A New Matrix Atlas

Consolidating the Work of
Paul Hayden Duensing
and Others

DRAFT

Rev. 9

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Preface

The slim booklet entitled *Matlas* (for “Matrix Atlas”), written and compiled by the late Paul Hayden Duensing, was for its time the essential reference in the amateur and revivalist typefounding community for technical details about typecasting matrices.

But Duensing's *Matlas* was never issued in a final version or as an actual book. It was a series of typescripts which evolved over the years. That evolution was not necessarily cumulative; each version contains information not present in the other versions. Moreover, although Duensing was a careful scholar, errors exist in all versions. (For example, the value cited as the depth of drive for Ludlow matrices is incorrect.) Sadly, Duensing did not live to complete a final version.

A need still exists, therefore, for a compendium of all of the matrix information in *Matlas*, corrected when necessary and augmented when possible with data from other sources. This is an attempt to produce such a work.

Any work such as this is necessarily detailed, because it must include all of the special cases and exceptions. After all, what good would be an Atlas of the world which left out certain regions because they contained too many countries? But in ordinary practice much of this detail may be ignored – the basics are pretty simple. All of the notes and references may be ignored as well. They're present because it is important not only to know things but to know *how and why* we know things.

This compendium draws upon and collates the work of many people - Duensing in particular, but others as well. However, all of the errors in this volume are of course my own. (If something is in error here it is so because I made a mistake in transcribing a source, or because I made a mistake in interpreting information, or because I failed to verify received data against actual experience or measurement, or because I made a mistake in my own measurement or understanding.) I would appreciate greatly all comments, corrections, and additions.

Note: Items enclosed in {braces} are references to the Bibliography. This convention is nonstandard, but quite useful.¹

¹ I find (parentheses) confusing when used for this purpose. [brackets] are reserved for indicating editorial content. <angles> are used in too many text formatting systems today. {braces} are all that is left.
To my wife, Rollande Krandall.
Acknowledgments

Six years before I began this present work, I'd never even seen a piece of type and didn't know what a matrix was. My debts to the typecasting and letterpress printing communities are boundless, and this list cannot, and does not, identify them all.

Pride of place must go to the late Paul Hayden Duensing, for his groundbreaking work in his original Matlas, and to Ginger Duensing for her permission to use that work. I greatly regret that I was never able to meet Duensing. My thanks go out also to Richard L. Hopkins for many things, including preserving and making available much of Duensing's work.

My debt to Schuyler (Sky) Shipley, proprietor of Skyline Type Foundry, is also impossible to overstate. I learned typecasting in my apprenticeship at his foundry.

Paul Aken also deserves special mention for making available to me many unique items of matrix and typecasting technological history.

The following people, listed alphabetically, contributed comments, corrections, suggestions, and new material to this work: Bob Magill (Monumental Type Foundry), Kevin Martin (Papertrail Handmade Paper and Book Arts), Gregory Jackson Walters.

The many faults which remain in this New Matrix Atlas should be attributed to me.
# Contents

1 Introduction
   1.1 Purpose
   1.2 Aspects of the Matrix
   1.3 Common Matrix Drives and Mold Depths
2 American (Lanston) Monotype
   2.1 American Standard Composition (Cellular)
   2.2 American Large Composition
   2.3 American Display (Type-&-Rule Caster)
   2.4 American Display (42 & 48 Point for the Thompson)
   2.5 Giant Caster
3 English Monotype
   3.1 English Standard Composition
   3.2 English Small Composition (4 1/2 pt)
   3.3 English Display
   3.4 Super Caster
4 Other Type Caster Manufacturers
   4.1 Thompson Type Machine Company
   4.2 Compositype
   4.3 Nuernberger-Rettig
5 Independent Matrix Makers
   5.1 Dunker Matrices for the Thompson
   5.2 Baltotype (for the Thompson)
   5.3 Baltotype (for the Type-&-Rule Caster?)
   5.4 Iwata Bokei (for the Thompson)
6 Linecaster
   6.1 American Linotype and Compatible
   6.2 English Linotype and Compatible
   6.3 Ludlow Typograph
   6.4 A-P-L
   6.5 Nebitype
7 “Foundry” Style
   7.1 ATF Data for Pivotal and Barth
8 Other
   8.1 Rogers Typograph
   8.2 Linotype Junior
   8.3 Linograph
9 Bibliography

10 Appendices
  10.1 What's the [American Printers'] Point?
  10.2 Table of Didot Points in Inches
  10.3 How Close is Close Enough?
  10.4 Beard Widths for Selected Depths and Angles
  10.5 Belief in the Expansion of Typemetal
  10.6 Technical Drawings
  10.7 Uncertain Information: Duensing's “Balto & Mono” Table
  10.8 Uncertain Information: Rice's Chart
1 Introduction

1.1 Purpose

Paul Hayden Duensing wrote that the purpose of his Matlas was

“to examine the various kinds of type matrices a contemporary typefounder is likely to encounter today and to describe their differences and similarities with a view to how they may be cast as single types for hand composition.”

This New Matrix Atlas has the same purpose, although I will not hesitate to investigate matrices that a contemporary typefounder is not likely to encounter.

Duensing then notes that

“Basic to this consideration are five factors which govern the success of casting from a given matrix. These are: depth of drive, mold height, metal quality, temperature and speed of casting.”

1.2 Aspects of the Matrix

But Duensing's list includes both factors integral to the matrix (e.g., depth of drive) and typecasting procedures independent of the matrix (e.g., temperature). I would suggest instead the following list of aspects of the matrix itself which may be described and quantified:

1. Depth of Drive
2. Mold Height (Type Height – Depth of Drive = Mold Height)
3. Head Bearing (and in some cases Foot Bearing)
4. Side Bearing
5. Geometry of the matrix
6. Dimensions of the matrix

To these matrix-centric factors, the person or organization designing the type and the type founder casting it must also add the three aspects of type alignment: vertical alignment.

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3 [Matlas 1988]
alignment, lateral (that is, horizontal) alignment, and set width. What follows in this Introduction is a set of discussions of these aspects of matrices and type in greater detail.

**Head Bearing and Side Bearing**

Head Bearing and Side Bearing are characteristics of the matrix (not of types). They are the relationships between the edges of the matrix and the edges of the body of the type as it would be cast from the matrix in perfect default alignment. They are not visible on the matrix (except insofar as a used matrix may show the shadow of the cast type body from heat discoloration), but are a part of the matrix's definition.

The Head Bearing is the offset from the top edge of the matrix to the theoretical top of the body of the type. The Side Bearing is that from side of the matrix to the corresponding theoretical edge of the body of the type. Head Bearing and Side Bearing are dimensions which are established in advance for each particular kind of matrix. They are a part of matrix engineering, not type design.

**Lining and Fitting**

The type itself has a relationship between the printing face of the type and the edges of its body. (In most cases, the printing face is smaller than the body, but in type with kerns it may be larger.) It is the responsibility of the type designer(s) and matrix maker(s) to establish the three relationships necessary to position a type's printing face as desired on a its body:

1. The vertical alignment of the printing face on the body.
2. The lateral alignment of the printing face on the body.
3. The set (set width) of the body.

(The height of the body is taken as fixed.) The establishment of these three dimensions is a part of type design, not matrix engineering. Establishing the vertical alignment may be termed “lining,” and establishing the set width and lateral alignment may be termed “fitting.”

The lining and fitting of type is a matter of judgment. (Important elements of type, such as “baseline,” are not physical features of type but are interpretations imposed on the type by the designer and, in practice, the type caster.) Unlike Head Bearing and Side Bearing, they are not absolute and may change.
Examples of the re-lining or re-fitting of existing types include:

• When existing types were re-lined and re-fitted from pre-point bodies to point system bodies after 1886.

• When existing types were re-lined for uniform lining systems, first by the Inland Type Foundry from at least 1894 and later, by 1906, by ATF (for their American Line).

• When 19th century types of unknown lining and fitting were reissued through electroformed matrices in the “antique” type revival of the mid-20th century.

• When existing matrices are cast today at narrower set widths than specified on the matrix. (Tastes in set and the letterspacing of type have changed, and type cast to the set widths which were stamped on the matrices in the early 20th century may appear too wide in the early 21st.)

• When existing matrices are cast to individually adjusted vertical alignments which do not necessarily match those of the lining standard for the matrix font. This happens often.

In principle, the lining and fitting of type is done by the type designer and matrix maker, and can be ignored by the type caster. For machine composition this must be the case, as the machine operator cannot manually intervene for individual types. But in casting single types, the type caster must always check these three lining and fitting factors, and frequently must adjust them.

In addition, type casting machines such as the Thompson have precise but relative adjustments for vertical and lateral alignment, rather than accurate adjustments to an external standard. Thus each time the machine is set up to cast from a particular matrix font the operator must vertically align the matrix. Even if a lining standard exists for the matrix font, the operator exercises his or her judgment as to what vertical alignment on the machine matches the lining standard. For situations where no lining standard exists, and for the lateral alignment of each sort, the type caster's judgment in the end controls the alignment.

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The Matrix and the Type

The following two illustrations attempt to put together these ideas of matrix bearings and type alignment.

The first illustration shows what you actually see on the matrix, the type cast from it, and the page printed from this type. On the matrix, ignoring numbers and codes stamped on it, all you see are the casting cavity and the external geometric shape of the matrix. The head and side bearings are not visible, as they are not physical features of the matrix as an object. On the type, all you see are the sides of the type body and the printing face of the type (ignoring things such as the beard and other nonprinting features). The vertical alignment and lateral alignment are not physical features of the type (though the set width is). On the printed page, all you see is the image made from the printing surface of the type. No matrix bearings or type alignments appear visually on the page, even though they locate the printed image on the page. Type as a physical thing in metal or ink has no features such as a baseline; they are brought to it by the interpretation of the type-maker.

So here's what you see:

Illustration 1: What You Actually See on a Matrix, Type, and Paper
But here's what you actually do:

Illustration 2: Matrix Bearings and Type Alignment
1.3 Common Matrix Drives and Mold Depths

Of the various dimensions of type, Duensing writes:

“Foremost is the depth of drive of the matrix being coupled with a mold which will yield the desired type height.”

The term “depth of drive” comes, of course, from the original method of manufacturing a matrix using a punch. It is used regardless of the method of manufacture of the matrix (punched, engraved, or electroformed), and designates the distance between the surface of the matrix which bears against the mold and the bottom of the casting cavity of the matrix.

Matrix Drives

For convenience, here is a table of the matrix depths of drive commonly (and sometimes less commonly) found in American type casting practice:

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5 [Matlas 1986] and [Matlas 1988].
6 This definition accommodates the unusually deep “drive” of Ludlow matrices, which is the sum of the actual depth the punch is driven in plus the milled cavity intended to form the crossbar of the 'T' of the Ludlow slug.
<table>
<thead>
<tr>
<th>Type</th>
<th>US Height</th>
<th>Type</th>
<th>Matrix Drive</th>
<th>Nominal Mold Height&lt;sup&gt;7&lt;/sup&gt;</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stereotype/Electrotype</td>
<td>0.918</td>
<td></td>
<td>0.155&lt;sup&gt;8&lt;/sup&gt;</td>
<td>0.763&lt;sup&gt;9&lt;/sup&gt;</td>
</tr>
<tr>
<td>Ludlow</td>
<td>0.918</td>
<td></td>
<td>0.153</td>
<td>0.765</td>
</tr>
<tr>
<td>ATF B-4 (NY/Conner), 120 pt and up&lt;sup&gt;10&lt;/sup&gt;</td>
<td>0.9180</td>
<td></td>
<td>0.1251</td>
<td>0.7929</td>
</tr>
<tr>
<td>ATF B-4 (NY/Conner), 48-108 pt</td>
<td>0.9180</td>
<td></td>
<td>0.1241</td>
<td>0.7939</td>
</tr>
<tr>
<td>ATF B-3 (NY/Conner), 30-42 pt</td>
<td>0.9180</td>
<td></td>
<td>0.0968</td>
<td>0.8212</td>
</tr>
<tr>
<td>ATF STL-3 (Central or St. L.), 36-72 pt</td>
<td>0.9180</td>
<td></td>
<td>0.0844</td>
<td>0.8336</td>
</tr>
<tr>
<td>ATF B-2 (NY/Conner), 14-24 pt</td>
<td>0.9180</td>
<td></td>
<td>0.0758</td>
<td>0.8522</td>
</tr>
<tr>
<td>English Linotype</td>
<td>0.918</td>
<td></td>
<td>0.075</td>
<td>0.843</td>
</tr>
<tr>
<td>Lanston Giant Caster &gt;= 42 pt</td>
<td>0.918</td>
<td></td>
<td>0.065</td>
<td>0.853</td>
</tr>
<tr>
<td>English Monotype Super Caster</td>
<td>0.918</td>
<td></td>
<td>0.065</td>
<td>0.853</td>
</tr>
<tr>
<td>Nuernberger-Rettig, native</td>
<td>0.918</td>
<td></td>
<td>0.065</td>
<td>0.853</td>
</tr>
<tr>
<td>English Monotype Display &gt; 36 pt</td>
<td>0.918</td>
<td></td>
<td>0.065</td>
<td>0.853</td>
</tr>
<tr>
<td>ATF STL-2 (Central or St. L.), 14-30 pt</td>
<td>0.9180</td>
<td></td>
<td>0.0535</td>
<td>0.8645</td>
</tr>
<tr>
<td>Lanston Monotype Display (14-36 pt)</td>
<td>0.918</td>
<td></td>
<td>0.050</td>
<td>0.868</td>
</tr>
<tr>
<td>English Monotype Display &lt;= 36 pt</td>
<td>0.918</td>
<td></td>
<td>0.050</td>
<td>0.868</td>
</tr>
<tr>
<td>English Monotype Comp. (except 4 ½ pt)</td>
<td>0.918</td>
<td></td>
<td>0.050</td>
<td>0.868</td>
</tr>
<tr>
<td>Mergenthaler Linotype &amp; compatible</td>
<td>0.918</td>
<td></td>
<td>0.043</td>
<td>0.875 (7/8&quot;)</td>
</tr>
<tr>
<td>Thompson Thompson, Compositype</td>
<td>0.918</td>
<td></td>
<td>0.043</td>
<td>0.875 (7/8&quot;)</td>
</tr>
<tr>
<td>Lanston Monotype Thompson</td>
<td>0.918</td>
<td></td>
<td>0.043</td>
<td>0.875 (7/8&quot;)</td>
</tr>
<tr>
<td>ATF B-1 (NY/Conner), 6-12 pt</td>
<td>0.9180</td>
<td></td>
<td>0.0420</td>
<td>0.8760</td>
</tr>
<tr>
<td>ATF STL-1A (Central or St. L.), 6-12 pt</td>
<td>0.9180</td>
<td></td>
<td>0.0309</td>
<td>0.8871</td>
</tr>
<tr>
<td>Lanston Monotype Composition</td>
<td>0.918</td>
<td></td>
<td>0.030</td>
<td>0.888</td>
</tr>
<tr>
<td>English Monotype 4 ½ pt Composition</td>
<td>0.918</td>
<td></td>
<td>0.030</td>
<td>0.888</td>
</tr>
</tbody>
</table>

<sup>7</sup> This is a calculated, theoretically perfect mold height assuming no shrinkage. See the section below for notes on real mold depths which take shrinkage into account.

<sup>8</sup> [Lanston Giant 12pg], p. 8.

<sup>9</sup> Of course, for stereotypes/electrotypes this is not really a "mold height" but a base height.

<sup>10</sup> ATF data from [Rehak 1993], p. 183.
A Note on Mold Depths

One of the most enduring fallacies in the history of type is that typemetal expands upon solidification. We have known from laboratory work since the early 20th century that this is false. Typemetal as an alloy, and each of its constituents individually (lead, antimony, tin), all contract upon solidification. Yet I have heard this myth repeated as a fact in the early 21st century, and it can be seen in at least one 21st century college textbook.11 See the Appendix “Belief in the Expansion of Typemetal” for a historical survey of this myth.

In more practical terms, what remains for the typefounder is the question of how much typemetal shrinks in solidification, and what compensation must therefore be made in the mold dimensions. (So far as I can tell, no compensation was ever made in matrix dimensions.) It appears that there are two views here, which I have not yet reconciled with practice.

On the one hand we have a value of approximately 2 percent shrinkage upon solidification as accepted in the metallurgical literature. This is cited by Hiers (1939), without source.12 Gonser and Winkler (1849) do give a source, the research of Matsuyama in 1928.13 Thompson (1930) also credits Matsuyama14, and cites the 2 percent value as one for lead-tin-antimony alloys containing “from 12 to 16 percent antimony.”. I have not yet tracked down Matsuyama's original article, although at least two copies exist in the US. It would appear that this 1928 research is the whole of the metallurgical research in this area (a fact which is surprising given the economic importance of typemetal throughout much of the 20th century. The data for the contraction of type metal reported in Gonser and Winkler are:

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11 {Sivasankar 2008}, p. 41.
12 {ASM 1939 /Hiers}, p. 1549.
13 {ASM 1948 /Gonser & Winkler}, p. 958.
14 {Thompson 1930}, p. 1093.
<table>
<thead>
<tr>
<th></th>
<th>Pb</th>
<th>Sn</th>
<th>Sb</th>
<th>Contraction, percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Electrotype</td>
<td>92</td>
<td>4</td>
<td>4</td>
<td>2.6</td>
</tr>
<tr>
<td>Stereotype</td>
<td>83.7</td>
<td>4</td>
<td>11.3</td>
<td>2.0</td>
</tr>
<tr>
<td>Linotype</td>
<td>79</td>
<td>5</td>
<td>16</td>
<td>2.0</td>
</tr>
<tr>
<td>Monotype</td>
<td>76</td>
<td>3</td>
<td>16</td>
<td>2.0</td>
</tr>
<tr>
<td>Lead</td>
<td>100</td>
<td>-</td>
<td>-</td>
<td>3.4</td>
</tr>
<tr>
<td>Tin</td>
<td>-</td>
<td>100</td>
<td>-</td>
<td>2.8</td>
</tr>
<tr>
<td>Antimony</td>
<td>-</td>
<td>-</td>
<td>100</td>
<td>1.4&lt;sup&gt;16&lt;/sup&gt;</td>
</tr>
</tbody>
</table>

These values should be treated as what they are: specific experimental values. In particular, the values for Linotype and Monotype alloys do not necessarily match practice, and no alloys are presented for the higher-tin and higher-antimony type metals. Note also that the properties of alloys cannot be extrapolated from their constituent elements<sup>17</sup>, so it would be unwise to make inferences from the values of pure Pb, Sn, and Sb.

Other sources cite a value an order of magnitude smaller: about 0.3 percent.

Kevin Martin notes that in reality “mold cavities are all slightly deeper and larger … by about 0.3% … to account for the shrinkage of the type as it cools after hardening.” He further cites an increase in mold height of about 0.003.<sup>18</sup>

The ATF/Dale Guild data used here is, as given in {Rehak 1993}, actually mold data, not matrix data. As presented in Rehak it specifies an over-height mold with an expected shrinkage. (Example: B4 48-108pt mold depth height is called out as 0.9216, with an expected shrinkage of 0.0032. 0.9216 – 0.0032 = 0.9184.) This example corresponds generally with Martin's, but disagree with the metallurgical literature.

The ATF/Dale Guild shrinkage factors cited in {Rehak 1993} are primarily 0.0032 “(inches, not percentages) for mold height for Barth machines (0.0042” for 120pt and up), but range from 0.0018” to 0.0027” for pivotal casters. In all cases, however, these values are nearly an order of magnitude less than the 2% expected from the metallurgical literature.

<sup>15</sup> “Specimen contained 0.5% Copper” (Gonser & Winkler's note)
<sup>16</sup> Value not from Matsuyama, but from an unnamed article by H. Endo in the J. Inst. Metals, 30, 121 (1923).
<sup>17</sup> The classic example is table salt, which is made of the poison gas chlorine together with sodium (which can explode if you drop it in water).
<sup>18</sup> {Martin 2015-01-23}
At present, I do not have sufficient practical experience to attempt to resolve this difference.
2 American (Lanston) Monotype

2.1 American Standard Composition (Cellular)

[TO DO]

History

[TO DO]

Depth of Drive

[TO DO]

Side Bearing

[TO DO; include note that side bearing is on the right side, and casting position is therefore upside-down on the Thompson]

Head Bearing

[TO DO]

Geometry and Dimensions

[TO DO]
Cellular Matrix Symbol Locations

Lanston cellular matrices were stamped with identifying alphanumeric symbols on two sides. With the character to be cast is in the normal reading position, the side to the left was the “point side,” containing the body size in points and optionally other information, and the side to the bottom (“nearest the reader”) is the “series side,” containing the type series number and optionally other information. Here is the illustration used by Lanston:  

In addition to the self-explanatory point (body) size, several kinds of symbols appear in these locations:

- Series Side, Classification Symbols
- Series Side, Unit Value Symbols

19 From {Lanston MMI}, p. 7
• Series Side, Miscellaneous Identifying Symbols
• Point Side, Set-Sizes
• Point Side, Miscellaneous Identifying Symbols
• Dash Symbols
• Single and Piece Fraction Symbols
• Ruled Form Matrices for Composition
• Classified Sign Matrices, System For

**Cellular Matrix, Series Side, Classification Symbols**

For cellular matrices, Lanston Monotype used a single-letter suffix after the series number to indicate the “classification” of the typeface. The suffixes were:

<table>
<thead>
<tr>
<th>Typeface Classification</th>
<th>Symbols Used After the Series Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>Modern Roman</td>
</tr>
<tr>
<td>B</td>
<td>Modern Roman small caps</td>
</tr>
<tr>
<td>C</td>
<td>Modern Italic</td>
</tr>
<tr>
<td>D</td>
<td>Modern Italic small caps</td>
</tr>
<tr>
<td>E</td>
<td>Old Style Roman</td>
</tr>
<tr>
<td>F</td>
<td>Old Style Roman small caps</td>
</tr>
<tr>
<td>G</td>
<td>Old Style Italic</td>
</tr>
<tr>
<td>H</td>
<td>Old Style Italic small caps</td>
</tr>
<tr>
<td>J</td>
<td>Boldface Roman</td>
</tr>
<tr>
<td>K</td>
<td>Boldface Italic</td>
</tr>
<tr>
<td>L</td>
<td>Typewriter, Mailing Lists, etc.</td>
</tr>
<tr>
<td>M</td>
<td>Foreign faces</td>
</tr>
</tbody>
</table>

*Table 2: Lanston Monotype Classification Symbols Used after the Series Number*

The series number indicated the series generally. Thus, the specimen book page for

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20 From [Lanston MMI], p. 7.
21 [Lanston MMI] distinguishes the set of post-series letters A-H/J-M as “classification” symbols and N/P/Q/R/S/T/X/Y (to be discussed later) as “miscellaneous” symbols. [Matlas 1988] concatenates a subset of them into a single run of symbols A-C/E-H/J/K/M/N/X. Here I've decided to keep them in separate tables as Lanston did.
series No. 8 (Modern Roman) shown in several sizes simply said “No. 8”.

Each matrix was stamped with the series number and a single classification letter. So for example the “98J” in the illustration above indicates that this matrix is of series No. 98, which is Cloister Black, and that in particular it is the Boldface Roman variation of Cloister Black.

These suffixes may appear confusing to the 21st century typefounder, because they mix two kinds of information that we now think of as distinct.

Sometimes letters simply give helpful information about the general style of the typeface (Modern vs. Old Style, for example). So “61E” indicates series 36 (which is Hess’ “Cochin”) and classification ‘E’ (that this face is an Old Style Roman). A “61A” could not exist in principle because Cochin is an Old Style face while 'A' designates Modern faces.  

At other times the letters indicate what we would now consider to be variations within a single typeface (Italic vs. Roman or Small Caps, for example). So “61G” indicates Cochin (Old Style) Italic.

The system is incomplete in that it is not possible to specify all combinations (there is no way to classify explicitly a Modern Boldface Roman vs. an Old Style Boldface Roman, for example). It is not, however, as inconsistent as it would appear today. It was developed in the first decade of the 20th century, when modern ideas of what a “typeface” is had not yet settled down, and when the first commercially successful “families” of types were just beginning to appear. These classifying letters represent, in my opinion, an older approach to thinking about type – before the modern concept of a typeface with variations was firmly established.

Cellular Matrix, Series Side, Unit Value Symbols

[TO DO: a – s, from {Lanston MMI}, p. 7]

Cellular Matrix, Series Side, Miscellaneous Identifying Symbols

---

22 Kevin Martin notes, further, that some composition faces were available only as J and K, even though they were not explicitly “bold” faces (example: Franklin Gothic, Series 107). {Martin 2015-01-23}

23 For a polemical discussion of this, see {CR CC}.
<table>
<thead>
<tr>
<th>Miscellaneous Symbols Used After the Series Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>N</td>
</tr>
<tr>
<td>P</td>
</tr>
<tr>
<td>Q</td>
</tr>
<tr>
<td>R</td>
</tr>
<tr>
<td>S</td>
</tr>
<tr>
<td>X</td>
</tr>
<tr>
<td>Y</td>
</tr>
</tbody>
</table>

*Table 3: Lanston Monotype Miscellaneous Symbols Used After the Series Number*

<table>
<thead>
<tr>
<th>Miscellaneous Symbols Used Before the Series Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>T</td>
</tr>
</tbody>
</table>

*Table 4: Lanston Monotype Miscellaneous Symbols Used Before the Series Number*

**Cellular Matrix, Point Side, Set-Sizes**

[TO DO: Z – M, from {Lanston MMI}, p. 7]

**Cellular Matrix, Point Side, Miscellaneous Identifying Symbols**

{Lanston MMI}, p. 7, defines meanings for symbols “Miscellaneous” symbols appearing after the point size. The symbols defined are A – G and H1 - H9.

Duensing, in all editions of Matlas, defines meanings for “Codes for Modified Characters,” without indicating where they appear. The symbols defined are H1 – H9, plus H12, H13, H22, H32, and H61.

Here is a composite table showing all of these symbols. If two definitions exist, separated by a slash, the one before is Duensing's and the one after is Lanston Monotype's.
### Miscellaneous 'A' – 'G' Symbols Used After the Point Size

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>Accent</td>
</tr>
<tr>
<td>B</td>
<td>Superior cap or figure</td>
</tr>
<tr>
<td>C</td>
<td>Superior lower case</td>
</tr>
<tr>
<td>D</td>
<td>Inferior cap or figures</td>
</tr>
<tr>
<td>E</td>
<td>Inferior lower case</td>
</tr>
<tr>
<td>F</td>
<td>Modern figures or Old Style Hanging Figures</td>
</tr>
<tr>
<td>G</td>
<td>Old Style lining figures</td>
</tr>
</tbody>
</table>

*Table 5: Lanston Monotype Miscellaneous A-G Symbols Used After the Point Size*

### Miscellaneous 'H' Symbols Used After the Point Size

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>H1</td>
<td>Shortened characters / Shortened descender</td>
</tr>
<tr>
<td>H12</td>
<td>Shortened descenders and condensed</td>
</tr>
<tr>
<td>H13</td>
<td>Shortened descenders and extended</td>
</tr>
<tr>
<td>H2</td>
<td>Condensed on a narrower body / more condensed than normal</td>
</tr>
<tr>
<td>H22</td>
<td>Condensed on a narrower body</td>
</tr>
<tr>
<td>H3</td>
<td>Extended on a wider body / more extended than normal</td>
</tr>
<tr>
<td>H32</td>
<td>Extended on a wider body</td>
</tr>
<tr>
<td>H4</td>
<td>Full face on body pointways(^\text{24})</td>
</tr>
<tr>
<td>H5</td>
<td>Shortened ascenders</td>
</tr>
<tr>
<td>H6</td>
<td>Central on body pointways</td>
</tr>
<tr>
<td>H61</td>
<td>Central on body and safe on a smaller body</td>
</tr>
<tr>
<td>H7</td>
<td>Low alignment / Low line</td>
</tr>
<tr>
<td>H8</td>
<td>High line / High line</td>
</tr>
<tr>
<td>H9</td>
<td>Means a multitude of things, including long descenders and re-designed characters / Redesigned</td>
</tr>
</tbody>
</table>

*Table 6: Lanston Monotype Miscellaneous 'H' Symbols Used After the Point Size*

Note: Some of these symbols (especially H4 and H9) were used with the same meanings by Lanston Monotype in describing their display matrices in their literature. (But these symbols were never stamped directly on display matrices.) For more on this, I think, but have not confirmed, that this means a titling face.

\(^{24}\) I think, but have not confirmed, that this means a titling face.
see the “Display Matrix Alphanumeric Codes” section of the chapter on Lanston Monotype Display Matrices, below.

**Cellular Matrix Dash Symbols**

[TO DO, system from {Lanston MMI}, p. 7]

**Cellular Matrix Single and Piece Fraction Symbols**

[TO DO, system and letters (J, K) from {Lanston MMI}, p. 7]

**Ruled Form Matrices for Composition**

[TO DO, system from {Lanston MMI}, p. 7]

[Note as distinct from Ruled Form System from display matrices, q.v.]

**Classified Sign Matrices, System Form**

[TO DO – synthesize from “Classified and Miscellaneous SIGNS for Monotype Machine Typesetting” from the loose-leaf specimen book.]

[Note: this system draws upon the Set-Size and Unit Value tables]

**2.2 American Large Composition (Cellular)**

[TO DO]
2.3 American Display

Kinds of American (Lanston) Display Matrices

The Lanston Monotype Machine Company made three overall styles of matrices for casting single types for hand composition:

- Display matrices intended for the Type-&-Rule Caster, for type body sizes up to 36 points. These are flat rectangular matrices with two distinctive beveled corner cuts.

- Display matrices for the Thompson Type-Caster for 42 and 48 point type body sizes only. These are flat rectangular matrices without corner cuts.

- Display matrices for the Giant Caster, for type body sizes up to 72 points. These are thicker square or rectangular matrices with side grooves.

The present section will cover the first of these. The others will be discussed later.

American (Lanston) Display (For the Type-&-Rule Caster)

The matrices manufactured by the Lanston Monotype Machine Company for use in their Type-&-Rule Caster became the mainstay of independent typefounding in the 20th century, and are still in use today. While the Type-&-Rule caster could cast from 4 point to 36 point, display matrices were used only for the 12 to 36 point bodies. (The low end of this range overlaps the high end of the composition matrix range.)

25 The largest body accommodated in normal orientation was 72 points, but the set could be larger and types could be cast sideways to an effective body height up to the limit of the set. Hopkins, in {ATFNL 32} (reprinted in {Matlas 2008}) shows a Giant Caster matrix intended to cast a 108 point character sideways.

26 The name of this machine is particularly troublesome. Lanston Monotype employed several different names for it – sometimes in the same document! It began as a display casting attachment for the ordinary composition caster. After the introduction of the fusion-casting capability it could cast strip material as well (if so equipped). In later use, Lanston seems to have settled on “Type-&-Rule Caster,” even when the machine was not equipped for casting strip material. With a suitable kit of parts, one could convert a Composition Caster into a Type-&-Rule Caster and vice versa. It is often informally called an “Orphan Annie.” The origin of this nickname is not known. The story still circulates that it is because of an “OA” prefix to the serial numbers, but Richard L. Hopkins has been unable to substantiate this by finding such a serial number. See {Hopkins 2012}, p. 205.

27 See the Lanston Monotype eight-page brochure "Monotype Type-&-Rule Caster", reprinted in {CR TR} (Sales Literature section).
These were flat matrices with beveled cuts on diagonally opposite corners. Initially, and for decades after, they were electroformed. Early Lanston literature explicitly calls them “electro” matrices. A handwritten note by Duensing in his copy of \textit{Matlas 1986} says “1950s most still electroed”. Later they were punched in both brass and (more commonly) aluminum. In addition to their use on the Type-&-Rule Caster, with appropriate mold and matrix equipment they may also be cast on the Thompson Type-Caster, the Giant Caster, the Super Caster, and the Nuernberger-Rettig.

Here’s the standard illustration of it that Lanston used for decades.\footnote{This illustration appeared as a photograph in \textit{Lanston 1912}, but by \textit{Lanston 1916} was redone as a line engraving. The version here is from \textit{Lanston MMI} and probably dates from the 1930s or 1940s.}

\begin{figure}[h]
\centering
\includegraphics[width=0.5\textwidth]{image3.png}
\caption{Lanston Monotype Display Matrix}
\end{figure}
For the Hasty

Understanding the Lanston display matrix in detail and with some aspiration to accuracy turns out to be surprisingly difficult – a lengthy task beyond the patience of some. Here, then, is a quick simplified view of the matter. The caveat is that each gain in brevity is a loss in truth.

Size: 1 1/8 in. long x 3/4 in. wide x 0.094 in. thick.

Shape: Diagonal corner cuts top left and bottom right at a 30 to 35 degree angle to the long axis, beveled 60 degrees, sized to fit Lanston Monotype X41A Matrix Holder.

Depth of Drive: 0.050 in.

Side Bearing: 8 points (0.1107 in.) at all body sizes.

Head Bearings:

<table>
<thead>
<tr>
<th>Body Size (in points)</th>
<th>Head Bearing (in points)</th>
</tr>
</thead>
<tbody>
<tr>
<td>12</td>
<td>32</td>
</tr>
<tr>
<td>14</td>
<td>30</td>
</tr>
<tr>
<td>18</td>
<td>26</td>
</tr>
<tr>
<td>24</td>
<td>32</td>
</tr>
<tr>
<td>30</td>
<td>26</td>
</tr>
<tr>
<td>36</td>
<td>20</td>
</tr>
</tbody>
</table>

Table 7: Lanston Monotype Display Matrix Head Bearings
Prehistory

The display casting attachment for the Lanston Monotype caster was announced in 1903.\(^{29}\) The patent for this was \{US 883,378\}, issued to John Sellers Bancroft and Mauritz C. Indahl and assigned to the Lanston Monotype Machine Company. It was filed December 1, 1904, but not actually issued until March 31, 1908.

However, the Bancroft/Indahl patent specifies a rectangular matrix without corner cuts. The distinctive Lanston Monotype display matrix with its corner-cuts on diagonally opposite corners was patented by William Elmer Chalfant in \{US 904,510\}. This was filed on October 12, 1907, but not issued until November 24, 1908. This issue date is stamped on the back of most Lanston Monotype display matrices. (This date has no other significance, and does not indicate a date of manufacture. It appears on matrices clearly made after the patent expired.) I do not know what form of matrix was employed by the very early display casting attachments in the 1903-1907 timeframe.

But while the Chalfant patent established the matrix geometry, it employed a matrix holder which substituted for the entire die case. A holder of this style is illustrated in the original 1912 edition of *The Monotype System* \{Lanston 1912\}, p. 174). The now more familiar removable “Sorts Matrix Holder Slide”\(^{30} \, 31\) was not described until a 1915/1916 patent by John Sellars Bancroft and Mauritz C. Indahl \{US 1,193,345\}. This style of holder is shown in the 1916 second edition of *The Monotype System* \{Lanston 1916\}, p. 160). This change in holder design has no bearing\(^{32}\) on the matrix design.

For a further discussion of this, with reprints of the patents, see \{CR TR Mats\}.

Sizes

The five most common body sizes for display matrices are: 14, 18, 24, 30, and 36.

Physical bodies down to 12 point could be cast on the Type-&-Rule Caster. Some faces smaller than this, issued on display matrices, were designed to be cast on 12 point bodies. For example, series No. 166, Heavy Copperplate Gothic Extended, was issued in 8 point and 10 point sizes for casting 8-on-12 and 10-on-12.

\(^{29}\) In a four page insert following p. 328, by Wood & Nathan Co., the “sole selling agent” for the Lanston Monotype Machine Company. *The Inland Printer*. Vol. 32, No. 3 (December, 1903). Reprinted in \{CR Lanston 1903\}.

\(^{30}\) So called in \{Lanston 1916\}, p. 160, for example.

\(^{31}\) More formally the X41A Matrix Holder (for Display Matrices) group. \{Lanston 1941\}, p. 6.

\(^{32}\) Pun intended, of course.
Other sizes were also offered, including: 16, 20, 21, and 22 point.\textsuperscript{33}

Lining faces were sometimes issued in multiple face sizes per body size. For example, series No. 85, Hess Stationers Gothic Bold, was issued in three sizes at 18 point (No. 1, 2, and 3).\textsuperscript{34}

\textbf{Depth of Drive}

All Lanston Monotype (that is, American) display matrices have a depth of drive of 0.050 inches.

\textbf{Side Bearing}

Duensing writes:

\begin{quote}
All American Monotype Display Mats have uniform side-bearings of 8 points or .1107”
\end{quote}

With a point of 0.013,8, eight points would be is 0.110,4 inches. It would seem, however, that Duensing was being more accurate. If he employed the 1886 Type Founders' Association point to six decimal places (0.013,835), eight points is 0.11068. If he employed the ATF point of published in 1902 (0.013,87), eight points is 0.110,696. If he employed the Monotype point of 0.013,833, eight points is 0.110,664. Each of these values rounds to 0.110,7.\textsuperscript{35} (For a more detailed discussion of the value of the American printers' point, see the Appendix “What's the Point?” at the end of this present work.)

\textbf{Head Bearings}

Later versions of Matlas\textsuperscript{36} give the following values, in points, for head bearings for

\begin{itemize}
  \item \textsuperscript{33} See {Lanston 1955}. Series 790 Stymie Bold was issued in 21 point display matrices; see {Lanston Stymie 21}
  \item \textsuperscript{34} Curiously, while it was only \textit{issued} in a single size at 24 point, that size was No. 2.
  \item \textsuperscript{35} The value that Duensing published under his own typefoundry letterhead in {Matlas 1986} and repeated in {Matlas 1988} was taken to only five places (0.013,83). This produces a value for 8 points of 0.110,64, which rounds to 0.110,6, not 0.110,7.
  \item \textsuperscript{36} {Matlas 1988} and {Matlas 2008}, but not {Matlas 1986}.
\end{itemize}
Lanston Display matrices. Schuyler R. Shipley has confirmed\(^{37}\) that these are correct in his experience.

<table>
<thead>
<tr>
<th>Body Size (in points)</th>
<th>Head Bearing (in points)</th>
</tr>
</thead>
<tbody>
<tr>
<td>12</td>
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<td>14</td>
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<td>18</td>
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<td>32</td>
</tr>
<tr>
<td>30</td>
<td>26</td>
</tr>
<tr>
<td>36</td>
<td>20</td>
</tr>
</tbody>
</table>

*Table 8: Lanston Monotype Display Matrix Head Bearings*

For an explanation of why the progression of head bearing values is not uniform, see the next section.

I do not yet know the head bearings for the less common sizes (16, 20, 21, and 22 point).

The 1986 version of Matlas had a more complex table which included a “Balto & Mono” section which appears to conflict with the “Mono. Std.” information reprinted above. For a discussion of this, see the Appendix: Uncertain Information: Duensing's “Balto & Mono” Table.

**Foot Bearings and Mold Styles**

*Matlas* also gives “foot bearing” information for Lanston Display matrices.\(^{38}\) This is a curious dimension, for two reasons.

First, it is not necessary, either for making or casting from a matrix. The matrix bears upon its holder on its left and top sides only. The side bearing (to the left) and head bearing (to the top) fully define the position of the type body relative to the matrix edges and the matrix holder.

Second, it has long been recognized that you cannot control both a chain of dimensions along a line and an overall dimension of the same line.\(^{39}\) Thus, if a matrix has

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\(^{37}\) In a telephone conversation, December 2014.
\(^{38}\) All editions also give Thompson foot bearing information within the Lanston Display section. The 1986 edition also gives Baltotype foot bearing information, again within the Lanston Display section.
\(^{39}\) For an early, and more general, description of this, see {Buckingham 1921}, p. 48.
a defined overall length (head to foot), and if that overall length is composed of a head bearing, a body size, and a foot bearing, you cannot simultaneously dimension and tolerance all four of these values. Something's got to give. Since the foot bearing is an unnecessary dimension, if it is included at all it should be made clear that it is a nominal or (in drafting terms) “reference” dimension.

However, the foot bearing is useful in understanding why the sequence of head bearing values does not decrease uniformly as body size increases.

The Type-&-Rule casters uses two different styles of mold to accommodate the range of bodies it cast. Duensing calls these “T-Molds” and “U-Molds.” More formally, Lanston called them Style 1T and Style 1U Sorts Casting Molds (succeeded by Style 2T and Style 2U).\(^40\) The “T-Mold” is for 12, 14, and 18 point bodies. The “U-Mold” is for 24, 30, and 36 point bodies.

Each of these two styles of mold was designed to use a constant “foot bearing” for all of the body sizes was made for, and a different head bearing for each body size. The foot bearing for the T-Mold is 36 points; for the U-Mold it is 24 points. This arrangement becomes relatively clear when presented in a drawing:

\(^{40}\) See {Lanston 1T/1U 1918} and {Lanston 2T/2U 1949} I do not yet know if later versions were introduced.
The only problem with this is that we do not in fact know the intended length of a Lanston Monotype display matrix (see the next section for a discussion of the problems). Whatever their length “really” is, it probably isn't 80 points.

It would be best, then, to use “foot bearing” for Lanston display matrices as a way of understanding why the sequence of head bearing values is nonmonotonic, and then to forget about it.

**Planchet Issues**

Given the ubiquity of the Lanston display matrix, it is surprising how difficult it is actually to define its external geometry and dimensions. The problem has to do with cutting corners, in both a literal and a figurative sense.

In the one case, these matrices are difficult to measure and define because they involve compound angle cuts to their corners. These would be relatively complicated to
describe in a perfect world. When they must be re-derived from existing matrices which typically have banged-up corners (so that the point you're measuring doesn't actually exist in metal any more), the situation deteriorates.

In the other case, the mechanism of the Bancroft/Indahl 1915/1916 matrix holder design is robust and admits of considerable variation in matrix form. Lanston's production engineers knew this, and took advantage of it. The result is that in certain basic dimensions (such as length) there is so much variation in surviving examples that is isn't really possible to say what the value should be.

**Planchet Overall Length**

It would appear, generally, that Lanston display matrices are 1 1/8 inches long (1.125 inches). Duensing cites this as one of his values, and matrices made to this length will work in both the Type-&-Rule caster and the Thompson.

But there is a variation of more than 0.01 in those matrices I have examined, with values up to at least 1.136 inches. Duensing uses two different values in the same sentence: 80 points (1.1068) and 1.125 inches. Roy Rice used 81 points (1.1206 inches). Moreover, in actual practice the bottom edge of some Lanston-manufactured display matrices is anything but straight – some are distinctly wavy. As such, they do not even have a defined length (or, rather, they have a length with such broad tolerances that ordinary careful workmanship would produce better results).

**Planchet Overall Width**

It would appear that the overall width is ¾ inch. Roy Rice used 0.75 inches. It would probably be unwise to look to precision to three decimal places. Duensing in 1988 used 54 ¼ points (which is 0.7506), but converted this to 0.747 inches. Examples measured to date range up to 0.759.

A matrix made to 0.75 +0.01 would, I believe, work in both the Type-&-Rule

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41 {Matlas 1988}, p. 4 and {Matlas 2008}, p. 4.
42 {Rice MDMD}
43 {Rice MDMD}
44 {Matlas 1988}, p. 3, and {Matlas 2008}, p. 3.
45 This would give a nonstandard point of 0.013769, which is not, I think, what Duensing intended. Rather, I think that the 0.747 is a holdover from {Matlas 1986}, p. 3, where he used a width of 54 points (which is 0.74709 inches).
Caster and the Thompson. Actual tolerances are probably broader than this.

The Three Styles of Lanston Display Matrices for the T&R Caster

As noted earlier, Lanston Monotype display matrices for the Type-&-Rule Caster were produced in three major variants: brass electroformed, brass punched, and aluminum punched.

![Three Styles of Lanston Display Matrices](image)

**Three Styles of Lanston Display Matrices**

*Illustration 5: Three Lanston Monotype Display Matrices, Front and Back.*

The brass electroformed version, which is the oldest style, is nominally flat on the front and back. All Lanston matrices appear to have been stamped with the Chalfant patent date, regardless of their date of manufacture. Note however that it was (and is) common practice among amateur matrix makers to drill out unwanted Lanston matrices.
to make planchets for electroforming new matrices.

The right and, especially, the bottom edges of the brass electroformed matrices are frequently not straight, but this does not matter in matrix alignment.

Both styles of punched matrix bear the patent date on the back in relief within a channel.\textsuperscript{46} Both punched styles have what appears at first to be a raised center section. Actually, this center section is the standard matrix thickness (0.094 inches, approx.). The two sides are of lesser thickness (approx. 0.090). The edges of this center section are often quite rough, and both front and back typically show quite distinct surface patterns from milling. This front-surface geometry is not relevant at all to the use of these matrices on the Type-&-Rule caster (which holds them by the corner chamfers) and is not relevant to their use on the Thompson (there is enough freedom of motion in the Matrix Holder that you don't even notice that you're gripping the matrix 0.004” below its front surface).

Note: The circular shadow visible on the back sides of the punched matrices shown is due to the X41A Matrix Holder on the Type-&-Rule Caster.

All four main sides of the brass electroformed matrices are relatively sharp, suggesting that they were cut. The left and right sides of the punched matrices (both brass and aluminum) are similarly sharp, but their top and bottom sides have a slight radius. This, together with vertical striations on these sides suggests that they may have been sheared or pressed on these edges. Here is a close-up photograph of the top left corner of a brass punched matrix:

\textsuperscript{46} I have at least one font of flat-backed aluminum punched mats, but they are under-height and appear to have been milled down.
This photograph shows clearly:

- The rounding of the upper edge of the top side (to the left in the photograph).
- The vertical striations on the top edge.
- The two levels of the surface.
- The coarse and indefinite nature of the transition between the two levels of the surface.
- The fact that the exact corners of the bevel are by no means easy to define, up close, and typically are not physical features in metal.

The Corner Cuts

The distinctive beveled corner cuts on the Lanston display matrices are the most difficult feature on them to describe accurately. Fortunately, they are also the least important feature and probably also the feature which allows for the greatest variation. They are used only for holding the matrix into the matrix holder on the Type-&-Rule caster. They are not used at all when casting on other machines such as the Thompson.

To the best of my knowledge, original engineering specifications for these matrices do not survive. Reconstructing approximate specifications which will work is easy, given the wide tolerances allowed. Reconstructing exact specifications is nearly impossible, as
the several points of the corner bevel that one would expect to measure are typically either rounded off or, on close examination, consist instead of complex geometries which are probably not part of the bevel itself.

It is perhaps best to try to understand the corner cuts in terms first of their function and then of at least one method probably used to produce them. This will, in turn, help to put measured drawings in perspective.

Here are two photographs of a brass electroformed display matrix in a Lanston X41A Matrix Holder. On the left, the holder is shown open, on the right it is shown closed on the matrix. The views are as you would see the holder when holding it in your hand (that is, the handle is beyond the bottom side of the photographs).

![Illustration 7: Lanston Display Matrix in X41A Matrix Holder, Open and Closed](image)

The top side of the matrix banks against the fixed abutment 41A17 (on the left in the photograph), while the left side of the matrix banks against fixed abutment which is a part of 41A (on the bottom in the photograph). The corner bevels play no part in positioning the matrix.

In the left photograph, the two sliders which will clamp the matrix in are shown retracted.

In the right photograph above, and in the closer view below, the long rectangular slider 41A6 at the upper right of the photograph has moved leftward under spring

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47 This abutment is not a separate part, but is cast and machined as an integral part of the 41A Matrix Holder's main casting.
pressure to push against the lower right bevel of the matrix. The C-shaped part a41A5 on the left has moved rightward and just a little bit downward. It both clamps down on the matrix's upper left corner bevel and pushes against the upper right side of the mat. (I presume that the spring pressure acting on it is less than that acting on 41A6.)

It's clear that these corner bevels will work even with quite a wide variation in their form.

Now let's consider how such corner bevels might have been made. I have no idea how Lanston Monotype actually did it; to the best of my knowledge, the display matrix machinery has not survived. But the equipment that Andrew Dunker used to machine his matrices has survived. It represents the way in which an expert machinist trained in the late 19th century would have approached the matter, and it is possible that Lanston Monotype employed a similar method on a larger scale.

Dunker employed a metalworking shaper to machine his mats. The vise he built for holding matrices for it is designed both for finishing the matrix surfaces and for making corner bevels (though I am not aware of any Dunker matrices with corner bevels). In the photograph below, it is shown as Dunker left it, with a matrix being held in its top part for surface finishing. Ignore this, and assume that it has been folded out of the way.

Illustration 8: Lanston Display Matrix in X41A Matrix Holder, Parts and Motions

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---

48 I'd love to be wrong about this.
49 An E. N. Boynton traversing head shaper. For more information on it, see the section “Dunker Matrices for the Thompson,” below.
Instead, look at the channel on the side. If you were to put a matrix planchet in it and clamp it down (probably using the socket-head screw to the right), and then were to pass a cutter horizontally over the top, you would generate the corner bevel.

From the point of view of specifying a matrix, the important thing here is that the depth and dimensions of the corner bevels depend on the length of the matrix, not on each other or on common datums. In modern engineering drawing practice, the natural thing to do would be to establish two datums (probably at the head and side bearing sides of the matrix) and then to define both corner bevels relative to these. Feed this into a CNC mill and you're done.

But to accurately draw the matrix as it would be fixtured and cut in Dunker's vise,

---

50 Either the shaper's cutter as Dunker used it, or a conventional milling cutter.
you would instead specify the two angles (corner cut angle and bevel angle) and the overall length of the matrix. Here is a graphical comparison of the two methods, simplified to two dimensions (ignoring the bevel angle):

![Graphical Comparison of Modern vs. Dunker Methods]

**Corner Bevels: Modern v. Dunker**

Illustration 10: Modern (Quasi-GDT) vs. Fixturing Methods for Lanston Corner Bevels

**Measured Drawings**

Evidence is always nice. Here are measured drawings of Lanston display matrices. [TO DO: Only have one so far – do brass punched and an aluminum punched matrices.]

After several days of attempting to measure mats using height gages on surface plates, microscopes, etc. I realized that the best approach would be, instead, to capture an image at known size and work from it. Ordinary office flatbed scanners turn out to be remarkably accurate for work actually in contact with the glass. A resolution of 1200 dpi is good enough for this work. I then imported the image into a 2-D CAD program capable of drawing proper lines and measuring dimensions.

---

51 They become inaccurate as measuring tools very quickly as you go above the glass.
52 I use LibreCAD, but any 2-D CAD program should work. Inkscape is not sufficient – it is very
Here is a scanned image and measured drawing of the front and back of a brass electroformed Lanston display matrix.

**Markings; Reading Set Widths**

Four numbers (and optionally an asterisk) appear on the non-casting portions of the front of a Lanston display matrix.

The upper left number is the body size of the type to be cast, in points.

The upper right number is the Lanston Monotype series number of the face. Tables of Lanston Monotype series numbers are available online at {CR MDST} and in print in {McGrew 1993}. Note that American (Lanston) and English Monotype series numbers are unrelated.

The two bottom numbers (and optional asterisk) indicate the wedge positions for the

difficult to do an accurate drawing in it.

53 “LD-E” is simply an identifier for the sample: Lanston Display specimen E.
Type-&-Rule Caster when using this matrix. The left number gives the wetting of the 47S Normal Wedge, the right number gives the setting of the 46S Justification Wedge, and the asterisk, if present, indicates that the 60S Abutment-Screw Packing Piece must also be in position.⁵⁴

These numbers can also be interpreted as the intended set width of the character. This can be useful when casting the matrix on machines other than the Type-&-Rule Caster. The left number (the Normal Wedge number) indicates the number of whole points in the set. The right number (the Justification Wedge number) indicates the number of additional eights of a point. If the asterisk is present, then the sum of these two numbers is the set width. So for example if these numbers are 16 and 6, then the set width is 16 + (6 * 1/8) = 16 ¾ points. If the asterisk is not present, then add 17 points to the result. Thus if the numbers are “*16 2” the set width is 17 + 16 + ¼ points, or 33 ¼ points.

Display Matrix Alphanumeric Codes

The only numbers or symbols physically stamped on Lanston display matrices are those described earlier (point size, series number, the two wedge setting numbers, sometimes an asterisk, and the Chalfant patent date on the back). However, in their literature Lanston Monotype employed some of the alphanumeric symbols normally used for cellular matrices to describe display matrix fonts. So for example in the *Handy Index of 'Monotype' Rental Matrices*,⁵⁵ series No. 345 (Copperplate Gothic Bold) was offered in both 18 point and 18H4 point, the latter being “full face on body,” which is to say titling.

These are the symbols for which I have seen evidence:

<table>
<thead>
<tr>
<th>'H' Symbols (from Cellular: Misc. Symbols Used After the Point Size)</th>
</tr>
</thead>
<tbody>
<tr>
<td>H4</td>
</tr>
<tr>
<td>H9</td>
</tr>
</tbody>
</table>

*Table 9: Lanston Display Alphanumeric Codes, 'H'*

---

⁵⁴ See for example {Lanston 1916}, p. 164.
⁵⁵ {Lanston 1955}
⁵⁶ Examples in {Lanston 1955}
⁵⁷ The description here is Duensing's. I don't actually have evidence of this yet from the Lanston literature.
| Other Symbols (from Cellular: Classification Symbols Used After the Series Number) |
|---------------------|--------------------------|
| B                   | Small Caps [Cellular: Modern Roman Small Caps] |

Table 10: Lanston Display Alphanumeric Codes, Other

(Note that in Cellular usage, 'B' is “Modern Roman Small Caps,” but in display matrix usage it just means “small caps.” For example, see series No. 248, Garamont, which was issued in 14B and 18B “Small Capitals for Hand Composition. Garamont is certainly not a Modern face.)

Display Matrix Series Numbers vs. 'K'

In cellular matrix fonts, Lanston's practice was to indicate an italic font by using the “Classification” letter suffixes after the series number. Thus in cellular sizes No. 86 (Cheltenham Bold) was 86J for roman and 86K for italic.

In display and Giant Caster sizes, Lanston did not use these suffixes in this way. Instead, the roman or basic variant just carried the series number (thus, for example, 24 point No. 86, Cheltenham Bold) and the italic variant had a series number with the digit '1' appended (thus, 24 point No. 861, Cheltenham Bold Italic).

It was, however, the informal practice of some foundries to label their boxes of display matrices with the 'K' suffix to indicate italic (thus: “14 thru 36 86K”).

There are about a dozen exceptions to the “add 1 for italic” formula, some of which seem to have a historical basis, others of which seem simply arbitrary. For a discussion of them see {CR Composite Lanston Specimen}.

Other (Conflicting) Data

Other information about Lanston display matrices which would appear to conflict with that given here has been published and/or distributed. It doesn't do just to dismiss it, because it comes from serious sources and clearly they were looking at something. For discussions of these, see the Appendices:
2.4 American Display (42 & 48 Point, for the Thompson)

History/Explanation

These matrices have not received much coverage in the literature.

Richard L. Hopkins illustrated one of them in his photographic survey of “Display Matrices for Individual Castings.” This appeared first in the American Typecasting Fellowship Newsletter and was later incorporated by him in his 2008 edition of Matlas.

The 1955 Lanston rental index notes that “Matrices are available … including 42 and 48 point Display matrices for use on the Thompson Caster. (0.050 drive)” This is useful because it gives an official specification for the depth of drive.

Duensing, in {Matlas 1986}, p. 3, includes 42 and 48 point “Thompson” head and foot bearings in the “Balto & Mono” section of his “American Mono Display” table.

These matrices were intended for the Monotype-Thompson Type-Caster. They cannot be cast on the Type-&-Rule caster. While their size would be within the capacity of both the Giant Caster and the Super Caster, I do not know whether mold and matrix equipment was made for those machines to cast these matrices.

Depth of Drive

As mentioned above, {Lanston 1955}, p. 1, asserts that the depth of drive for these matrices is 0.050 inches.

Side Bearing

58 {ATFNL 32}
59 {Matlas 2008}
60 {Lanston 1955}, p. 1.
Head and Foot Bearings

Duensing's "American Mono Display" table in [Matlas 1986] gives information which is probably about these matrices. However, this information raises questions, and he did not include it in later editions. He has the following (all values in points):

<table>
<thead>
<tr>
<th></th>
<th>Balto &amp; Mono</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Head</td>
</tr>
<tr>
<td>Thompson</td>
<td>42</td>
</tr>
<tr>
<td></td>
<td>48</td>
</tr>
</tbody>
</table>

The problem here is twofold:

First, Duensing says that these are “NG” - which I presume means “no good”.

Second, the 42 point line sums to 80 points, while the 48 point line sums to 78 points. These values, whatever they might be, should be equal.

Markings and Identification

[TO DO]

Geometry and Dimensions

[UNKNOWN TO ME]
2.5 Giant Caster

[TO DO]
3 English Monotype

3.1 English Standard Composition
   [TO DO]

3.2 English Small Composition (4 1/2 pt)
   [TO DO]
3.3 English Display

The display matrices produced by the English Monotype company were much more substantial than those produced by Lanston. Their manufacture is in part documented in \{MR 40.3\} and \{Making Sure 2\}. They were punched, not electroformed. Richard L. Hopkins indicates that they were “made of copper encased in a very fine coating of chrome,” but that “very old English display matrices were not chrome plated.” (\{Matlas 2008\}, p. 6)

They came in two sizes: 1 inch square and 1 1/4 inch square. The specifications for the external dimensions, with tolerances, for the 1 inch square English Display matrices for use from 42 to 60 point type survive in the English Monotype drawing D3437, dated Feb. 6, 1929. This was reprinted by Duensing in \{Matlas 1986\}. See also the illustration below and Drawing No. CR-22 in the Appendices for dimensioned drawings based upon this information.

Depth of Drive

The depth of drive is .065. English Monotype drawing D3437, gives the “REJECT SIZES” for depth of drive as .0652 .0645 . My interpretation of this is that if the depth was .0652 or deeper, or if the depth was .0645 or shallower, the matrix would be rejected. 61

Head and Side Bearings

The head and side bearings of English Display matrices are presently incompletely known to me.

In \{Matlas 1986\} the only reference to English Display matrices is English Monotype drawing D3437 (1929). It gives a dimension which might be the side bearing, but for its value only calls out “J50 STANDARD”. It does not indiate head bearing(s).

In \{Matlas 1988\} Duensing prepared a drawing of an English Display matrix, with values. These values seem to be the nominal/basic values from D3437, with the addition

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61 On Drawing D3437 as reprinted in \{Matlas 1986\} the word “REJECT” is crossed out and the word “LIMIT” is substituted, implying that matrices at exactly 0.0645 and 0.0652 would be accepted. This is not a Monotype engineering revision to this drawing, however, but merely a later interpretation by someone who possessed this copy of this drawing. It cannot be accepted as Monotype practice.
of a value for the Side Bearing: .150”. There is no indication of head bearing.

In {Matlas, the 2008}, editor by Richard L. Hopkins adds a drawing by Duensing (which didn't actually appear in any known Matlas during Duensing's life) which gives some dimensions for English Display matrices, including head and side bearings. But these dimensions are questionable. The dimensions given for the thickness of the matrix (0.250) and the width of the slot on the bottom (.210) do not agree with those given in the English Monotype drawing D3437 of 1929 (which gives .2650 and .1875, .2647 and .1880, respectively), or in Duensing's own {Matlas 1988}. Moreover, the head bearing Duensing does give, 0.275, cannot be correct for at least the 42-60 point size of the matrix (because 60 points is 0.834”, and 0.834 + 0.275 = 1.109”, which is larger than the matrix). Pending further information, the side bearing remains unverified and the head bearing or bearings remain unknown.

<table>
<thead>
<tr>
<th>English Display</th>
<th>Head Bearing</th>
<th>Side Bearing</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt; 42 point</td>
<td>unknown</td>
<td>0.150 [unverified]</td>
</tr>
<tr>
<td>42 to 60 point</td>
<td>unknown</td>
<td>0.150 [unverified]</td>
</tr>
<tr>
<td>&gt; 60 point</td>
<td>unknown</td>
<td>0.150 [unverified]</td>
</tr>
</tbody>
</table>

*Table 11: English Display Head and Side Bearings*

**External Dimensions**

The following illustration contains external dimension information derived from English Monotype drawing D3437 of 1929 as reprinted in {Matlas 1986}. For a version in the style of an engineering drawing, see drawing CR-22 in the Appendices.
Dimensioning Practices

A note about drawing style and tolerancing/gaging practices may be in order. Monotype drawing D3437 of 1929 was not prepared in conformity to the then-new British Standard 308:1927 Engineering Drawing Office Practice. (For example, it omits the leading '0' on dimensions under 1 inch; BS308:1927 called for this '0'.) However, it does represent the state of the art in dimensioning and gaging practices for 1929. In every case but that of the “REJECT SIZES,” the dimension specified as the upper dimension in a pair is that of the part at what was then called the “Maximum Metal Condition” (MMC). This concept of maximum (and minimum) material conditions remains a core idea in 21st century “geometric dimensioning and tolerancing,” but while it is stated as a set of procedures in modern textbooks, we have lost sight of the underlying reasons for it which developed out of manufacturing and gaging needs. These are relevant to the maker of a new matrix.

The idea was that it is a desirable practice to manufacture a part to its Maximum
Metal Condition (thus: the largest acceptable shaft and the smallest acceptable hole). This gave the greatest allowance for wear, and was also the condition in which you could most easily rework the part if necessary (e.g., turning down the shaft, reaming out the hole). This manufacturing practice was reflected in engineering drawings by a particular method of expressing tolerances. Rather than expressing tolerances bilaterally (plus-or-minus), tolerances were expressed unilaterally from the MMC.

For example, rather than specifying an external size of \[0.9999 \pm 0.0001\] (a bilateral tolerance), the external dimensions on this drawing were specified as \[1.0000\ 0.9998\] (a unilateral tolerance), with the assumption that the upper number specified the MMC.\(^{62}\)\(^{63}\)

In the case of a hole, slot, radius, or other “negative” feature, the smaller number represents the MMC. So for example the width of the bottom slot was specified as \[0.1875\ 0.1880\] In this case the MMC (the upper number) is smaller; it is also the desired slot width (.1875 is 3/16 inch - many decimal dimensions in older engineering practice work out to decimalized fractional inches).

However, it should be noted that there are probably some cases on this drawing where the limit dimensioning actually represents bilateral tolerancing. For example, the depth of the side slot was specified as \[0.048\ 0.052\]. While the upper number (0.48) is the MMC, it is likely that the desired slot depth was actually 0.05. (It is just a slot for retaining the matrix in its holder; nothing registers against its internal side.) So this dimension probably means \[0.050\ +\ 0.002\] rather than \[0.048\ +\ 0.004\]. We do not, however, at this time have any solid evidence either way (beyond assuming a preference for simpler

\(^{62}\) This style of writing the dimensions as a pair of limit dimensions, one above the other, is in itself ambiguous with regard to material condition. We know from {Abbott 1953}, p. 30, that in British practice “a convention in common use requires that the uppermost dimension of the pair should always give the maximum metal size.” This convention was made official in {BS308:1953}. Modern practice (in the US at least) distinguishes “limit dimensioning” from unilateral tolerancing. In limit dimensioning in current practice there is no longer any assumption of material condition, as there was in earlier British practice. But with unilateral tolerancing the Maximum Material Condition can now be made explicit as a 0 tolerance. So the “limit dimension” style dimensioning of this matrix, given as \[1.0000\ 0.9998\] with an assumption that the upper number was the MMC, becomes the unilaterally tolerated dimension: \[1.0000\ 0.0002\]. See {ASME Y14.5-2009}, p. 25.

\(^{63}\) See {CR DT} for a discussion of the history of this topic. It gets complicated.
numbers).

An apparent exception to this MMC practice occurs in the specification of the two REJECT SIZES for depth of drive: 0.0652, 0.0645. The upper number represents a deeper drive, and thus the Least Material Condition (LMC), not the MMC. This makes sense, however, when you consider the manufacturing origins of the concept of MMC and LMC (something not addressed in modern textbooks). The upper number represents not so much the MMC per se as it does the desired manufacturing outcome. In the case of an 0.065 drive matrix, ideally you want this to be 0.065 exactly. Monotype allowed a very slight tolerance for a deeper drive (< .0002) and a greater tolerance for a shallower drive (< .0005), but clearly the desirable outcome was a matrix as close to 0.065 as possible (that is, closer to the upper number).

Matrix Planchet Manufacturing

So how does this rather arcane account of former engineering drawing practices affect the matrix maker today? If you're just making a single matrix, it does not. A newly made matrix which gages or measures within the limit dimensions specified on D3437 without any other considerations will be interchangeable with any other matrix made to these same specifications.

The difference comes when you wish to do either (or both) of two things: (1) to tune your manufacturing process so that it reflects the understanding of interchangeable manufacture that The Monotype Corporation Ltd. had in the 1920s, and/or (2) to convert the tolerated dimensions of D3437 into an unambiguous specification in 21st century engineering drawing practices - this would allow even a computer controlled milling machine to understand the original manufacturing goals.

In doing this, the following points emerge:

1. It is not correct simply to treat the limit dimensions of D3437 as limit dimensions without consideration of material conditions (as described by {ASME Y14.5-2009}, for example).

2. It is in general not correct to translate these limit dimensions into bilaterally tolerated dimensions. (The exception is the depth of the side groove, which probably is in intent a bilaterally tolerated dimension.)

3. It is in general correct to translate these limit dimensions into unilaterally
toleranced dimensions from a MMC which was expressed by the top number in
the D3437 limit dimension. (The exception, again, is the depth of the side
groove.)

4. In the case of the “REJECT SIZES,” it is probably correct to translate these into
an unequal bilaterally tolerated dimension. The only difficulty is that standards
such as Y14.5-2009 do not include the concept of “less than” or “greater than”
(but not equal to) in tolerances. So a slightly nonstandard expression such as this
must suffice: \[0.0650 < +0.0002 \quad > -0.0005\]. A geometric dimensioning and tolerancing
“BASIC” dimension with a tolerance in an associated frame would also work.
3.4 Super Caster

[TO DO]
4 Other Type Caster Manufacturers

The Thompson comes first here, because it has been the workhorse of the independent typefounding industry since its introduction in 1907. But it is worth noting that the Compositype came first. Moreover, Compositype was co-founded by John E. Hanrahan, who formerly had been the principal type designer of the John Ryan Type Foundry (Baltimore). The National Compositype Company developed an extensive matrix library, the acquisition of which after its demise was the subject of a strongly worded fight in the press between the Universal Type-Making Machine Company (the successors to Nuernberger-Rettig) and the Thompson Type-Making Company.

The manufacturers considere here are:

• Thompson
• Compositype
• Nuernberger-Rettig

4.1 Thompson Type Machine Company

With appropriate mold and matrix equipment, the Thompson Type-Caster can cast from any style of matrix in sizes up to 48 point. The section here concerns specifically the style of flat matrix introduced by the Thompson Type-Machine Company (TTMC) for their caster. Duensing gives data for three variations: small and large “old Thompson” matrices (that is, matrices made by the TTMC) and “Monotype Thompson” matrices made by the Lanston Monotype Machine Company (presumably after their acquisition of the TTMC in 1929).

See also the section later in this present volume on Independent Matrix Makers (for whom the Thompson was an obvious target machine), and especially the section there on Andrew Dunker's matrices for the Thompson. Dunker's precise reverse-engineering of a Thompson-compatible matrix may be a better place for the aspiring matrix maker to start than the Thompson data here.

64 See [Annenberg 1994], p. 222.
65 See various advertisements placed by both firms in The Inland Printer in April and May of 1914. These are reprinted in {CR Thompson} and {CR NR}. 
Depth of Drive

The design of the first version of the matrix equipment for the Thompson Type-Caster, appears to have been intended for casting from Linotype matrices. In consequence, when the Thompson Type-Machine Company introduced matrices of their own format (at an exact date which is not known), they retained the standard Mergenthaler Linotype depth of drive: 0.043”. (This is in fact a quite logical number for American type: 0.918 - 0.043 = 0.875, which is 7/8.)

Head and Side Bearings

In all editions of Matlas, Duensing gives the side bearing of both sizes of Thompson matrix as a uniform 8 points.

Head Bearings in the 1986 Edition of Matlas

The values given by Duensing for the head bearing(s) are more complex. In at least one case they also involve a foot bearing. More importantly, the information in various editions of Matlas is contradictory, both between versions and within editions. Moreover, it is not entirely clear in some cases if he is referring to Thompson-style or Monotype display style matrices.

I’ll start with the earliest information, which is that in {Matlas 1986}. Thompson head bearing information occurs in three places in it.

(A) Head Bearing for the Old Thompson small (“narrow”) matrices.

This is on p. 5 of {Matlas 1986}. This table does not appear in later versions of

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66 The early machines employed a method of “set blocks” for establishing the set width of the type. Later machines employed the “Micrometer Set Adjusting Device.” While the name of this Device makes it sound as if it was simply an attachment, it actually represented a complete, and not backward-compatible, re-engineering of the matrix equipment for the machine.

67 The initial announcements of the machine to the trade said, more specifically: “The most striking feature of the Thompson Typecaster is the matrix it employs - the ordinary Linotype matrix - although it is built to cast type from any other matrix desired - Monotype, Compositype or foundry matrix.” {IP 39.2 p.250}

68 Given the initial focus of the Thompson on Linotype matrices, it would be interesting to learn whether the TTMC adopted the ATF point of 0.0139 or the Mergenthaler Linotype point of 0.014.
Matlas. It is elaborate and internally consistent, but it contradicts information both in other parts of the 1986 edition and in later editions of Matlas.

For the head bearings of the small “Old Thompson” matrices (he calls them “narrow” here), Duensing presents a drawing and a table of values. In the drawing, the small Thompson style matrix is shown with a constant foot bearing of 24 points. The table gives a set of variable head bearings for various body sizes. In each case the sum of the head bearing, the body size, and the foot bearing is 81 points. This works out to 1.1259” (which is only 0.001 over the nominal matrix length of 1.125 inches).

<table>
<thead>
<tr>
<th>Body size in points</th>
<th>Head bearing in points</th>
<th>Comment (Duensing’s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>6</td>
<td>51</td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>49</td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>47</td>
<td></td>
</tr>
<tr>
<td>12</td>
<td>45</td>
<td></td>
</tr>
<tr>
<td>14</td>
<td>43</td>
<td></td>
</tr>
<tr>
<td>18</td>
<td>39</td>
<td></td>
</tr>
<tr>
<td>24</td>
<td>33</td>
<td></td>
</tr>
<tr>
<td>30</td>
<td>27</td>
<td></td>
</tr>
<tr>
<td>36</td>
<td>21</td>
<td></td>
</tr>
<tr>
<td>42</td>
<td>15</td>
<td>“will not clear mold”</td>
</tr>
<tr>
<td>48</td>
<td>9</td>
<td>“will not clear mold”</td>
</tr>
</tbody>
</table>

*Table 12: Head Bearings for Old Thompson Small Matrices [Matlas 1986]*

If in fact the 42 and 48 point head bearings result in matrices whose body position cannot be raised up to meet the casting cavity of the mold (which is how I interpret Duensing’s comment), then one wonders if these values were determined from the equation or from actual matrices.

In *Matlas 1986*, in the Thompson section, Duensing says nothing about the head bearings of the large Old Thompson matrices.

However, in *Matlas 1986* in the “American Mono Display” section, Duensing presents Thompson information in two parts of a table. This table says that it shows head and foot bearings for Monotype display matrices (not Thompson matrices). Nevertheless, it gives “Thompson” information.
In the section of the table marked “Balto & Mono”, he gives head and foot bearings for Monotype “T” Molds (sorts casting molds for the Type-&-Rule caster for 12pt, 14pt, and 18pt) and U-Molds (sorts casting molds for 24pt, 30pt, and 36pt). This information is clearly for Lanston display matrices. However, in the same section of the table he also gives two lines of data marked “Thompson”. Here is this section of this table:

<table>
<thead>
<tr>
<th></th>
<th>Balto &amp; Mono</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Head</td>
</tr>
<tr>
<td>T-Mold</td>
<td>12</td>
</tr>
<tr>
<td></td>
<td>14</td>
</tr>
<tr>
<td></td>
<td>18</td>
</tr>
<tr>
<td>U-Mold</td>
<td>24</td>
</tr>
<tr>
<td></td>
<td>30</td>
</tr>
<tr>
<td></td>
<td>36</td>
</tr>
<tr>
<td>Thompson</td>
<td>42</td>
</tr>
<tr>
<td></td>
<td>48</td>
</tr>
</tbody>
</table>

*Table 13: "Balto & Mono" Head and Foot Bearing Data from [Matlas 1986]*

For all of the T-Mold and U-Mold entries the sum of the body size, the head bearing, and the foot bearing are all 80 points, which is the size Duensing gives for the length of a Monotype display matrix in the diagram accompanying this table.

The first “Thompson” line also sums to 80 points, but the second sums to 78 points. As I would interpret “NG” to mean “No Good,” I'm not sure why these two lines appear in this section of the table at all. They were dropped from this table in later editions.

In the section of this same table marked “Thompson” there are values for head and foot bearings for some kind of matrix – but it isn't clear what kind. If you interpret the table literally, they must be for Lanston Monotype display matrices as used on the Thompson. If you accept the numbers in the table as correct, then they cannot be for “Old Thompson” small matrices, as these numbers have a fixed head bearing where Duensing on p. 5 gives a variable head bearing for Thompson small mats. My current interpretation of this table (though I suspect that I am wrong) is that it contains values for “Old Thompson” large matrices. Here is this section of this table:
In each case, the sum of the constant head bearing (18 points), the body size, and the variable foot bearing is 80 points. This fits the value Duensing gives in the drawing accompanying this table for the length of a Lanston Monotype display matrix. Unfortunately, it does not match either of the length values that he gives on p. 5 for Thompson-style matrices. (80 points is 1.104 inches. On p. 5 he gives the length of the small Thompson-style matrix as 1.125 inches and the large as 1.190 inches.)

Summary of the 1986 data:

1. The table on p. 5 gives variable head bearings and constant foot bearings for “narrow” (= small) Thompson-style matrices.

2. The two lines for 42pt and 48pt “Thompson” in the “Balto & Mono” part of the American Mono Display table on p. 3 should probably be discarded.

3. The part of the table on p. 3 (in the American Mono Display section) may specify constant head bearing data for large Thompson-style matrices. If it does, though, it does not match the length dimension of either size of Thompson-style matrix.

**Head Bearings in the 1988 (and 2008) Editions of Matlas**

The primary difficulty with Thompson-style matrix information in later editions of *Matlas* is that the table of (variable) head bearing and (constant) foot bearings for the small (“narrow”) Thompson-style matrices, on p. 5 of the 1986 edition, is entirely missing. Later editions just have a simplified table which specifies a constant foot bearing for “Old Thompson Small” matrices of 24 points, with no head bearing.
Here is the head and side bearing information from Table 5 (on p. 5) of {Matlas 1988} (the table also gives other information on external dimensions and Baltotype and Iwata Bokei practice; this is not relevant here):

<table>
<thead>
<tr>
<th></th>
<th>Head Bearing</th>
<th>Foot Bearing</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Old Thompson Small</td>
<td>-</td>
<td>24 pt</td>
<td>{Matlas 1988}</td>
</tr>
<tr>
<td>Old Thompson Large</td>
<td>18 pt</td>
<td>not applicable</td>
<td>{Matlas 1988} {Matlas 1986}</td>
</tr>
<tr>
<td>Monotype Thompson</td>
<td>18 pt</td>
<td>not applicable</td>
<td>{Matlas 1988}</td>
</tr>
</tbody>
</table>

Table 15: Head (and Foot) Bearings for Thompson Matrices from {Matlas 1988}

The same table is reprinted verbatim in {Matlas 2008}.

In the “U.S. Lanston Mono Display” section of {Matlas 1988}, Duensing presents a reformatted and slightly reduced version of the table which appeared in the “American Mono Display” section of the 1986 edition. He now labels the “T-Mold” and “U-Mold” data as “MONOTYPE STANDARD”, and he drops the 42-point and 48-point “Thompson” lines. This is unproblematic: this information is for Monotype display matrices, not Thompson-style matrices.

However, the third section of the 1986 table, “Thompson”, is in 1988 converted into a separate table marked “THOMPSON STANDARD.” The values in it remain the same. Each line still sums to 80 points, which is the length Duensing associates with the Lanston display matrix, not any Thompson-style matrix.

Head Bearings in Matlas, Summary

The information presented in the various editions of Matlas for Thompson matrices:

1. Has internal contradictions
2. Does not clearly distinguish Monotype display and Thompson style matrices
3. Omits important information in later editions

It is difficult to rely upon information with these issues, and it might be best to discard it and start from scratch.

On Foot Bearings
Most (all?) matrices are located in their holders by two surfaces, typically one at the head of the matrix and one at the side. So it is only necessary to specify two offsets from the sides of the matrix which bear on these locating surfaces in order to determine the intended position of the type body against the matrix: the head bearing and the side bearing, typically.

Yet in several cases Duensing also presents a foot bearing. There are three issues with this. First, this dimension is quite obviously redundant. The external size of the matrix is known, and the head bearing plus the body size plus the foot bearing must equal the matrix length. Second, this dimension is also less critical. So long as the matrix fits in its holder, the length of the “foot bearing” may vary without affecting the alignment of the matrix. Third, specifying this dimension is at odds with the basic principles of dimensioning for interchangeable manufacture established in the early 20th century: you cannot specify both a stack of dimensions and its overall length in real manufacturing situations where mathematically perfect parts are impossible.69

Nevertheless, foot bearings were important in the opinion of at least two of the generation of independent matrix makers working in the 1980s. In addition to Duensing in Matlas, Roy Rice prepared an entire chart of Lanston display matrix dimensions specifying head bearings, body sizes, and foot bearings.70

### External Dimensions

Duensing writes “These mats were made in two sizes and may be identified by their having two chamfered corners at the head.” In {Matlas 1986} (and duplicated in {Matlas 2008}), he presented the following information about Thompson matrices. Dimensions in inches.

<table>
<thead>
<tr>
<th></th>
<th>Length</th>
<th>Width</th>
<th>Thickness</th>
</tr>
</thead>
<tbody>
<tr>
<td>Old Thompson Small</td>
<td>1.125</td>
<td>.750</td>
<td>.094 - .099</td>
</tr>
<tr>
<td>Old Thompson Large</td>
<td>1.190</td>
<td>.875</td>
<td>.085 - .086</td>
</tr>
<tr>
<td>Monotype Thompson</td>
<td>1.181</td>
<td>.875</td>
<td>.119</td>
</tr>
</tbody>
</table>

*Table 16: Thompson Matrix External Dimensions from {Matlas 1988}*

However, in the earlier {Matlas 1986} he presented slightly conflicting data.

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69 See for example {Buckingham 1921}, p. 48, where this principle becomes the first law of dimensioning. It has remained a core idea in engineering drawing ever since.

70 This was distributed at least on a limited basis. A copy exists in Duensing’s papers. It is not yet online.
In TABLE 6 (p. 5), he gives thickness values which appear to apply to both matrix sizes, and which are further interesting because they're expressed in terms of nominal points, but which don't always match the thickness values cited above:

<table>
<thead>
<tr>
<th>Thickness range</th>
<th>Nominal thickness in points</th>
</tr>
</thead>
<tbody>
<tr>
<td>Both sizes of TTMC matrices</td>
<td>.094 - .099</td>
</tr>
<tr>
<td>“some old ones”</td>
<td>.085 - .086</td>
</tr>
</tbody>
</table>

This information becomes even more problematic when one calculates the actual values of these two point dimensions in inches. Given a point of 0.0139”, 7 points is 0.0973”, which is comfortably within the range cited. But 6 points is 0.0834, which is well below the range cited.

It is worth noting that within reasonable limits the thickness of a flat matrix on a Thompson is not a critical value.

**Geometry**

[TO DO: Drawing illustrating the Thompson matrices.]

Note: The drawings of Thompson matrices in *Matlas* show relatively large un-beveled corner-cuts at both top corners. But the Thompson matrices presently in my possession (which are in original Thompson Type-Machine Company boxes) have very small corner-cuts. Schuyler Shipley, proprietor of Skyline Type Foundry, has examined
a dozen Thompson matrices from his extensive collection. He reports that the size of the corner cuts varies widely, from “barely even there” to “as big as 1/8 inch.”\textsuperscript{71} The corner cuts on the Thompson matrix play no part in its use on any type casting machine.

\textsuperscript{71} In an e-mail to the editor, 2015-01-11.
4.2 Compositype

History

The Compositype was the first of several type casting machines which emerged around the turn of the 20th century in response to the notion that every printer should be his own typefounder. It was not successful in the market as a casting machine, but it is notable for its influence on early 20th century matrix production. This influence came about not only because it was the first, but also because one of the founders of the National Compositype Company was John E. Hanrahan, formerly the principal type designer of the John Ryan Type Foundry (Baltimore) and with ATF from 1892 to the start of Compositype in 1899.72

A 1909 article in The Inland Printer noted that “the [Compositype] company had practically exhausted its resources in 1907, and its factory in Baltimore has not been in operation for the past few years.”73

In 1914, an interesting dispute was conducted in the trade press by the Universal Type-Making Machine Company (successors to Nuernberger-Rettig) and the Thompson Type-Machine Company. By way of background, both companies not only sold matrices but rented them. In April 1914, Universal (N-R) announced that they had purchased “the entire matrix equipment” of the National Compositype Company. Simultaneously, Thompson announced that they had purchased “an entire Compositype matrix library” and that in doing so they had “secured this line of matrices.” Further, Thompson proposed to loan these matrices to Thompson owners for free.74

It is clear from an examination of Thompson Type-Machine Company specimens that many of the Thompson series numbers bear a strong relation to Compositype series numbers, but the exact nature of this has not yet been worked out.

At some point around 1918/1920, the Universal and the Thompson companies became one, and in 1929 the Lanston Monotype Machine Company purchased the Thompson Type Machine Company.

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72 {Annenberg 1994}, p. 222.
73 {McCue 1909, Part 2}
74 The advertising history of this dispute may be read in the “Advertisements and Trade Notes” sections of {CR Thompson} and {CR N-R}.
Depth of Drive

[TO DO]

Geometry and Dimensions

[TO DO. They're very much like early Thompson matrices.]

4.3 Nuernberger-Rettig

The Nuernberger-Rettig was basically a pivotal type caster adapted with a more sophisticated drive mechanism for intended use by printers. It also featured a mold which differed from the ordinary pivotal mold by casting a jet which would break off above the feet of the type.\textsuperscript{75} This allowed it to cast type which did not require the foot to be plowed.

The N-R company later became the Universal Type-Making Machine Company and the caster was renamed the Universal Type-Making Machine.

With appropriate mold and matrix equipment, the N-R could be configured to cast ordinary Lanston Monotype display matrices, as well as its own matrices.

Depth of Drive

Duensing lists the depth of drive of the native Nuernberger-Rettig matrix as 0.065 inches in all versions of Matlas.

Geometry and Dimensions

[TO DO]

\textsuperscript{75} Not all Nuernberger-Rettig molds had this feature, however. The N-R molds that I have examined from the two ex-Sterling Type Foundry N-Rs were a mix of the special N-R molds and ordinary pivotal caster molds.
5 Independent Matrix Makers

Many independent companies and individuals made matrices in the 20th century. For the most part, technical information about their practices has been lost.

In the case of companies such as Baltotype, the information which was recorded in Duensing's *Matlas* has to do with overall dimensions and head/side bearings.

In the special case of the matrices made by Andrew Dunker for the Thompson Type Caster, however, the surviving information is particularly interesting. Dunker presented (and Duensing published, in *Matlas*), a reasonably functional reverse-engineering of a simple matrix form which was satisfactory for use with the Thompson. Because of its simplicity (no corner cuts) and because he gave toleranced dimensions, his work may be the best starting place for someone wishing to make new matrices for the Thompson.

5.1 Dunker Matrices for the Thompson

The late Andrew W. Dunker of Michigan was a highly skilled machinist who produced over the years a series of matrix fonts for the Thompson Type-Caster. For the most part these were revivals of “antique” typefaces no longer available (though in one special case, the typefaced “Homespun,” he produced a very unusual original design). I have had the pleasure of casting from Dunker’s matrices at Skyline Type Foundry, and can attest that they are of high quality and utterly remarkable construction. For the “antique” revivals, Dunker electroformed his matrices. The normal technique for electroforming, as practiced since Starr’s patent in 1845, involves creating a blank matrix (or “planchet”), typically of brass, with a hole in it into which the casting cavity of the matrix is electroformed in copper. After electroforming, relatively little work is needed to finish the matrix to size. Dunker did not do this, however. Instead, he electroformed the entire matrix in copper in the solid and then machined this down to size.76

In the 1988 16-page edition of *Matlas*, Duensing reprinted a dimensioned sketch by Dunker showing his regular and large-size electroformed matrices. (This sketch does not appear in *Matlas 2008*, even though most of the 2008 edition is based on the 1988 edition.)

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76 He used a metalworking shaper (a machine unrelated to the now more common woodworking shaper). The shaper he used was an E. N. Boynton shaper, the pattern for the main casting of which was made before 1879 (the year that the E. N. Boynton company became the Boynton & Plummer company). It is of an unusual style which Boynton called “Traverse Head,” but which is more commonly known today as “traveling head.” This machine survives. The metalworking shaper is a reciprocating machine tool which produces a characteristic pattern of straight tooling marks on the workpiece. These marks appear as a fine pattern of straight lines on the Dunker matrices, and in turn they are cast into the shoulders of the types cast from Dunker matrices (making type cast from these matrices easily identifiable as such).
edition.) Here are two illustrations reproducing the information from that sketch (for a version of both done in the style of an engineering drawing, see Crawing No. CR-23 in the Appendices.)

Illustration 13: Thompson Matrix by Andrew W. Dunker, Regular Size (Matlas 1988)
Typically, Dunker made his matrices to an .043 depth of drive, because his thompson was equipped with a mold for this depth. However, a complete census of known Dunker matrices and their dimensions and drives has not been done.

Illustration 14: Thompson Matrix by Andrew W. Dunker, Large Size [Matlas 988]
5.2 Baltotype (for the Thompson)

In *Matlas* 1986 and *Matlas* 1988, Dunsing presented the following information about Baltotype matrices for the Thomson Type-Caster. Dimensions in inches (or points if indicated).

<table>
<thead>
<tr>
<th></th>
<th>Head Bearing</th>
<th>Side Bearing</th>
<th>Length</th>
<th>Width</th>
<th>Thickness</th>
</tr>
</thead>
<tbody>
<tr>
<td>Baltotype</td>
<td>18 pt</td>
<td>8 pt</td>
<td>1.181</td>
<td>.815 (varies)</td>
<td>.098 (varies)</td>
</tr>
</tbody>
</table>

*Table 19: Baltotype Matrix Data*

Duensing's illustration accompanying this information was of a standard Thompson style matrix with two corner chamfers at the top. No further dimensions were supplied.

5.3 Baltotype (for the Type-&-Rule Caster?)

In the Lanston Monotype Display Matrix section (not the Thompson section) of *Matlas* 1986, one section of the table of head and foot bearings is labeled “Balto & Mono”. However, the values that it gives do *not* seem to be correct for Lanston Monotype Display matrices. (Moreover, in the same table, there is a section labeled “Mono. Std.” which does give correct Lanston values.) These do not seem to be values for matrices for the Thompson, because

- they conflict with the values given above which are explicitly identified as Baltotype for the Thompson,
- There is a separate Thompson section in this 1986 table, and
- The “Balto & Mono” section of the table is further labeled with “T-Mold” and “U-Mold” identifiers, which are Type-&-Rule Caster mold designations.

These values, which may be for Baltotype matrices for the Type-&-Rule Caster, are:
<table>
<thead>
<tr>
<th></th>
<th>[Body Size (points)]</th>
<th>Head Bearing (points)</th>
<th>Foot Bearing (points)</th>
</tr>
</thead>
<tbody>
<tr>
<td>T-Mold</td>
<td>12</td>
<td>32</td>
<td>36</td>
</tr>
<tr>
<td></td>
<td>14</td>
<td>29</td>
<td>37</td>
</tr>
<tr>
<td></td>
<td>18</td>
<td>25</td>
<td>37</td>
</tr>
<tr>
<td>U-Mold</td>
<td>24</td>
<td>31</td>
<td>25</td>
</tr>
<tr>
<td></td>
<td>30</td>
<td>26</td>
<td>25</td>
</tr>
<tr>
<td></td>
<td>36</td>
<td>19</td>
<td>25</td>
</tr>
</tbody>
</table>

Table 20: "Balto & Mono" Head and Foot Bearings, T-Mold and U-Mold, from {Matlas 1986}

For an explanation of “foot bearing,” and why it cannot be taken as anything more than a reference value, see the discussion of “Foot Bearing and Molds” in the Lanston Monotype Display Matrix section earlier.

For a more complete discussion of this table in {Matlas 1986}, see the Appendix “Uncertain Information: Duensing's 1986 Table.”

5.4 Iwata Bokei (for the Thompson)

In {Matlas 1986} and {Matlas 1988}, Dunsing presented the following information about Iwata Bokei matrices for the Thomson Type-Caster. Dimensions in inches (or points if indicated).

<table>
<thead>
<tr>
<th></th>
<th>Head Bearing</th>
<th>Side Bearing</th>
<th>Length</th>
<th>Width</th>
<th>Thickness</th>
</tr>
</thead>
<tbody>
<tr>
<td>Iwata Bokei</td>
<td>18 pt</td>
<td>8 pt</td>
<td>1.125</td>
<td>.875</td>
<td>.125</td>
</tr>
</tbody>
</table>

Table 21: Baltotype Matrix Data

Duensing's illustration accompanying this information was of a standard Thompson style matrix with two corner chamfers at the top. No further dimensions were supplied.

I know nothing else about Iwata Bokei.
6 Linecaster

Matrices designed for both composing linecasters (such as the Linotype) and noncomposing linecasters (such as the Ludlow Typograph) may be used by the typefounder. They all have characteristics which derive from the needs of linecasting which must still be taken into account when they are used to cast single types.

The most significant of these is their side bearing, which is zero because linecasting matrices must fit directly against each other so that the line to be cast can be composed.\textsuperscript{77}

6.1 American Linotype and Compatible

[TO DO]

6.2 English Linotype and Compatible

[TO DO]

\textsuperscript{77} As an exception to this, some Ludlow matrices were made such that they cast lengthwise on the Ludlow slug, not in composition. These have non-zero side bearings.
6.3 Ludlow Typograph

Ludlow matrices were manufactured in three widths (7/8”, 1 1/4”, and 1 1/2”) and three “slants” (roman (upright), standard italic (17 degree slant), and a 40-degree slant italic\(^{78}\)) . No complete information exists as to which faces were cut on which matrix widths. Sometimes this is indicated by notes in the specimen books, sometimes it is not. Most Ludlow matrices were punched, but the very large sizes typically were engraved.\(^{79}\) Any number of special third-party matrices were also engraved, especially for use in casting slugs for use in making rubber stamps.\(^{80}\)

Type bodies larger than 96 point (the largest which would fit in ordinary orientation on a 1 1/2” matrix) were positioned horizontally on the matrix so as to cast longitudinally on the slug, usually one matrix at a time. (The largest Ludlow face offered was 240 point 3-BEC Ludlow Bodoni Campanile Advertising Figures.\(^{81}\)) In addition, advertising figures in sizes starting at 72 point were also sometimes made to cast longitudinally on the slug.\(^{82}\)

For more information on these, see the subsection below on Ludlow Matrix Sizes, Styles, and Dimensions.

Matrices intended for the Ludlow Typograph can be cast on the following typecasting equipment:

- The Thompson, 7/8” width matrices only, up to 48 point.
- [Can they be cast on the Giant Caster?]
- [Can they be cast on the Super Caster?]

If the correct mold and matrix equipment is used, it is not necessary to alter Ludlow

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\(^{78}\) The 40-degree italic was used only for 48-MIC Flair and 51-MIC Formal Script.

\(^{79}\) There were exceptions, however. For example, a set of Ludlow punches for advertising figures at some size over 144 points in an as yet unidentified plain gothic survive, as well as a set of matrices punched in aluminum from them, on 1 1/4 inch mats, to cast lengthwise on the slug.

\(^{80}\) There are also a number of less common matrices attested, including aluminum matrices (in 7/8” and 1 1/4” at least), electroformed matrices (in 7/8”), and some which appear to be solid copper.

\(^{81}\) See, inter alia, \{Ludlow Typefaces D\}, p. 102, and \{Ludlow LS47\}, “Typeface Family No. 3,” p. F-3-3.

\(^{82}\) For detailed information on Ludlow matrix offerings, see Confidential Information for Ludlow Salesmen, a copy of which is reprinted online at \{Ludlow LS47\}. In particular, see section FP (“Ludlow Matrix Font Price List,” dated 10-22-62) for a complete list of sizes offered, and section F (“Fonts”) for sticks required (thus matrix sizes) for advertising figures from 72 to 240 point.
matrices for use on typecasting machines. I have, however, a font of Ludlow matrices which has been milled down so as to reduce its depth of drive, presumably to allow it to be used with non-Ludlow-mold equipment on the Thompson.

**Ludlow Depth of Drive**

All editions of *Matlas* are in error when they state that the depth of drive of Ludlow Typograph matrices is 0.168” and that Ludlow mold depth is 0.750. The actual depth of drive for the Ludlow is 0.153”, giving a mold depth of 0.765. The correct Ludlow depth of drive is confirmed in the Ludlow Typograph Company technical bulletin “Uneven Ludlow Slug Height” by “EPF” (Edward P. Forman), which gives the Ludlow blank slug height as 0.765. I’ve also confirmed this myself by measuring an actual well-cast Ludlow slug in my shop.

**The “Thompson Space Mold” and Ludlow Matrices**

Neither is it true that you can cast Ludlow matrices on the Thompson using a “Thompson space mold,” as stated in *Matlas*. Schuyler Shipley, proprietor of Skyline Type Foundry, points out that while the numbers almost match, the geometry of the mold and the matrix holder will not produce the intended result and may damage the Thompson.

There is no “Thompson space mold” as such. High spacing may be cast on any Thompson mold using a blank matrix. Low spacing may be cast on the Thompson using a standard 0.868 mold for 0.050 Lanston Monotype matrices, adapted for casting spacing by the replacement of the 42TC33 Mold Front Wall Space Plate and the use of low space 44TC21 Type Body Pieces and 42TC77 Low Quad and Space Matrices. This will result in spacing material that is 0.763” high, which is very close to the 0.765 Ludlow blank slug height. However, this height is due to the Thompson low space matrix projecting 0.105 into the mold. The mold itself is still 0.868. Using a Ludlow matrix with this mold would (a) result in a type height of 0.868 + 0.153 = 1.021, and (b) require that the X30TC Matrix Carrier Cam Lever be adjusted 1.021 – 0.918 = 0.103” further out than normal. It is possible that this would exceed the limits of the machine and break the lever.

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83 This Ludlow bulletin has been reprinted in {Parrish FSN}, p. 111.
84 Neither Skyline Type Foundry nor the CircuitousRoot Type Foundry have actually tried this, because it would risk breaking the lever and would not produce a useful result even if it worked.
Ludlow Head and Side Bearings

For all Ludlow matrices designed to cast in the ordinary direction on the slug, the side bearing is zero. (For matrices to cast lengthwise on the slug, see below.)

The head bearing of Ludlow matrices is unusually complex. Four situations need to be considered:

- “Regular” faces
- Lining faces
- Titling face + size combinations
- Matrices to cast lengthwise on the slug

Head Bearings for Regular Faces

The type bodies of “regular” Ludlow faces bodies are centered on the longitudinal centerline of the Ludlow slug. (Further, the matrices themselves are also centered on the centerline of the mold cavity / slug body.) This means that for these faces the head bearing is different for each body size. Here are a couple of illustrations of this from the Ludlow company's literature.

[Illustration 15: Typical Ludlow Matrices]

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85 I am indebted to Kylian Wrzesinski for the verification of this. I could have measured it myself, but Ky had already measured the relationship between the Ludlow mold cavity and the Ludlow stick sides (and thus Ludlow matrices) quite carefully during the engineering of a custom Ludlow matrix stick for casting Linotype matrices.

86 These were scanned from the undated brochure which apparently introduced the Model L Ludlow Typograph, but they were used frequently in later Ludlow literature. {Ludlow L1}
The head bearing for “regular” Ludlow matrices may be computed as:

\[
\frac{\text{matrix size}}{2} - \frac{\text{body size}}{2}.
\]

For example, a 24 point size of a regular Ludlow face would be punched on a 7/8” matrix. \((7/8) / 2 - ((24 \times 0.0138) / 2) = 0.271,9”\) head bearing.

**Head Bearings for Lining Faces**

Unlike regular Ludlow faces, “lining” faces such as the Ludlow Lining Plate Gothics align at the bottom of the letter, regardless of size. All of these faces are capital-only (but not titling). Here is the principle as illustrated in a Ludlow specimen book.87

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87 {Ludlow Typefaces D}, p. 162.
[TO DO: I suspect that the largest size of the face centers on the stick, but I need to actually pull some matrices to check this.]

[TO DO: I further assume that the alignment for the other sizes could be calculated by subtracting the difference in sizes; verify this.]

The problem is made more difficult because the various nominal body sizes for lining faces typically were cut not in a single size but in up to four subsizes. In one case only do we have documentation about these subsizes. (The specimen books observe that 6 point Ludlow Lining Plate Gothic No. 1 sets solid on a 4 point slug.) [TO DO / QUESTION: How to handle this?]

Head Bearings for Titling Face + Size Combinations

So far I have found only a very few cases in this category (of non-lining, titling faces which cast in the regular manner, not lengthwise on the slug).88 89

- 6-BCT Ludlow Gothic Bold Condensed Title. This face was cut only in 60, 72, and 84 point sizes on 1 ¼ inch matrices and in the 96 point size on 1 ½ inch matrices. 90

---

88 To complicate matters, sometimes “Title” in the specimen books really does mean titling in the conventional sense. Although I haven’t examined matrices for them (only specimens and {Ludlow LS47}), I’m pretty sure that the following Advertising Figures, marked as “(Title)” and casting in regular orientation on the slug, are on driven on bodies of their specified size as regular titling faces:
- Ludlow 6-B Medium Gothic Condensed Advertising Figures, 84pt & 96pt.
- Ludlow 28-H Tempo Heavy Advertising Figures, 84pt & 96pt

89 I haven’t yet found a showing (and don’t have the matrices) for 6-EC Gothic Extra Condensed Advertising Figures in 60,72, 84, and 96 point. They are listed as casting in regular orientation in {Ludlow LS47}

90 6-BCT 60, 72, and 84 is shown in {Ludlow Typefaces D}, p. 128. I have not yet found a showing of the 96 point size, but all four sizes are listed in the “Typeface Family No. 6” section of {Ludlow LS47}, p. F-6-2, dated October 22, 1962.
• 3-BEC Ludlow Bodoni Campanile (but not 3-BEC Bodoni Campanile Advertising Figures). In the 84 and 96 point sizes this was cut as a “Cap Font” on 1 ¼” matrices.\footnote{See “Typeface Family No. 3” in \{Ludlow LS47\}, p. F-3-3. The 96 point size is shown in \{Ludlow Typefaces D\}, p. 96; some editions of the softcover/comb-bound \textit{Some Ludlow Typefaces} show the 84 point size.}

• 6-FEC Ludlow Franklin Gothic Extra Condensed (“Caps, figures and points only”), which in the 84 and 96 point sizes was driven in 1 ¼ inch matrices.\footnote{See \{Ludlow Typefaces D\} (or other specimen books) and \{Ludlow LS47\}, p. F-6-4.}

The complication with these Ludlow titling faces is that Ludlow did not follow the conventions of typefounders.

In typefounding practice, a “titling” face is not just the collection of all of the capital sorts out of a regular font, but rather is an all-caps face sized (and aligned) to take up the entire body of the type. So for example in the illustration below,\footnote{These illustrations are rather crudely done with the lettering available on my 2-D CAD program, not with real type.} the 72 point titling face has all-capital sorts whose printing faces are nearly 72 points in height, while the 72 point regular (uppercase and lowercase) face has capitals whose printing faces are much less than 72 points.

In conventional typefounding, it is sometimes, \textit{but not necessarily}, possible to make a titling face at one body size (say, 72 point) by taking the matrices for the capitals from a larger body size (say, 84 or 96) and casting them full-face on the the body. In the illustration below, this more-or-less worked by using 72 and 96 point sizes of the lettering available in my CAD program.
But Ludlow practice was to do their “Caps, figures and points” titling faces as if they were simply larger sizes of regular faces which were supplied in “caps, figures and points only,” and their body sizes are called out as such. Yet they were cut as titling faces full on the matrix, not as regular faces with room for descenders. So for example 96 point Ludlow 6-FEC Franklin Gothic Extra Condensed was driven on 1 ¼ inch matrices. The printing face of this type is about 74 points, which fits comfortably on a matrix of this size. Yet the body size is still called out by Ludlow as 96 points (1.3248 inches), which is too large to fit on a 1 ¼ inch matrix.

So to determine the head bearing of a Ludlow face at a size where it is offered in “Caps, figures and points only,” you must first determine the actual body size of this titling face. This information was never published. Then you can use this effective

94 According to its entry in various Ludlow specimen books.
95 As measured from a specimen book.
96 Attempting to derive this information from the next size down does not work. Thus 84 point Ludlow 6-FEC Franklin Gothic Extra Condensed (a “caps, figures and points only” size) does have a regular caps + lowercase size one size down (at 72 points). But the full cap height of the 84 point titling size is about 65 points (7 points less than 72). The full cap height of the 72 point size is about 56 points, and the overall height from the highest ascender to the lowest descender in the 72 point size is about 68
body size in the regular formula given earlier to determine the head bearing.

**Matrices Cast Lengthwise on the Slug**

Larger Ludlow matrices were engraved (or sometimes punched) in an orientation rotated by 90 degrees from normal, so that they would cast lengthwise on the slug. In the 84 and 96 point sizes, there was some overlap of orientation. Ludlow 6-B Medium Condensed Gothic in 84 and 96 point, for example, were driven in 1 ½ inch matrices and cast in the regular orientation, while Ludlow 28-B Tempo Bold Advertising Figures from 84 to 144 point cast the long way on the slug. The largest size which would fit in normal orientation on the largest (1 ½”) Ludlow matrix was 96 point (1.324,8”).

Unlike matrices in regular orientation, which had to fit with each other in composition in the stick and therefore had a side bearing of zero, matrices made to cast lengthwise in the stick have nonzero side bearings.

[TO DO: I have no idea how to determine either the side or the head bearings in these cases.]

**Ludlow Matrix Sizes, Styles, and Dimensions**

[TO DO: measure and draw all three sizes and slants.]

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(points 4 points less than 72). These face measurements do not suggest that 72 points is the real body size for the “84 point” titling size.

97 See “Typeface Family No. 6,” p. F-6-2, in {Ludlow LS47}.
98 See many specimen books, including {Ludlow Typeface D}, p. 55.
99 It can get more complex. 96 point 3-BEC Ludlow Bodoni Campanile was driven as a (titling) “Cap Font” in regular orientation on 1 ¼” matrices (with a face height of about 76 points), while 96 point 3-BEC Ludlow Bodoni Campanile Advertising Figures were engraved, probably on 7/8” matrices to cast lengthwise on the slug (with a face height of about 90 points). The only way to distinguish the two aside from physical inspection was by their telegraph code words in ordering: “Luxes” vs. “Midst”.

72
6.4 A-P-L

[TO DO]

6.5 Nebitype

[TO DO]
7 “Foundry” Style

7.1 ATF Data for Pivotal and Barth

[TO DO]
8 Other

These are primarily of antiquarian interest. These matrices are unlikely to be encountered by the typefounder, and if they are they are approaching a degree of rarity which would suggest conservation rather than use.

8.1 Rogers Typograph

[TO DO]

8.2 Linotype Junior

[TO DO]

8.3 Linograph

[TO DO]
9 Bibliography and References

The entries here are ordered by {bracketed reference identifier}.


This outlines various practices not all of which were followed by The Monotype Corporation Limited in the 1920s.


It is worth trying to find a physical copy of this work, as it is the primary document describing the theory of interchangeable manufacturing in the first half of the 20th
century. It is also online at Google Books at
http://books.google.com/books?id=Wk9DAAAAIAAJ
and at the Hathi Trust (search on the author and title at: http://www.hathitrust.org

{CR CC} The CircuitousRoot essay “Clubs and Cults: Revisiting the Concept of ‘Typeface’ and the Optical Scale in Typefounding.” Online at:

Note that this piece is a radical argument which does not represent mainstream 21st century thought about type.

{CR Composite Lanston Specimen} “A Composite Specimen of Lanston Monotype Faces.” This is incomplete, but what exists is online at:

{CR DT} MacMillan, David M. “Drawing Studies: Dimensioning and Tolerancing.” Online on CircuitousRoot at:

{CR Lanston 1903} A CircuitousRoot Notebook reprinting advertisements by the Lanston Monotype Machine Company from The Inland Printer in 1903. Online at:

{CR MDST} The CircuitousRoot Notebooks on Lanston Monotype Matrix Data, Specimens, and Typography. Online at:

{CR MLC DWG} The CircuitousRoot Notebooks reprinting Mergenthaler Linotype Company engineering drawings. Online at:

{CR NR} The CircuitousRoot Notebooks on the Nuernberger-Rettig Type-Caster, also known as the Universal Type-Making Machine. Online at:

{CR Point/Pica} The CircuitousRoot Notebook “Point and Pica Conversion Tables.” Online at:

{CR Thompson} The CircuitousRoot Notebooks on the Thompson Type-Caster. Online at:

77
The CircuitousRoot Notebooks on the Lanston Monotype Type-&#38;Rule Caster (sales and technical literature. Online at:


The CircuitousRoot Notebook on Lanston Monotype Type-&#38;Rule Caster Matrices. Online at:


The 1900 Century edition and the 1914 (NY: Oswald Publishing Co.) are online on Google Books.


You need this book.


Imperial 1918} *Type Metal Explained.* Philadelphia, PA: Imperial Type Metal Company, 1918.

This is available online via Google Books.


This has been scanned by Google Books from the University of Michigan copy, but they didn't fold out the plates. A copy of this Google digitization, augmented by scans of the plates done from my own copy, is online at:


This second edition has not yet been digitized.


A 16-page folded maintenance brochure. Online at:


An un-illustrated parts price list. First published March 1, 1941 and revised November 14, 1941. Online at:


A 16-page folded maintenance brochure. Online at:


A twelve page brochure describing the Lanston Monotype Giant Caster. Online at:


This is an eight-page booklet which appeared as a section in the loose-leaf Lanston Monotype specimen book in the 1930s and 1940s. A copy is online at:


[Ludlow L1] “Now a New and Improved Ludlow.” [undated brochure apparently introducing the Ludlow Typograph.]

[TO DO: scan and put online.]

[Ludlow LS47] Confidential Information for Ludlow Salesmen. Chicago: Ludlow Typography Company, [updated through 1962]. Copy No. 47 of this book is online (with thanks to Jeff Shay for lending it for reprinting) at:


[Ludlow Typefaces D] Ludlow Typefaces. Chicago: Ludlow Typograph Company, [n.d.] There were apparently four editions of the hardcover Ludlow specimen book, of which three are now attested ([A], B, and D; I know of no copies of edition C). The hardcover specimen books bore the title “Ludlow Typefaces,” while the various softcover and comb-bound specimen books were entitled “Some Ludlow Typefaces.” Edition D of the hardcover specimen book is the one with the red or maroon cover. It is online at:


{MR 40.1} seems to have been made after this film, not in conjunction with it.

[Making Sure 2] 'Making Sure' At the Monotype Works: Type Faces In the Making. Film. Peak Film Productions for The Monotype Corporation, Limited, circa 1956. Made in conjunction with {MR 4.3}.

This is the second of two films with the main title “‘Making Sure’ At the Monotype Works.”. The first bore the subtitle “How the Machines are Made.”

[Martin 2015-01-23] Personal correspondence (e-mail) from Kevin Martin of The Papertrail Handmade Paper and Book Arts, 2015-01-23.

{Matlas 1986}

{Matlas 1988}
Duensing's *Matlas* was produced as an ongoing project over a number of years; it was never released as a single published work. All currently known versions have been reprinted at:


The 2008 version was edited by Richard L. Hopkins and contains additional material by him.

Matsuyama, Y. “On the Volume Change in Certain Type Metals During Solidification.” Sci. Reports, Tohoku Imperial University, Series 1, Vol. 17, No. 1 (1928).


Reviews the Compositype, Nuernberger-Rettig, and Thompson. It is online at:


The 1993 edition is the “second edition,” but it is effectively the initial definitive version. The “first edition” was a loose-leaf compilation distributed by McGrew to friends in the community to solicit additional material.


This is the so-called “Mendenhall Order” which adopted for this department the International Prototype Metre as a standard and the conversion values suggested by the 1866 “Metric Act.” This became the *de facto* US standard for the inch until 1959. This Bulletin was approved for publication on April 5, 1893, and was collected in Volume II of the U.S. Coast and Geodetic Survey Bulletins. This is online via Google Books at:

https://books.google.com/books?id=8EobAAAMAAJ

https://books.google.com/books?=id=5hU6AQAAIAAJ


This is a tour of the (English) Monotype factory at Salfords, illustrated with photographs by Guy Gravett. It appears to have been produced before *Making Sure 1*, even though from our perspective today it serves as if it were a companion piece.


Issued in conjunction with *Making Sure 2*.


The section of this article on “Antimony” contains a statement asserting the expansion of typemetal on solidification, although, curiously, the alloy it specifies contains no tin.


This book is still available from Parrish's successor, Dave Seat of Hot Metal Services: http://www.hotmetalservices.com


A single page chart found in the papers of Paul Hayden Duensing in the possession of Richard L. Hopkins. It is not clear how widely this circulated, if at all.


Righter, Guy A. Mixing Printers' Metals. Decatur, IL: [by the author], 1908.

Righter, Guy A. Casting and Mixing Printers' Metals. Richmond, IN: [by the author], 1923.
A digital version of this is online at [http://www.FolioCIII.com/](http://www.FolioCIII.com/)


This is the basic patent for the display casting attachment for the Monotype caster, although it does not yet employ the corner-cut mats used later.

This patent is available online from the USPTO and other sites such as pat2pdf.org. It is also reprinted in {CR TR Mats}


This is the patent for the corner-cut Lanston Monotype display matrix and its holder. Its issue date was stamped on the back of innumerable Lanston mats.


This is the patent for the removable X41A Matrix Holder.
10 Appendices

10.1 What's the Point?

Although it seems old to us now, the American printers' point is a relatively new innovation in the history of type. The first four hundred years of typefounding and printing did quite well without it. Still, for over a century the point has been a unit basic to the daily work of the typefounder.

But what is the value, in decimal inches, of a point? The definitive study of this subject is Richard L. Hopkins' book *The Origin of the American Point System for Printers' Type Measurement*. {Hopkins 1976}. No typecaster should be without it.\(^\text{100}\)

The simple answer to the question is that all versions of the American printer's point when expressed to four decimal places (that is, to the ten-thousandth of an inch) work out to 0.013,8 inches. If you are working to thousandths (three decimal places), as is common enough in typecasting, then this value is sufficient.

It was not sufficient for all typefounders and typecasting machinery makers, however. ATF, for example, published tables of the decimal equivalents of points which went out to six decimal plates (that is, millionths of an inch). The two Monotype companies published values to *seven* decimal places. Moreover, in some cases encountered in practice it does actually matter. For example, according to Duensing the side bearing of Lanston display matrices is 8 points. With a point rounded to 0.013,8", this gives a side bearing of 0.110,4". But with the actual Monotype point of 0.013,833", it gives a side bearing of 0.110,7". While the difference of 0.000,3" is small, it is within the capabilities of any machine shop.

The Type Founders' Association Point of 1886

The basic unit of the American printers' point system is the pica; the point is defined as 1/12 pica, exactly. The value of the pica adopted by the Type Founders' Association in 1886 was the MacKellar, Smiths and Jordan foundry's house standard, the “Johnson Pica.” This house standard had a long history, but for the purposes of establishing the new pica they found an expression of their standard in terms of centimeters: 83 picas per

\(^{100}\) There is also an extensive historical discussion of the American and other point systems in {DeVinne 1900}, but Hopkins had access to archival material that DeVinne did not.
35 centimeters.\textsuperscript{101} Converting centimeters (35) to millimeters (350) and picas (83) to points (996), and then converting the whole expression to inches, we get a point of: 
\[
\frac{350}{996} / 25.4 = 0.013,834,867...
\textsuperscript{102}
\]

When rounded to each decimal place out to six, the American printers' point as defined by the Type Founders' Association in 1886 becomes:

<table>
<thead>
<tr>
<th>Decimal places</th>
<th>Rounded Value of the Point, in Inches</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>0.0 [obviously this is not useful]</td>
</tr>
<tr>
<td>2</td>
<td>0.01</td>
</tr>
<tr>
<td>3</td>
<td>0.014</td>
</tr>
<tr>
<td>4</td>
<td>0.013,8</td>
</tr>
<tr>
<td>5</td>
<td>0.013,83</td>
</tr>
<tr>
<td>6</td>
<td>0.013,835</td>
</tr>
</tbody>
</table>

\textit{Table 22: The American Printers' Point to Various Precisions}

The Monotype Point

Lanston Monotype (and the The Monotype Corp. Ltd. in England) adopted a different value for their point: 0.013,833. This differs from the Typefounders' point by only 0.000,002, so in practical terms the two are the same. But it's interesting to see how Monotype got to their value.

The Monotype point was based on the assumption that the pica was 0.166 inch, exactly. That's not unreasonable when working to the thousandth (three decimal places), as the Type Founders' Association pica of 1866 is 0.166,018,... In retrospect, though, taking .166 exactly was a curious decision - it is a value rounded to the thousandth of an inch, but they then proceeded to multiply things out to seven decimal places (tenths of

\textsuperscript{101} They had no choice but to use a metric basis, because at the time the US lacked even a practical definition of an inch which would be suitable for fine metrology. This was before the Mendenhall Order of 1893 established a pragmatic, if extra-legal, definition of the inch by adopting for the purposes of the U.S. Coast and Geodetic Survey the International Prototype Metre along with the informal conversion values suggested in the US “Metric Act” of 1866. See \{Mendenhall 1893\} The US still lacks an actual legal standard for the inch.

\textsuperscript{102} Purists will note that the standard for metric conversion of 25.4 mm to the inch, exactly, was not adopted uniformly by American federal government standards organizations until 1959. It doesn't matter. If you employ the conversion in general use from the 1866 Metric Act and confirmed by the Mendenhall Order (1 yard = 3600/3937 meter) you get instead a value for the point of .013,834,839,... The difference is .000,000,027,..., which is beyond the precision required by even Linn Boyd Benton.
millionths of the inch) and to consider the rounded value of that number to be exact.

The Lanston unit system is based on a unit of 1/18th of the body size at any given body size. But they had to anchor this somewhere, and they did so with a body size of one point.

Lanston Monotype explained this in The Monotype System in 1912:

“54. The Set Size of any eighteen-unit character in any twelve-set font is one pica (12 points); that is, .166″. If it were possible to make a one-set face, the eighteen-unit characters of this one-set face would be one-twelfth as wide as the eighteen-unit characters of twelve-set, thus:

\[ .166\text{″} \div 12 = \text{eighteen units of one set, which may be expressed} \]

thus: \[ \frac{.166\text{″}}{12} \]

“55. One unit of one set would be one-eighth of this size (eighteen units of one set), or

\[ \frac{.166\text{″}}{12} \div 18 = \frac{.166\text{″}}{216} = .0007685 \text{″} \text{, one-unit-of-one-set.} \]

“56. Knowing the size of one unit of one set, to find the size of one unit of any set multiply the value of one unit of one set (.0007685″) by the set desired; to find the size of any number of units of this set multiply this product (one unit of its set) by the required number of units.”

The result of this calculation (0.000,768,5) is the correct rounding of what becomes an infinitely repeating decimal expansion. It represents both the unit size for one point bodies and the basic fixed decimal unit Monotype could then multiply out to get any desired unit value. In particular, since this is the unit for one point bodies, and since the unit for any body size is 1/18th the body size, you simply multiply 0.000,768,5 by 18 to get the Monotype point: 0.013,833 (exactly).

Decades later, the English Monotype company put it more concisely (and, fortunately for us, in doing so made it clear that they employed the same point):

The base unit of 'Monotype' founts is .0007685. This is 1 unit of 1 point. A 'unit' is the 18th part of an em quad. By multiplying the measurement of 1 unit of 1 point by any number the unit value of the larger set is obtained. Thus: .0007685″ multiplied by 8 ½ gives 0.0065324″ as the measurement of

103 From {Lanston 1912}, p. 25. {Lanston 1916}, p. 24, has essentially the same information.
1 unit of 8 ½ set, and the em quad would be .1175 (taken to the fourth decimal position).\textsuperscript{104}

### Comparing Point Values

Here’s a tabulation of every published or otherwise cited value for the point that I am aware of, compared in each case with the theoretical value rounded to the same number of decimal places.

<table>
<thead>
<tr>
<th>Published Value</th>
<th>vs. Theoretical</th>
<th>Source</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.013,8</td>
<td>0.013,8</td>
<td>ATF, Chart C-100.4 \textsuperscript{105}</td>
</tr>
<tr>
<td>0.013,833</td>
<td>0.013,835</td>
<td>Monotype (US &amp; UK)</td>
</tr>
<tr>
<td>0.013,834</td>
<td>0.013,835</td>
<td>“other sources” \textsuperscript{106}</td>
</tr>
<tr>
<td>0.013,834,867,...</td>
<td>0.03,834,867,...</td>
<td>Type Founders’ Assn. 1886</td>
</tr>
<tr>
<td>0.013,835</td>
<td>0.013,835</td>
<td>DeVinne ? \textsuperscript{107}</td>
</tr>
<tr>
<td>0.013,837</td>
<td>0.013,835</td>
<td>ATF, May 1902 \textsuperscript{108}</td>
</tr>
</tbody>
</table>

\textbf{Table 23: Various Values for the American Printers’ Point, Compared}

\textsuperscript{104} {Monotype UK 1952}, p. 115.
\textsuperscript{105} From an American Type Founders table identified as “C-100.4”. Reprinted in {CR Point/Pica}. My thanks to Stephen O. Saxe for supplying a photocopy of this table from his library.
\textsuperscript{106} {Rehak 1993}, p. 177, says ‘but other sources usually state that 1 point = .013834”’. He does not identify these other sources.
\textsuperscript{107} {Rehak 1993}, p. 177, attributes this value to a 1902 volume of DeVinne's \textit{The Practice of Typography}, which must have been the volume “Correct Composition.” But I have been unable to find this number in either the 1902 book or in the first volume of DeVinne's \textit{Practice of Typography}, “Plain Printing Types” (DeVinne 1900).
\textsuperscript{108} This value is taken from a “Punch and Matrix Table” published by American Type Founders in May, 1902 and reprinted in {Rehak 1993}, p. 181. Actually, they didn't define the point itself, but rather the table includes a value for 10 points of 0.13837. I have simply divided this by 10 to get 1 point.
10.2 Table of Didot Points in Inches

[TO DO]

10.3 How Close is Close Enough?

It is very easy to write down numbers to the sixth decimal place of an inch. But it is worth remembering that 0.000,001 is one millionth of an inch (one microinch). For comparison, that's the tolerance of the highest grade (grade 0.5) of gage block – and that gage blocks of this grade typically are intended for use not in production but as calibration masters for other gages. In practical terms, when tolerances exceed the thousandth (0.001”) or “tenth” (ten-thousandths of an inch, 0.000,1”) costs rise sharply.

Here, then, is a miscellaneous collection of citations of claimed tolerances in excess of 0.001 for matrix or mold making.

• {Rehak 2004} (The Fall of ATF), p. 22, cites a tolerance of +/- 0.000,1 for matrix engraving at American Type Founders.

• Drawing D3437, dated February 6, 1929, of The Monotype Corporation Ltd. (UK) expresses critical dimensions to four decimal places (in inches).

It is also interesting to examine the practices of linecaster manufacturers for their molds (as yet I have no matrix data from the manufacturers).

Original engineering drawings of the Mergenthaler Linotype Company indicate:

• Fractional dimensions were tolerated to +/- 0.005 unless otherwise specified.

• Decimal inch dimensions and tolerances to three places were typical, and tolerances to four places for precision features were not unusual.

• In unusual cases tolerances to five decimal places occur. But I suspect that these are “soft decimal conversions” of fractions of “tenths.” (In the example which prompts this remark, the value in question is 0.000,25. I suspect that this really means “a quarter tenth” rather than a true tolerance to five decimal places.)

109 [NIST 180], p. 13.
111 Example: Mergenthaler Linotype Co. Drawing F-2930 [Recessed Display Mold]. Reprinted in {CR MLC DWG}
112 This occurs on MLC Drawing F-2930. In {CR MLC DWG}
In summary it would seem that work to four decimal places of the inch was common. I have not yet found evidence of accuracy beyond this, but of course much of the source material has been destroyed. We do not, for example, have the engineering drawings for Monotype or Thompson molds.

It should also be noted that for mold work, at least, both the American and English Monotype companies selectively employed hand fitting (resulting in parts which were not truly interchangeable and had to be fitted at the factory). This is shown in the film {Making Sure 2} and is reflected in instructions in parts lists such as {Thompson 1942}.

10.4 Beard Widths for Selected Depths and Angles

Here is a table computing the widths of the beard for a range of depths of drive. The depths cover a range around an assumed average of 8 degrees, plus 10 degrees because it's a round number and 16 degrees because ATF used for at least some molds. Not all of the values computed here are sensible, or were found in practice. For example, it is unlikely that a 16 degree beard ever really existed for 0.030 drive type, or for a Linotype matrix.

This table is maintained in a separate file (a LibreOffice / Apache OpenOffice spreadsheet) which may be found at:


as


Here's a copy embedded within this present document. (It may not be completely up-to-date.)
# Beard Widths

For Selected Depths of Drive and Beard Angles

## Widths at

<table>
<thead>
<tr>
<th>Depth</th>
<th>6 deg.</th>
<th>7 deg.</th>
<th>8 deg.</th>
<th>9 deg.</th>
<th>10 deg</th>
<th>16 deg.</th>
<th>This depth used on</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.1251</td>
<td>0.0131</td>
<td>0.0154</td>
<td>0.0176</td>
<td>0.0198</td>
<td>0.0221</td>
<td>0.0359</td>
<td>ATF B-4 (NY/Conner), 120 pt and up</td>
</tr>
<tr>
<td>0.1241</td>
<td>0.0130</td>
<td>0.0152</td>
<td>0.0174</td>
<td>0.0197</td>
<td>0.0219</td>
<td>0.0356</td>
<td>ATF B-4 (NY/Conner), 48 – 108 pt</td>
</tr>
<tr>
<td>0.0968</td>
<td>0.0102</td>
<td>0.0119</td>
<td>0.0136</td>
<td>0.0153</td>
<td>0.0171</td>
<td>0.0278</td>
<td>ATF B-3 (NY/Conner), 30 – 42 pt</td>
</tr>
<tr>
<td>0.0844</td>
<td>0.0089</td>
<td>0.0104</td>
<td>0.0119</td>
<td>0.0134</td>
<td>0.0149</td>
<td>0.0242</td>
<td>ATF STL-3 (Central or St. L.), 36 – 72 pt</td>
</tr>
<tr>
<td>0.0758</td>
<td>0.0080</td>
<td>0.0093</td>
<td>0.0107</td>
<td>0.0120</td>
<td>0.0134</td>
<td>0.0217</td>
<td>ATF B-2 (NY/Conner), 14 – 24 pt</td>
</tr>
<tr>
<td>0.0750</td>
<td>0.0079</td>
<td>0.0092</td>
<td>0.0105</td>
<td>0.0119</td>
<td>0.0132</td>
<td>0.0215</td>
<td>English Linotype</td>
</tr>
<tr>
<td>0.0650</td>
<td>0.0068</td>
<td>0.0080</td>
<td>0.0091</td>
<td>0.0103</td>
<td>0.0115</td>
<td>0.0186</td>
<td>Giant / Super / Eng. Disp. &gt; 36 pt / N-R</td>
</tr>
<tr>
<td>0.0535</td>
<td>0.0056</td>
<td>0.0066</td>
<td>0.0075</td>
<td>0.0085</td>
<td>0.0094</td>
<td>0.0153</td>
<td>ATF STL-2 (Central or St. L), 14 – 30 pt</td>
</tr>
<tr>
<td>0.0500</td>
<td>0.0053</td>
<td>0.0061</td>
<td>0.0070</td>
<td>0.0079</td>
<td>0.0088</td>
<td>0.0143</td>
<td>Lanston 14 – 36 pt / Eng. Disp. &lt; 36 pt</td>
</tr>
<tr>
<td>0.0430</td>
<td>0.0045</td>
<td>0.0053</td>
<td>0.0060</td>
<td>0.0068</td>
<td>0.0076</td>
<td>0.0123</td>
<td>Linotype / Thompson / Compositype</td>
</tr>
<tr>
<td>0.0420</td>
<td>0.0044</td>
<td>0.0052</td>
<td>0.0059</td>
<td>0.0067</td>
<td>0.0074</td>
<td>0.0120</td>
<td>ATF B-1 (NY/Conner), 6-12 pt</td>
</tr>
<tr>
<td>0.0309</td>
<td>0.0032</td>
<td>0.0038</td>
<td>0.0043</td>
<td>0.0049</td>
<td>0.0054</td>
<td>0.0089</td>
<td>ATF STL-1A (Central or St. L.), 6 – 12 pt</td>
</tr>
<tr>
<td>0.0300</td>
<td>0.0032</td>
<td>0.0037</td>
<td>0.0042</td>
<td>0.0048</td>
<td>0.0053</td>
<td>0.0086</td>
<td>Lanston cellular / Eng. Mono. 4 ½ pt</td>
</tr>
</tbody>
</table>

**Formula:** width = depth * tan (angle)

---

**Notes:**

1. All dimensions in inches.
2. Not all values computed here are sensible.
3. Ludlow overall depth is 0.153, but depth of the beard is smaller and not yet measured.
4. Data for ATF from Rehak, Practical Typecasting.
5. 16 deg. cited by Rehak for ATF molds: B-1/2/3/4, STL-1A/2/3.

REV A. 2015-02-21. DMM for CircuitousRoot

Data public domain. File CC-By-SA 4.0
10.5 Belief in the Expansion of Typemetal

As has been noted in the section on “A Note on Mold Depths” in “Common Matrix Drives and Mold Depths,” earlier, typemetal contracts during solidification. Yet the notion that it expands has been persistent throughout the last two centuries, at least. Laboratory evidence that it does not contract has been a part of the metallurgical literature since 1928, yet it shows up in at least one modern college textbook.

Here are some representative examples, spanning the period from 1835 to 2012:

An article in *The Penny Magazine* in 1835 summarizes this myth quite well:

“The peculiar adaptation of this alloy to this purpose is its property of expanding when it congeals from the melted state, by which it insinuates itself into the minutest parts of the mould.”

An intermediate form of this myth holds that Antimony, specifically, expands during solidification (it does not) and that this counteracts shrinkage. Thus in Pasko (1894) we have:

“Antimony is added for the purpose of giving hardness, in which lead is lacking, and because it has the quality of expanding when cooling, thus insuring that the molds shall be completely filled.”

This idea seemed firmly held by technically competent typefounders of the late 19th century. Carl Schraubstadter, Jr. (son of Carl Schraubstadter of the Central Type Foundry, and co-founder of the Inland Type Foundry) held that:

“A peculiar property of Antimony is that of slightly expanding on solidifying, thus insuring sharp faces”

113 {Matsuyama 1928}, cited most accessibly in {ASTM 1948 / Gonser & Winkler}.
114 {Sivasankar 2008}, p. 41 “The addition of antimony to the lead-tin alloy hardens it and also makes the alloy expand on solidification.”
115 {Penny Magazine 1835-10-03}, p. 387.
116 To be precise, the alloy referred to in the Penny Magazine article is one of lead, antimony and a trace of copper; as cited it contained no tin. Other alloys cited in this period were said to have contained bismuth (this goes back at least as far as Jost Annan in 1568), but aside from persistent reports in older literature (often cited without examination in modern literature up to and including Wikipedia), there is no evidence of typefounders using this quite expensive metal. Gonser and Winkler determined that it would take up to 25 percent Bismuth to make a stereotype alloy which did not shrink. {ASTM 1948 / Gonser & Winkler}, p. 958. In the absence of hard evidence, the historical use of bismuth in typemetal cannot be credited.
117 {Pasko 1894}, p. 560.
118 {Schraubstadter, Jr. 1888}, p. 729.
And Linn Boyd Benton (of the Northwestern Type Foundry of Benton, Waldo & Co. and later of ATF) wrote:

"Type are made of type metal, a mixture of tin, antimony, lead, and copper. As antimony expands in solidifying, advantage is taken of this quality, and the mixture is so proportioned that the expansion of the antimony will practically counteract the shrinkage of the other ingredients."\(^{119}\)

Perhaps the strangest form of this myth is one in which the typemetal expands suddenly upon solidification (to make a sharper type) and then contracts again. One prominent typemetal supply company actually believed this:

“Antimony has the valuable property of giving both hardness and fluidity to lead. Hardness when cold, fluidity when molten. Not only this but also the property of filling out the mould and expanding just as solidification occurs. The alloy contracts after solidifying just as any other metal or alloy, but at the instant of passing from the liquid to the solid it fills all the detail of the mould, and after solidifying draws away, retaining a perfect reproduction. This is a most remarkable and valuable property, and very essential to the alloy.\(^{120}\)

To their credit, by the 1923 edition they had changed this to:

“Antimony when added to lead has the valuable and unusual property of imparting hardness to the metal and also increasing the fluidity of the molten alloy. A lead alloy containing antimony, due to the fluidity has the property of filling out the type mould perfectly thus giving an exact reproduction of the mould.”\(^{121}\)

As an indication of its persistence, this myth can be seen in at least one 21\(^{st}\) century college textbook:

“The addition of antimony to the lead-tin alloy hardens it and also makes the alloy expand on solidification.”\(^{122}\)

Finally, and regrettably, it is now to be found in the 29\(^{th}\) edition (2012) of the usually more reliable Machinery's Handbook (it was not there in the earlier editions I’ve checked):

“Type Metal. - Antimony gives to metals the property of expansion on

\(^{119}\) {Benton 1906}, p. 30.  
\(^{120}\) {Imperial 1918}, p. 9. A similar account also occurs in {Righter 1908} and {Righter 1923}, p. 39.  
\(^{121}\) {Imperial 1923}, p. 9. This is interesting as it suggests that {Matsuyama 1928} was not the first to demonstrate in the laboratory that typemetal does not expand on solidification.  
\(^{122}\) {Sivasankar 2008}, p. 41
solidification, and hence, is used in type metal for casting type for the printing trades to insure completely filling the molds.”

This idea seems to have as many lives as a cinematic zombie.

None of the statements quoted has the slightest basis in reality. Those before 1928 have the excuse that they were just guessing (though none of them actually admitted that it was guesswork); those after do not.

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123 {Machinery's 29th}, p. 3017.
10.6 Technical Drawings

These are drawings done in the general style of real engineering drawings (though I make no claim that they conform to any specific drafting standard, ancient or modern). They should be comprehensible to a machinist called upon to make a matrix.

Please note that things such as fine dotted lines do not necessarily show up well when exported from a CAD program to a bitmap image and then imported into a desktop publishing program and scaled. These drawings as seen here do not appear at their best. If you really want to use these drawings, you would be better off obtaining their DXF format source and opening them in the CAD program of your choice.

The DXF format source files for these drawings are available online at:

[SPECIFY LOCATION]

The following drawings should be present:

• CR-22. ENGLISH DISPLAY MATRIX, 42-60 POINT.
• CR-23. DUNKER MATRICES FOR THE THOMPSON
Drawing 1: CR-22 English Display Matrix (42-60pt)
Drawing 2: Andrew W. Dunker Matrices for the Thompson Type-Caster
11 Uncertain Information: Duensing's 1986 Table

[NOTE: I need to rethink and revise this section. I wrote it before I understood that Lanston manufactured distinct flat composition matrices for the Thompson in 42 and 48 point body sizes. That explains a lot of my confusion with the “Balto & Mono” section of Duensing’s table.]

In versions of Matlas from 1988 on, the tables for head and foot bearings for Lanston Monotype display matrices and pre-Monotype Thompson large-sized matrices both appear in the “U.S. Lanston Monotype Display” section (labeled “MONOTYPE STANDARD” and “THOMPSON STANDARD”). See {Matlas 1988}, Table 4 (p. 4), for example. While it is initially confusing to have the Thompson large-matrix table in the Lanston display matrix section, the tables themselves are clear and the information in them appears to be accurate. However, these versions of Matlas do not have information on pre-Monotype Thompson small/narrow matrices or on pre-Monotype large matrices over 36 points. For that you must go back to {Matlas 1986}.

But while {Matlas 1986} does have a table for pre-Monotype Thompson small/narrow matrix head bearings (p. 5, Table 6), its treatment of Lanston Monotype display and pre-Monotype Thompson large matrices is done in a complex multi-part table which is difficult to understand. Yet the information which it includes on Baltotype matrices and on large pre-Monotype Thompson matrices in 42 and 48 point sizes is potentially useful and does not appear in later editions.

Here is the table (as an image, so as to avoid transcription errors). Values are in points.
Questions:

- Why do the (apparently correct) values for “Mono. Std.” differ from those for “Balto & Mono”?

- Are the 42pt and 48pt “Balto & Mono” lines for Baltotype matrices for the
Thompson or for Lanston Monotype matrices for the Thompson?

- What does “NG use large mat” mean? (These two lines work out to 80 pt and 78 pt matrices?)

- Why are these two lines in this section, rather than with the pre-Monotype Thompson large matrix data further on in the same table?

- If these two lines are for “small” (1.125” long) matrices, why do they use the 18pt head bearing of the “large” pre-Monotype Thompson matrices?

- If these two lines are for “small” pre-Monotype Thompson matrices, why do their head bearings (18 pt) differ from those in Table 6 of *Matlas 1986*, which gives head bearings of 15 pt and 9 pt, respectively?

### 12 Uncertain Information: Rice's Chart

A carefully drawn but undated and unpublished chart by Roy Rice (The Recalcitrant Press), found among Dunsing’s papers, gives the head and foot bearings (and other data) for six sizes of “Monotype Display” matrices (that is, with the corner-cut geometry). It is interesting for two reasons:

First, the head and foot bearing information that it gives for 14, 18, 34, 30, and 36 point matrices does not match Duensing’s. Rice gives:

<table>
<thead>
<tr>
<th>Body (points)</th>
<th>Head Bearing (points / in)</th>
<th>Foot Bearing (points)</th>
</tr>
</thead>
<tbody>
<tr>
<td>14</td>
<td>29 / .4012</td>
<td>38 / .5257</td>
</tr>
<tr>
<td>18</td>
<td>25 / .3458</td>
<td>38 / .5257</td>
</tr>
<tr>
<td>24</td>
<td>31 / .4289</td>
<td>26 / .3597</td>
</tr>
<tr>
<td>30</td>
<td>25 / .3458</td>
<td>26 / .3597</td>
</tr>
<tr>
<td>36</td>
<td>19 / .2628</td>
<td>26 / .3597</td>
</tr>
</tbody>
</table>

*Table 25: Roy Rice’s Values for Monotype Display Matrix Head and Foot Bearings*

These values do not seem to be correct for factory-produced Lanston Monotype matrices. It is possible, however, that independently produced matrices exist which employ them. The sum of head bearing + body + foot bearing for each of these values is

124 [Rice MDMD] I do not yet have permission to reprint this chart.
81 points, which is closer to the apparent “real” overall length of a Lanston display matrix (1.125 in.) than Duensing’s 80 points.

Rice gives conventional values for the other dimension: planchet width 0.75 in., planchet length 1.125 in., rough thickness .125 in., finished thickness .094 in., and side bearing 8 points (.111 in.)

The other reason that this table is interesting is that it shows a 48 point “Monotype Display” matrix (with corner cuts). This matrix is shown as 1.0 in. wide. It isn’t clear to me that such a matrix could be cast on a Type-&-Rule Caster. He gives a head bearing for it of 19 points (.2628 in.) and a foot bearing of 26 points (.3597 in.) Together with a body of 48 points, these sum to an overall length of 93 points (1.286 in.). Rice does not explicitly state the overall length, and draws this matrix at the same length as the others.

Clearly this chart presents several puzzles.
13 Revision History

If you're printing out a copy of this document, there's really no need to print this section. Dates are of the final commit of the revision.

Revision 8, 2015-02-21. ATF matrix depth of drive data. Beard width calculations. Also first version visible to the general public on the CircuitousRoot website.
Revision 6, 2015-01-12. Compositype & N-R history (but no matrix data yet). Added new (to me) type of matrix: American Display (42 & 48 point, for the Thompson).
Revision 4, 2014-12-25. Ludlow head bearing (except when lengthwise); Ludlow drawings not yet begun. Revised point system discussion and added Monotype point derivation.
Revision 1, 2014-12-20. English Display.