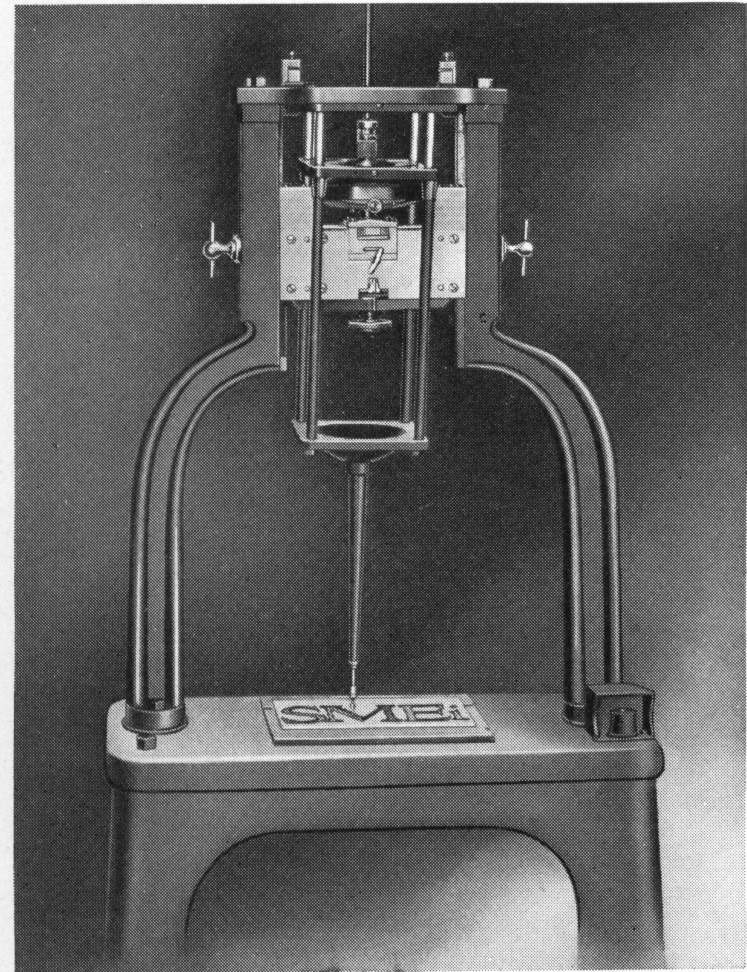


Benton's Second Vertical Pantograph

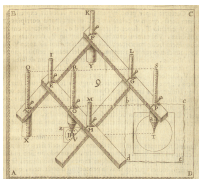
US Patent filed Jan. 17, 1899 (issued 1906).

Patent specifies both matrix and punch cutting.
Several of its claims refer to matrix cutting specifically.

Removable quill (patent for its cutter grinder not filed until 1900).



The celebrated Benton Matrix Engraving Machine, invented by L. B. Benton, director of the General Manufacturing Department of the American Type Founders Company, which manufactures the machine. It has completely revolutionized the art of matrix making.



Clarity of Language



This is not a “Frigidaire”

(1927 General Electric “Monitor Top” Refrigerator, photographed by “Magi Media”)



This is not a “Ford”

(1931 Chevrolet Series AE Independence Phaeton, photographed by “Qflieger” in Germany)

This is not a “Benton”

(Pierpont / English Monotype punch engraving pantograph, shown in Legros & Grant (1916))

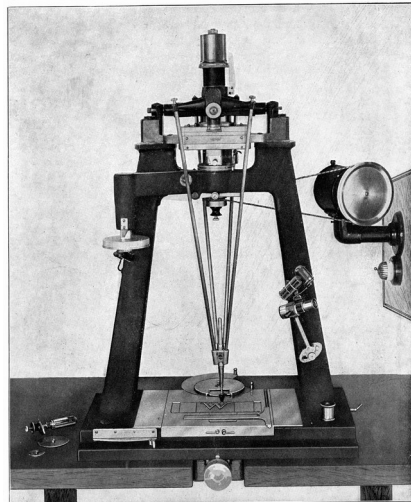
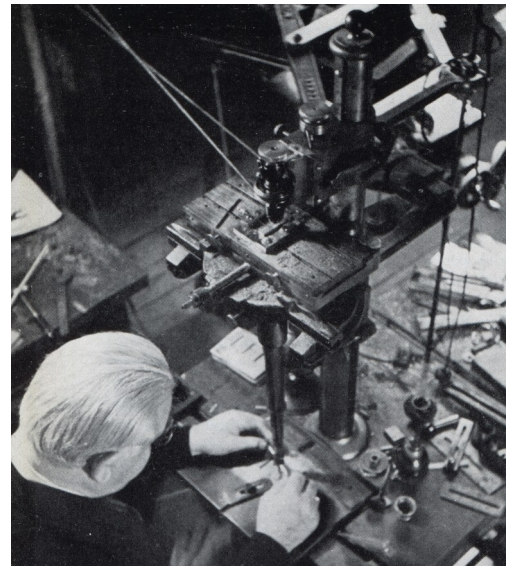
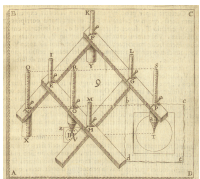


FIG. 162.—Pierpont or Monotype punch-cutter.



Neither is this

(Goudy at work on his Engravers' & Printers' Machinery Co. Model D rotary spindle pantograph engraving machine, just before the 1939 fire.)



Benton, Wiebking and Pierpont worked to tolerances in the hundred-thousandths of an inch. We do them a disservice if we cannot even name their machines properly.

Benton's "Opto-Mechanical" Pantograph

US patent 790,172, filed July 21, 1899 (issued 1905).
 In 1906 Benton called this his "delineating machine."

Reverses a regular pantograph. Microscope is the optical tracer; can trace an existing type. Pen draws at an enlarged scale.
 Can tilt the type to condense and expand design.
 Microscope automatically adjusts its height to keep in focus over a tilted type!

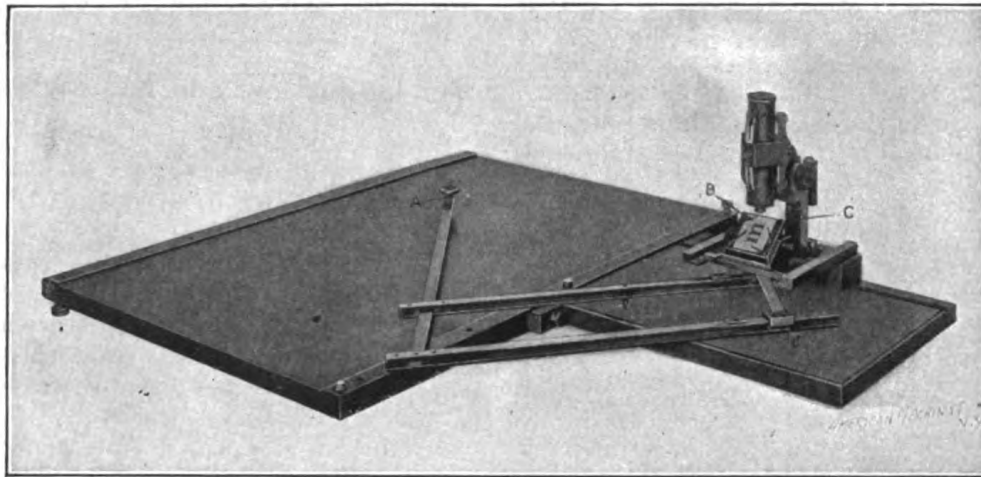
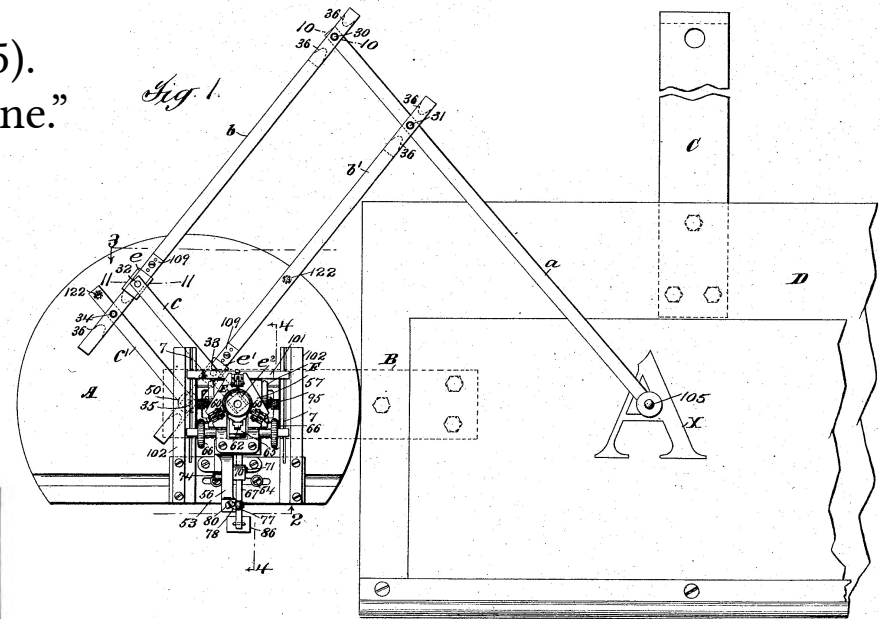
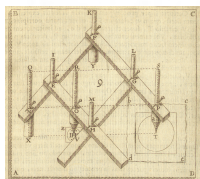
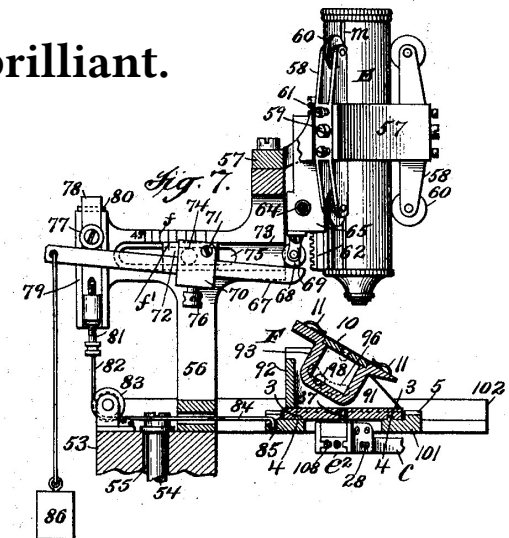


FIG. 1. DELINEATING THE CHARACTERS

A, tracing point; B, fingers for clamping character; C, bed plate showing angle possibilities.

This is just brilliant.



From Kaup in *American Machinist* (1909)

(I'm avoiding the term "Benton Delineator," as it has been used ambiguously in the past.)

20th Century Benton-Vertical Derivatives (1/5)

Linotype & Machinery Ltd. (UK)

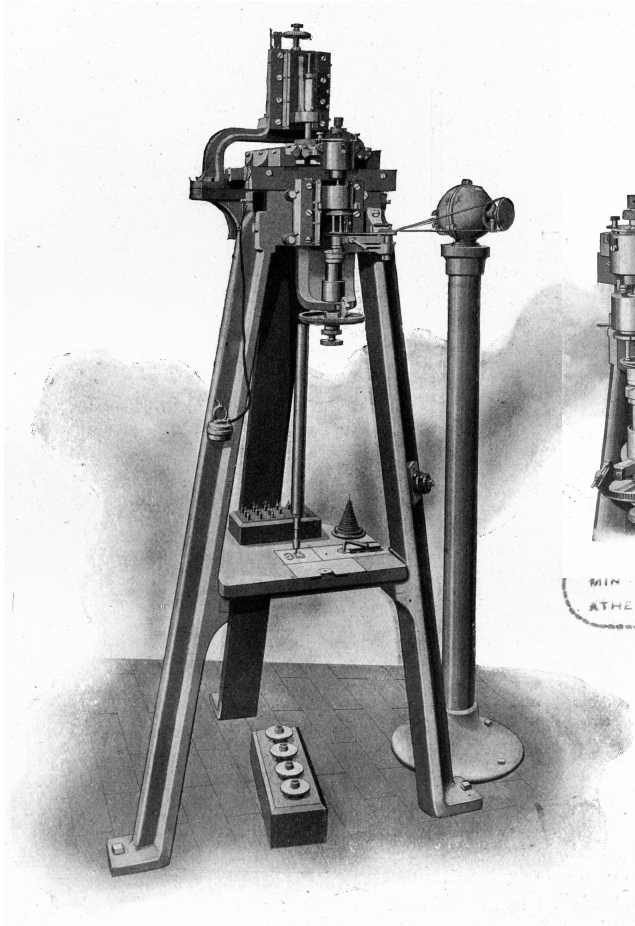


FIG. 159.—Barr or Linotype punch-cutter.

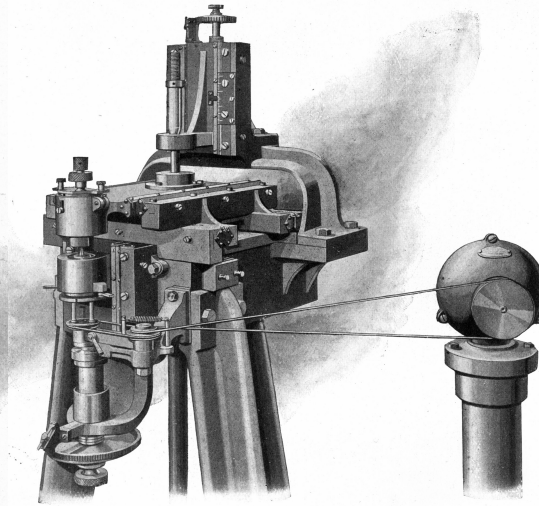


FIG. 160.—Barr or Linotype punch-cutter; details.

Legros & Grant (1916)

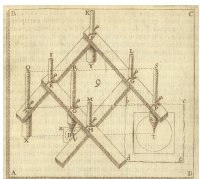


Science Museum, London
Later, make unknown

Mark Barr, for The Linotype Co. / Linotype & Machinery Ltd.

Patented ca. 1902 (GB ?, US 759,957, filed 1902)

Note: Barr patented a wide variety of pantographs and related devices. Note to self: See also GB 22,106 of 1900, pantograph with microphone annunciator.



Barr, 1902

20th Century Benton-Vertical Derivatives (2/5)

English Monotype

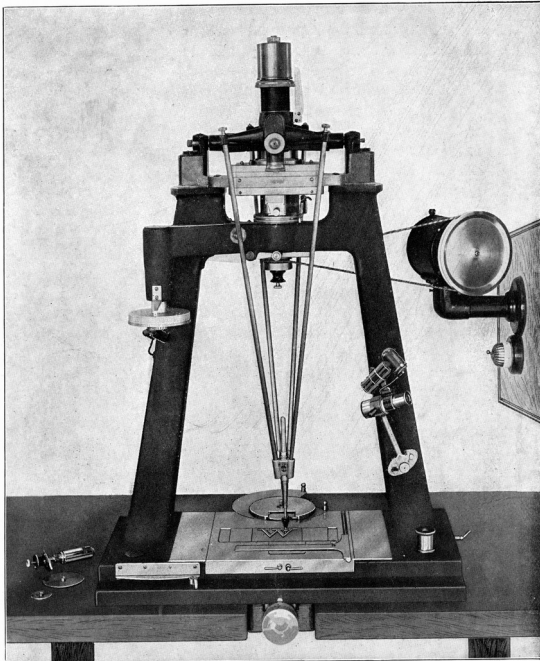
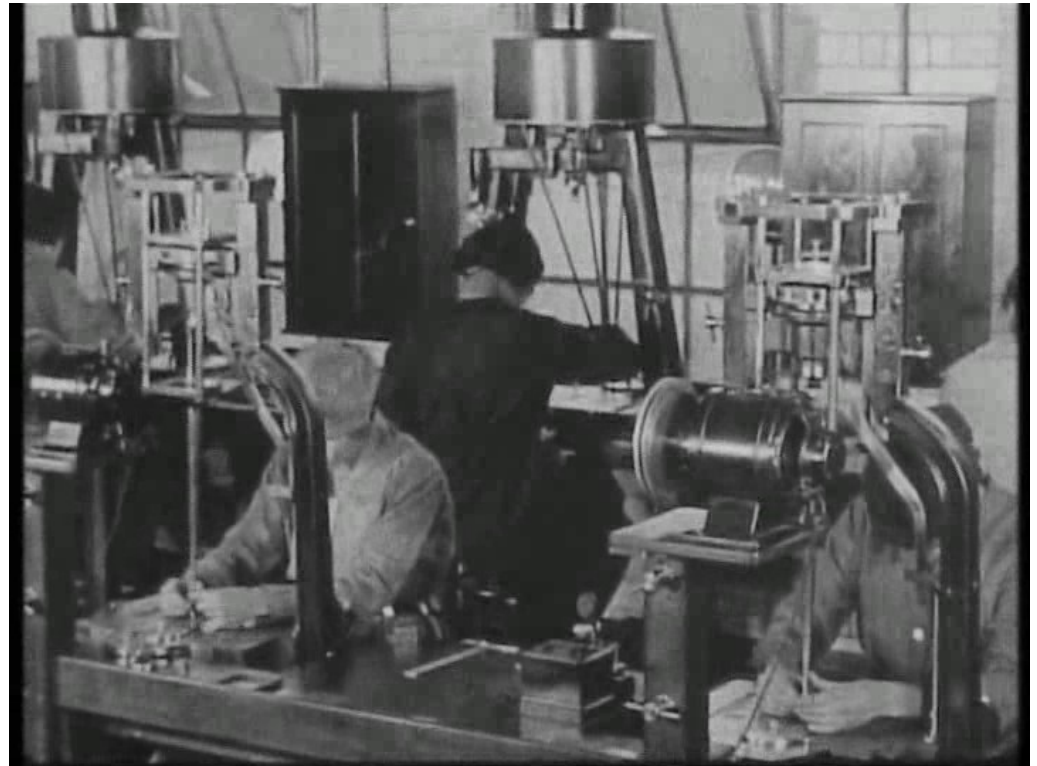


FIG. 162.—Pierpont or Monotype punch-cutter.

From Legros & Grant (1916)

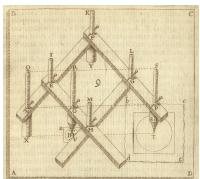


From film *A Monotype Composing Machine* (1925)

Frank Hinman Pierpont.

Patents filed 1906 (GB 7206 of 1906, US 938,074).

But *two* styles shown in 1925 and 1956 films - one much more like Benton's.



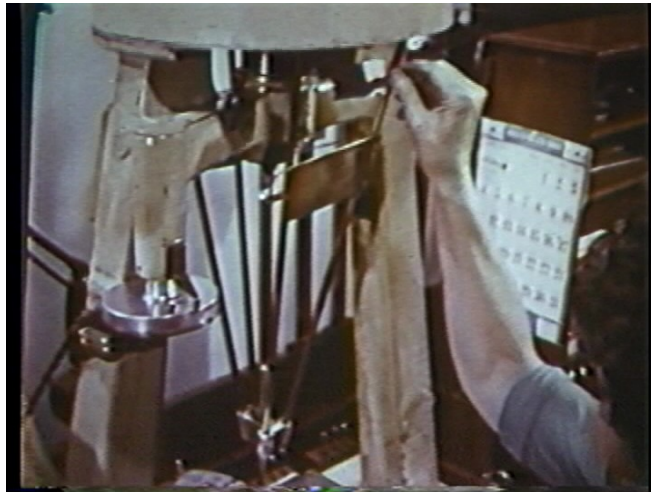
The ex-Lanston (US) machine which went to Hartzell, then M&H, then Giampa was a Pierpont machine (Fritz Klinke has a photograph of it online).

20th Century Benton-Vertical Derivatives (3/5)

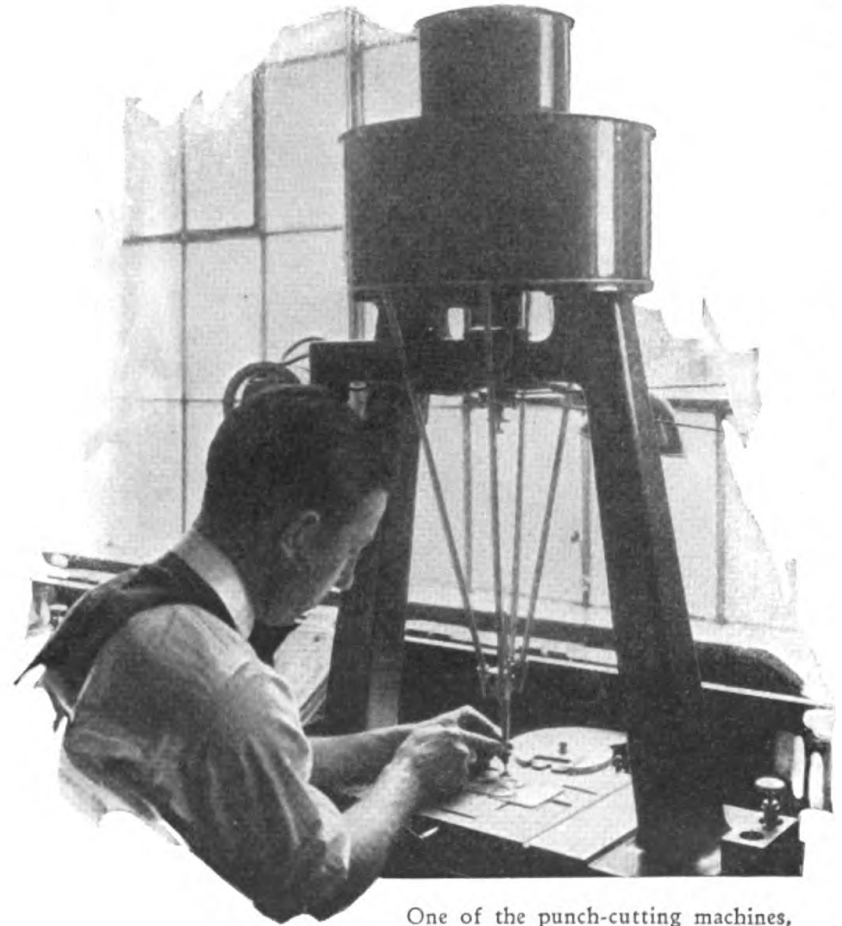
Mergenthaler Linotype (US)

An illustration in Wilkes (1990), p. 57, shows Barr vertical punchcutting pantographs in an “amerikanischer Gießerei vor 1900” (but Barr’s machine does not date to before 1900). It is possible that this is the Mergenthaler Linotype Company

By 1923, MLC was using a machine which looks a great deal more like a Pierpont. The same machine appears in their 1961 film *The Eighth Wonder*.

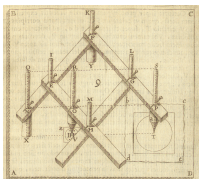


The Eighth Wonder (1961)



One of the punch-cutting machines,
a triumph of accuracy and precision.

Linotype Bulletin (1923)



20th Century Benton-Vertical Derivatives (4/5)

Intertype.

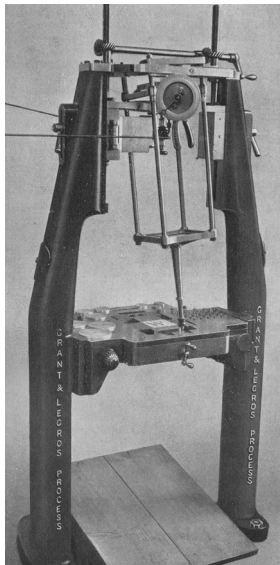
Photographs by Stan O. Coutant of the Intertype factory in Brooklyn in 1966 show machines very similar to the late machine from Linotype & Machinery Ltd.

A machine which looks exactly like a Pierpont machine is now owned by an ATF member. It is said to be ex-Intertype.

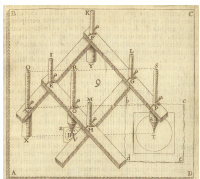


Intertype Factory Tour 1966

Formerly online on S. O. Coutant's website.
Now reposted to Dave Hughes' metatype.co.uk site.

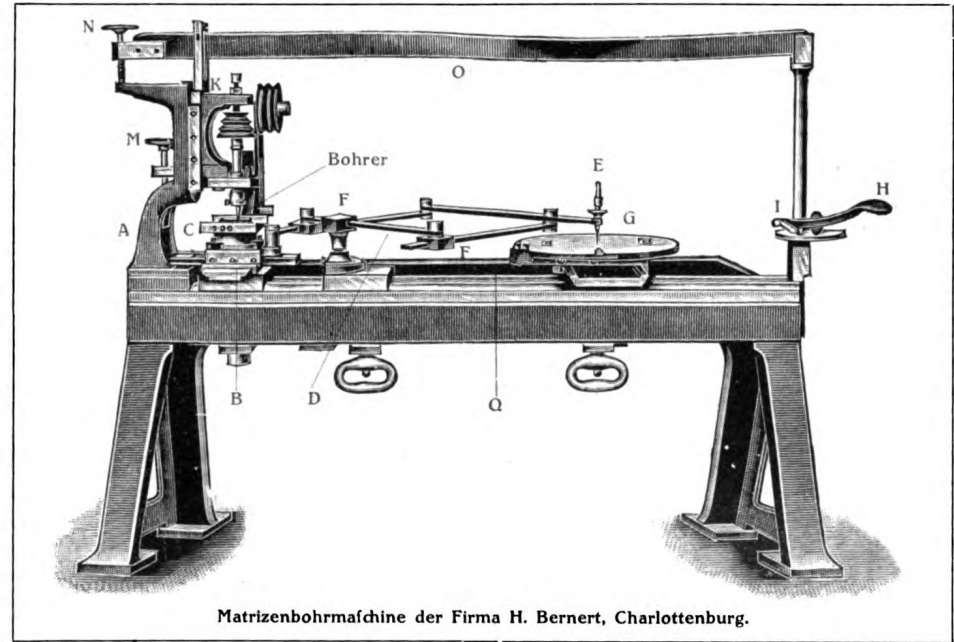


Naturally, John Cameron ["Poet of Empire"] Grant and Lucien Alphonse Legros made their own.



20th Century Other Typographical (1/7)

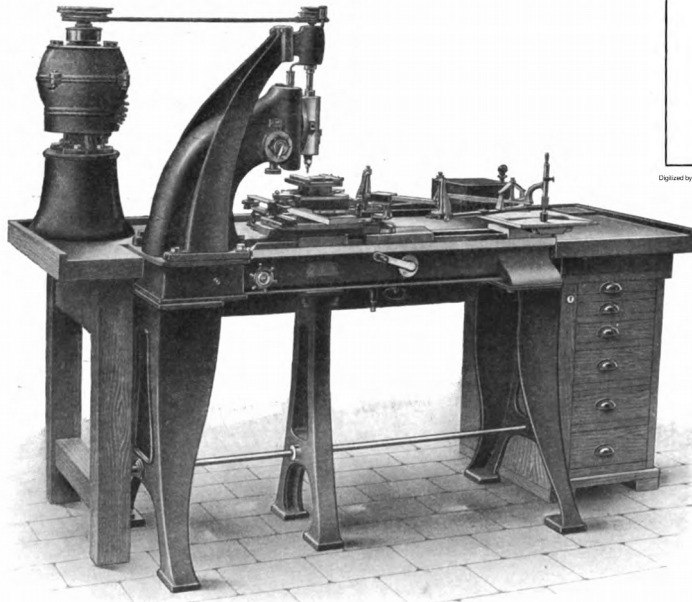
Some European foundries such as Stempel seemed to use Benton-derived machines. In those which did not, this general style of horizontal four-bar pantograph (storchschnabel) seemed common



Matrizenbohrmaschine der Firma H. Bernert, Charlottenburg.

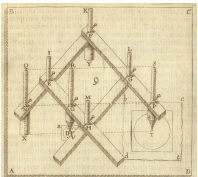
Digitized by Google

Two German matrizenbohrmaschinen, by Emil Gursch and H. Bernert, from an article by Julius Wernicke in *Klimsch's Jahrbuch*, 1909.



Digitized by Google

Graviermaschine der Firma Emil Gursch, Berlin.

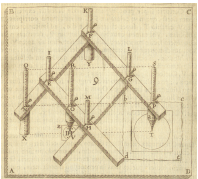


My thanks to Patrick Goossens for discovering this article.

20th Century Other Typographical (3/7)

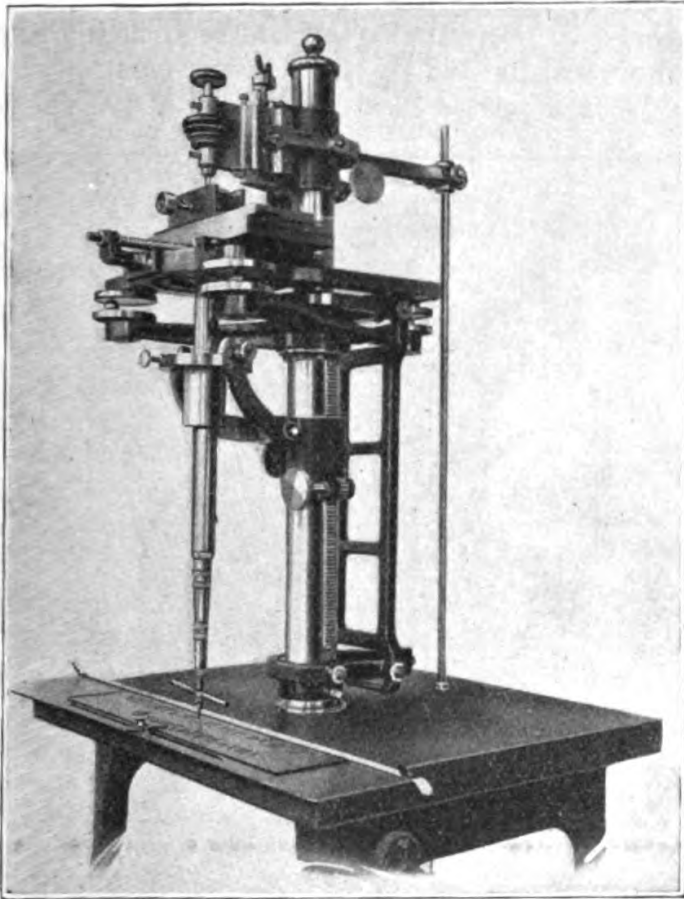
An unidentified pantograph in the Musée Renaudot, Loudun, France. According to its placard, it came from the Deberny & Peignot foundry.

Lane & Lommen (*Dutch Typefounders' Specimens*, 1998) show a photograph of the engraving room at Typefoundry Amsterdam in 1948 which has two (unidentified) horizontal-format 4-bar pantographs. Each is built into a kind of desk.



Photograph by Patrick Goossens

20th Century Other Typographical (4/7)

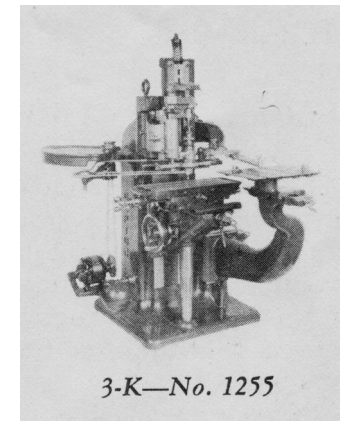


American Machinist (1919)

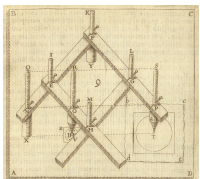
Goudy used Model D rotary spindle machines made by the Engravers' & Printers' Machinery Co. of Sag Harbor, NY. Shown here from *The American Machinist* at its introduction in 1919.

History back through Eaton (ca. 1900) to Engle (1880s)
History forward to Cronite

Gorton adopted the removable quill concept on several of its machines, making them suitable for matrix engraving. But this is their 3-K Matrix Machine, (shown in a 1935 catalog). Weight: 1,800 pounds.



Gorton Form/Catalog 1385 (1935)



In a 1999 LETPRESS posting, Bill Simon (editor of *The Ludlow Quarterly*) said that matrix engraver “Henry Sheer (sp)??” in NY used a “Godzilla sized” Gorton engraver weighing 2,500 pounds to make Ludlow and Linotype mats. Allowing for some exaggeration, that suggests a 3-K.

Summary of Technologies - 20th Century

Type-makers will use every technology that works.

Hand punchcutting did continue into the 20th Century. See Lane (1991).

Industrially: E. P. Prince, Louis Hoell, Charles Malin,
Paul Rädisch, August Rosenberger, Henk Drost, . . .

Revivalists: Rudolf and Paul Koch, Victor Hammer, Dard Hunter.

Later 20th C.: Nelly Gable, Christian Paput, Dan Carr, Stan Nelson, . . .

It continues today, though at a very much reduced scale.

Hand patrix cutting continued into the 20th Century in Europe.

Bauer, Stempel, Typfoundry Amsterdam, Enschedé, ...

Machine patrix engraving continued into the 20th Century

Compositype, [probably Lanston], ...

[need to find more evidence and more closely examine what we know]

Machine punchcutting remained important, esp. for matrix *manufacturers*.

Machine matrix engraving became important (esp. at ATF)

Pantographs from two major, and some minor, traditions:

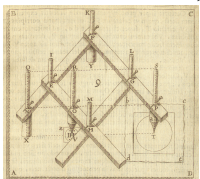
- ◆ Single-arm machines derived from Benton
- ◆ 4-bar machines — Wiebking, “Gursch/Mahr” style, [Gorton?], ...
- ◆ Goudy’s E&PM, Duensing’s Preis, Rimmer’s Ogata, ...

Despite hand methods, 20th century was the age of the pantograph.

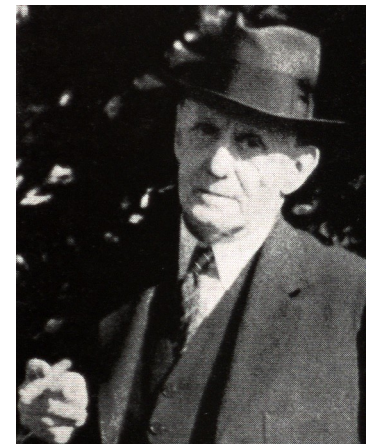
Linotype Ad, Mar. 1942



Inland Printer, v. 108, n. 6



Updike Obit., Mar. 1942



Inland Printer, v. 108, n. 6

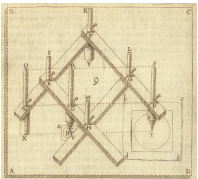
Not everybody was happy about this.
It is worthwhile to understand why.

(caution)

I'll be tangling two threads here:

- The mechanization of type-making at any size.
- The mechanical (or algorithmic) scaling of type.

It is difficult to untangle them,
as they're aspects of the same technological history.



Contemporary Opposition

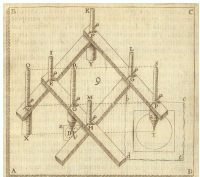
(It just seemed wrong to transcribe Updike with modern digital lettering. So here is what he said as he set it, in *Printing Types* (1922), p. 11.)

But a design for a type alphabet that may be entirely successful *for the size for which it is drawn*, cannot be successfully applied to all other sizes of the same series. Each size is a law unto itself, and is often bettered by modifications in the original design made by the feeling and taste of the designer.

Parallels with other fields - there were common objections to the Reducing Machine in coining/minting. Here's a relatively late example:

The greatest and indeed the most devastating innovation was the introduction in the late eighteenth century of the reducing machine. ... Ultimately, coins and medals depend ... upon working directly in the dies to produce toreutic qualities at a size and scale appropriate to them.”

- Ayres, *The Artist's Craft* (1985): 175-6.



(“toreutic” just means “metalworking”)

Contemporary Support

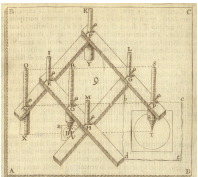
“The machine has not killed good craftsmanship; the machine in the hands of the craftsman is merely a more intricate tool than any that was available to the earlier worker, and *enables him to carry out his own creative ideas more exactly* than can be done when the work is passed into the hands of artisans ... *[who] obviously cannot realize fully* just what was in the type creator’s mind, and therefore cannot carry out the work absolutely in the spirit in which he worked.”

- Goudy. *Typologia*. (1940) [italics mine]

Modern comment in support of Reducing Machines:

“The reducing machine has been much blamed for the decline in standards of design and execution in modern coinage. This criticism is based on a confusion of ends and means, for the reducing machine in the hands of artists like Pistrucci and William Wyon was the mere servant of their skills, and did not diminish the quality of their work.”

- Pollard (1971): 317



Plan of Analysis

What is a “Typeface”?

I haven't found the first use of the term yet. It is not attested in the OED 1st ed.

Not a “natural” category.

The concept arose in the late 19th century.

You cannot understand type before ca. 1850-1870 by thinking in terms of typefaces.

This concept was a part of a general move to regularize type in the late 19th century.

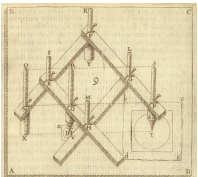
It predated the pantograph, but the pantograph enabled its full expression.

Can you always scale type algorithmically?

Yes, you can, and

No, you can't.

These are issues which arose out of the pantograph and its successor, the computer.



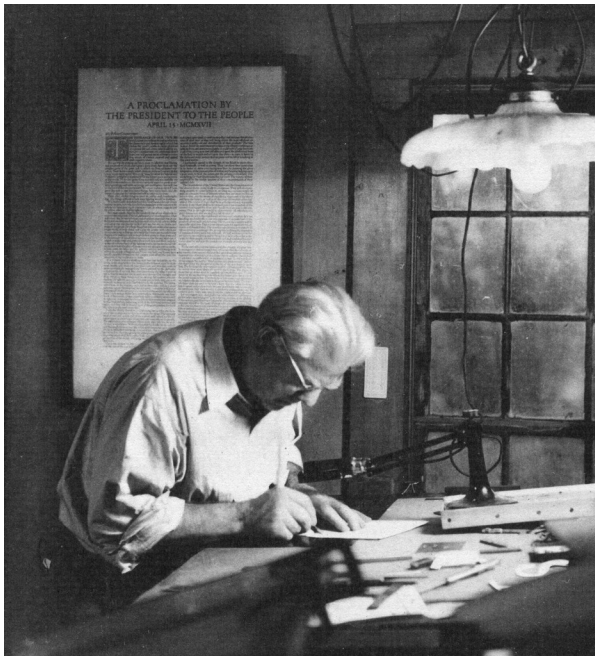
The Evolution of the Concept of a “Typeface”

Today: A “typeface” is a design.

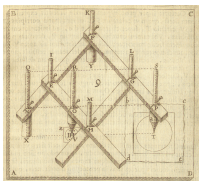
Covers many variations
(size, weight, roman/italic,
condensed/expanded, etc.)

But is essentially unified.

An expression of a designer’s intent.



Lewis (1941)



Goudy. The first Type Designer as Rock Star

Bruce's 1828 Specimen Book (1/2)

There are no typefaces in this specimen book.

MERIDIAN.

Quousque tandem abutere, Catilina, patientia nostra? quamdiu nos etiam furor iste tuus elud
ABCDEFGHIJKLM
\$ 1234567890 £

GEORGE BRUCE,

NEW-YORK.

DOUBLE COLUMBIAN.

Quousque tandem abutere, Catilina, patientia nostra? quamdiu nos etiam furor iste tuus eludet? quem ad finem sese effrenata jactabit audacia? nihilne te nocturnum præsidium palatii, nihil urbis vigiliæ, ni
ABCDEFGHIJKLMNQRST
\$ 1234567890 £

GEORGE BRUCE,

NEW-YORK.

PICA, No. 1.

Quousque tandem abutere, Catilina, patientia nostra? quamdiu nos etiam furor iste tuus eludet? quem ad finem sese effrenata jactabit audacia? nihilne te nocturnum præsidium palatii, nihil urbis vigiliæ, nihil timor populi, nihil consensus bonorum omnium, nihil hic munitissimus habendi senatus locus, nihil horum ora vultusque moverunt? patere tua consilia non sentis? constrictam jam omnium horum conscientia teneri conjurationem tuam non vides? quid proxima, quid superiore nocte egeris, ubi fueris, quos convocaveris, quid consilii ceperis, quem nostrum ignorare arbitraris? O tempora, o mores! Senatus hoc intelligit consul videt: hic tamen vivit. Vivit! imo vero in senatum venit: fit publici consilii particeps: notat et designat oc

ABCDEFGHIJKLMNÓPQRSTUVWXYZ

ABCDEFGHIJKLMNÓPQRSTUVWXYZÆE

\$ 1234567890 111123357
234834888

PICA, No. 2.

Quousque tandem abutere, Catilina patientia nostra? quamdiu nos etiam furor iste tuus eludet? quem ad finem sese effrenata jactabit audacia? nihilne te nocturnum præsidium palatii, nihil urbis vigiliæ, nihil timor populi, nihil consensus bonorum omnium, nihil hic munitissimus habendi senatus locus, nihil horum ora vultusque moverunt? patere tua consilia non sentis? constrictam jam omnium horum conscientia teneri conjurationem tuam non vides? quid proxima, quid superiore nocte egeris, ubi fueris, quos convocaveris, quid consilii ceperis, quem nostrum ignorare arbitraris? O tempora, o mores! Senatus hoc intelligit, consul videt: hic tamen vivit. Vivit! imo vero etiam in senatum venit fit publici consilii particeps: notat et designat oculis ad cædem unumquemque nostrum. Nos

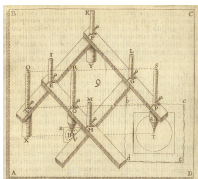
ABCDEFGHIJKLMNÓPQRSTUVWXYZ

ABCDEFGHIJKLMNÓPQRSTUVWXYZÆE

\$ 1234567890 £ 111123357
234834888

Types not named.
Identified only by size.
In only a few styles.

In a few instances
also numbered.



Bruce's 1828 Specimen Book (2/2)

FOUR LINE PICA SHADED.

WASHINGTON

James Monroe.

MERIDIAN SHADED.

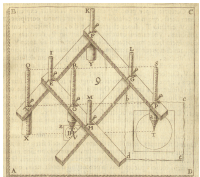
THO. JEFFERSON.

GEORGE BRUCE,

NEW-YORK.

Sometimes effects called out
(Shaded, Open)

There are type styles,
but every size was cut separately.
There are no typefaces.



Unusual/new/display types still
distinguished only by name of
style (Italian, Antique, Black)

SEVEN LINE PICA ITALIAN.

ATHENS

\$ 1 2 3 4 5 6 7

GEORGE BRUCE,

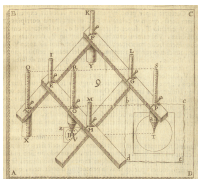
NEW-YORK.

Two Line Bourgeois would be about 18 point, Two Line Long Primer 20 point (= Paragon), and Two Line Small Pica maybe 22 point.

Cincinnati 1857 Specimen Book

<p>TWO LINES BOURGEOIS ORNAMENTED.</p> <p>No. 1. 15 A Fount, \$3 00. THE WAVING WILLOW TREES;</p> <p>No. 2. 15 A Fount with figures, \$3 25. UNCERTAIN CURRENTS GLIDE</p> <p>No. 3. 12 A Fount, \$3 25. GLETTERRING FROST</p> <p>No. 4. 15 A Fount with figures, \$2 50. REVOLUTIONARY ANECDOTES; \$4275</p> <p>No. 5. 18 A Fount, \$3 80. PHENOMENA OF LIGHT!</p> <p>No. 7. 18 A Fount, with figures, \$4 00. LIGHT FOR MORTALS</p> <p>No. 8. 18 A Fount with figures, \$3 50. ENTWINING IN THE GRASS;</p> <p>No. 9. 18 A Fount with figures, \$4 00. BRAVE LIKE AN EVERGREEN</p> <p>No. 10. 18 A Fount with figures, \$3 25. THE RUSTIC MAIDEN LOVES</p> <p>No. 11. 12 A fount with figures, \$3 80. REFLECTED RAYS!</p>	<p>TWO LINES LONG PRIMER ORNAMENTED.</p> <p>No. 1. 18 A Fount, \$3 60. BLAZE LIKE A COMETS TAIL</p> <p>No. 2. 16 A Fount with figures, \$3 00. NEW AND SPLENDID OIL PAINTINGS</p> <p>No. 4. 12 A Fount, \$3 60. SIGNS OF THINGS,</p> <p>No. 11. 10 A Fount with figures, \$3 20. INTERESTING VIEW</p>	<p>TWO LINES SMALL PICA ORNAMENTED.</p> <p>No. 1. 10 A Fount, \$3 60. VERNAL ROSES</p> <p>No. 2. 12 A Fount, \$4 00. GRECIAN ARCHITECTURE,</p> <p>No. 3. 16 A Fount, \$3 25. FAVORED CHARACTER</p> <p>No. 4. 12 A Fount, \$4 00. MATCHLESS BEAUTY!</p> <p>No. 5. 12 A Fount, \$4 00. GRAND CONCERT:</p> <p>No. 6. 12 A Fount, \$3 60. MORNING TWILIGHT,</p> <p>No. 7. 12 A Fount with figures, \$3 25 SUCCESSION OF DESIGNS!</p> <p>No. 8. 12 A Fount, \$3 60. THE WALL FLOWER</p> <p>No. 9. 12 A Fount, \$4 50. CATAWBA WINE</p> <p>No. 10. 8 A Fount, \$3 25. WHITE HEADS;</p>
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Cincinnati Type Foundry. *Specimen of Printing Types.* (1857)
Reprinted by David W. Peat. Used by permission.



The faces are just numbered in the order in which they were cut within each size. Size is still the basic feature, not design. We have since made typefaces out of some of these, but in 1857 they are still not being presented as typefaces.

Transition to “Typefaces” (1870s)

By the 1870 Cincinnati specimen book, they were organizing types into groups.

EGYPTIAN EXTENDED.

PICA EGYPTIAN EXTENDED.
MUNICIPAL RECORD
Schiedam Aromatic Bitters
For Sale Here 125

GREAT PRIMER EGYPTIAN EXTENDED.
JOHN HANKS
Hardware Merchant,
12 Park Row

DOUBLE PICA EGYPTIAN EXTENDED.
BUSHMAN'S HOME
Bremen and Hamburg Steamers
Printing Machines

DOUBLE GREAT PRIMER EGYPTIAN EXTENDED.
LIFE ASSOCIATION
Merchants' Life Insurance
Established 1859

FOUR-LINE PICA EGYPTIAN EXTENDED.
TYPE FOUNDRY
Transportation

CINCINNATI TYPE FOUNDRY CO. 20 VINE STREET.

POINTED LETTERS.

PICA ANTIQUE POINTED.
LAKE MICHIGAN
Improved Common Sense
Sewing Machines 63

GREAT PRIMER ANTIQUE POINTED.
GRAND BALL
Importer of English
and Scotch Ales

TWO-LINE SMALL PICA ANTIQUE POINTED.
AROUND THE WORLD
Adventurous Voyages of Cavendish

TWO-LINE ENGLISH ANTIQUE POINTED.
BERLIN FASHIONS
Persian Astrachan Cloaks 14

SIX-PAREIL SHANGHAI.
SPLENDID ASSORTMENT OF FRESH AND SEASONABLE GOODS DIRECT
FROM MANUFACTURERS AT LOW PRICES

TWO-LINE NON-PAREIL ORNA. No. 15.
FINANCIAL AND COMMERCIAL NEWS 59

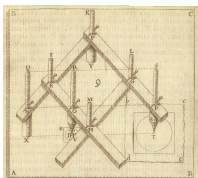
TWO-LINE PICA ORNA. No. 15.
BUSINESS COLLECS

TWO-LINE GREAT PRIMER ORNA. No. 15.
OPENING DAY

FOUR-LINE PICA ORNA. No. 21.
SUPERIOR

FIVE-LINE PICA ORNA. No. 1.
RAILROAD Convention

CINCINNATI TYPE FOUNDRY CO. 20 VINE STREET.



Sometimes these seem like typefaces.

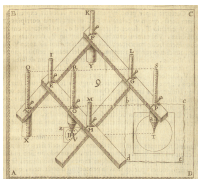
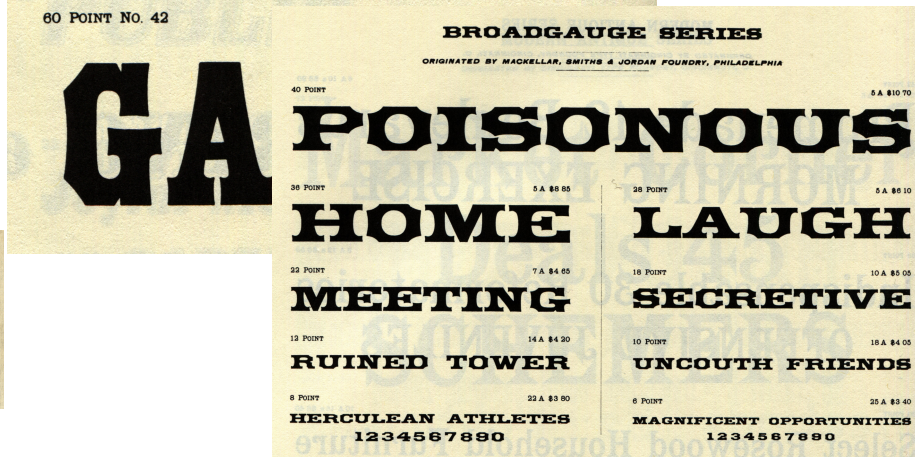
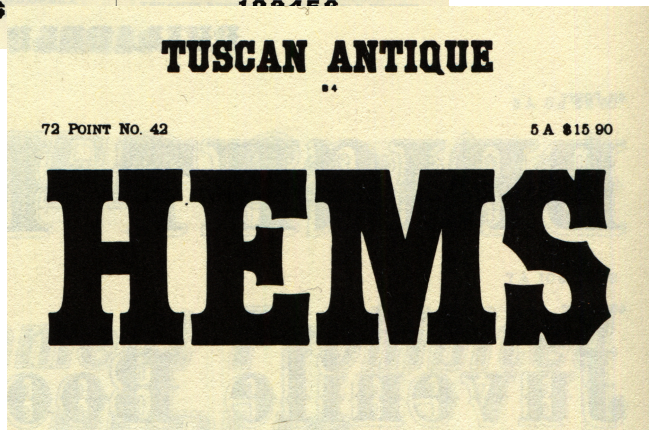
Sometimes they're just loosely related groups.

Typefaces as We Know Them (By 1895)

By (certainly before) the 1895/6 ATF "Collective" Specimen book:



Collections into
named groups.



Cohesively developed series.
Typefaces as we understand
the term.

Other Regularizations

THIS IS NOT PI

Point Bodies. From 1886. See Rich Hopkins' book.

Standard Type Height (introduced with the point system).

Standard Line (associated with two of the primary advocates of pantographs):

- ◆ Claimed by Nicholas Werner as his invention.
- ◆ The Bentons and ATF "American Line" (by 1906).

Point Line (in ATF's American Line; others?)

Unit Set:

- ◆ Precursors 1854 (Wiberg); 1880s (Thorp/Cleveland).
- ◆ Benton's "Self-Spacing" Type (by 1884).
- ◆ Lanston Monotype (1890s).

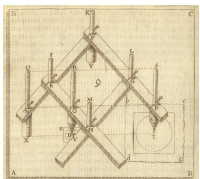
Point Set (Inland 1899; ATF spacing material).

Nor is it an *attempt* at being **odd** or **funny**. It is simply a specimen of **STANDARD LINE TYPE**. Notice that **all faces line at the bottom**. Of course you **would not** use your type in *this manner*, but you **can** readily **see the advantage** of having it all **line**. All different *faces* on **one body** if **STANDARD LINE** will line with each other and **with leaders**, and they will line with **all other sizes or 6-to-pica brass rule** by means of regular leads and slugs. **These** are but a few of *the advantages* which enable the printer to **make and save money** by using our type. If **you wish to keep abreast of the times** send for a copy of the **PRINTERS' QUARTERLY**

INLAND TYPE FOUNDRY

217-219 OLIVE ST.  ST. LOUIS

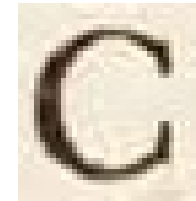
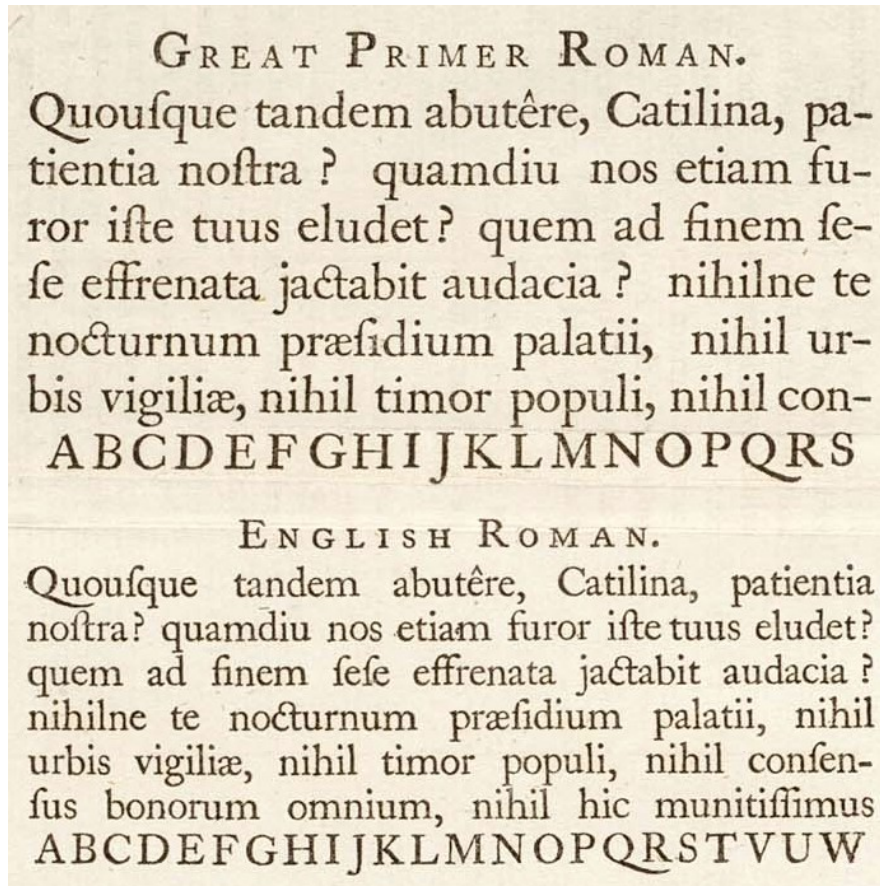
From *The Inland Printer* (1894)



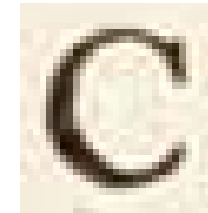
Caslon's 1734 Specimen Close-Up



Wikimedia Commons



Great Primer



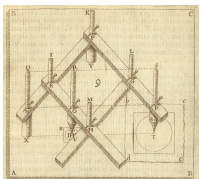
English



Caslon cut his types each specific to its size and style. He cut no typefaces.

“Caslon went so far as to buy an existing type, cut 50 years before his time, for his Canon size; moreover, by modern standards we should hardly judge his 14-point [English] and 18-point [Great Primer] to be members of one family”

- Harry Carter, “Optical Scale in Typefounding.” (1937): 2-3.



Opposition to Scaling: Harry Carter

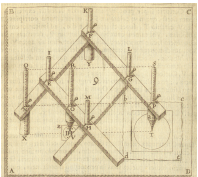
His 1937 article “Optical Scale in Typefounding” has often been cited.

He does not argue that “optical scaling” can be done.

Instead, he argues that the “optical scale” in typefounding means that at times types **should not be scaled at all.**

“The design [of a type] must have beauty enough for large sizes and legibility enough for small ones; and these qualities must be stressed in appropriate degree for each size. Types which lack either good quality *should only be cut in the sizes for which they are suitable.*”

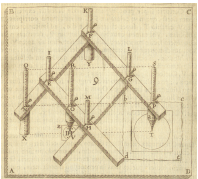
- Carter (1937): 6. [italics mine]



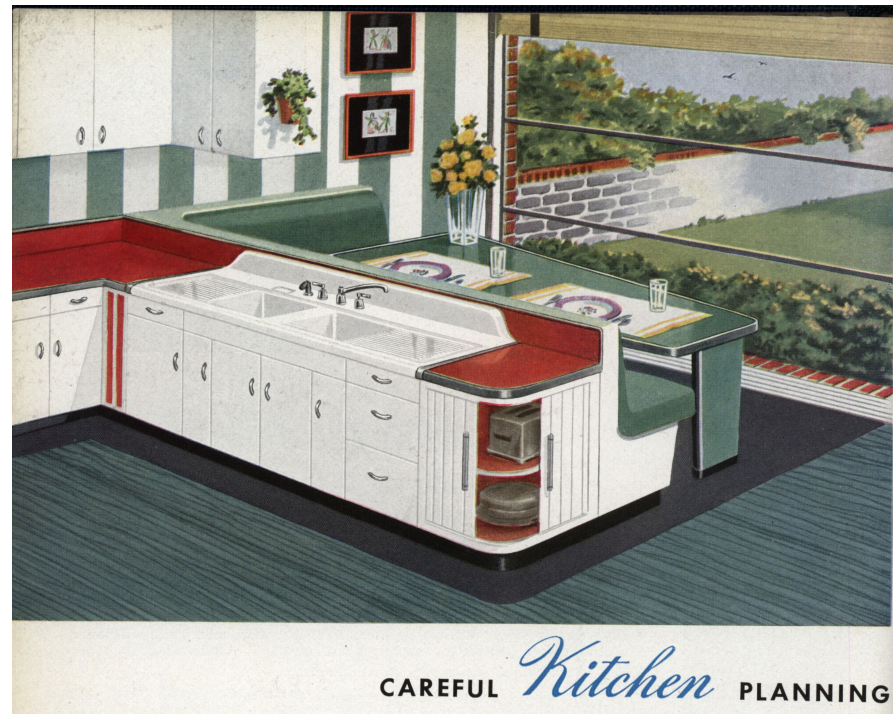
I'll stop here in my ATF 2018 presentation.

What remains involves a bit more “hand waving.”

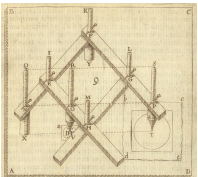
I try to go beyond arguments about type scaling to recover, for future development, Knuth's idea from the early 1980s that the mechanization of type *should* be a way to allow us to better describe type, and thus better understand it...



That's (almost) everything, plus...



Questions?



www.CircuitousRoot.com/artifice/letters/pantocut/index.html