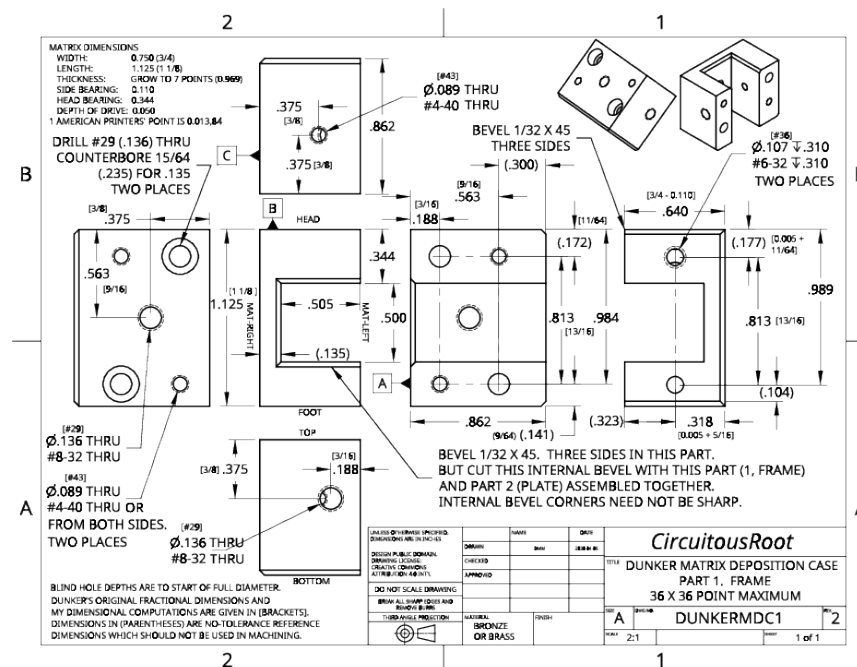


# Drawing Portfolio for Workshop Notes on Electroforming Matrices

(Dunker Method)

Dr. David M. MacMillan



The Typemakers' Society, Inc.

2020

## About this Portfolio

This is a portfolio of drawings to accompany Dr. David M. MacMillan's *Workshop Notes on Electroforming Matrices* (Mineral Point, WI: The Typemakers' Society, Inc., 2020). For more information, including a Bill of Materials and a Bill of Tools, please consult that text. It is freely available on its publisher's website at:

<http://www.TheTypemakersSociety.org/publications/index.html>

These drawings illustrate one possible design of an apparatus for one method of typographical matrix electroforming (the method used by Andrew W. Dunker, in which the entire matrix is grown as a solid copper piece).

The first four drawings are scans of photocopies of drawings by the late Paul Hayden Duensing and the late Andrew W. Dunker. They appear through the kind permission of Ginger Duensing and the dedicated preservation efforts of Richard L. Hopkins. Ginger Duensing requests that Paul Hayden Duensing always be identified as the author of his work.

The remaining drawings are new drawings by Dr. David M. MacMillan which interpret, fairly closely, Duensing and Dunker's drawings for a Dunker-method matrix electroforming case. These were created from a 3-D CAD model of this electroforming case. This CAD model and the digital originals of these drawings are freely available via the Onshape.com cloud-based CAD service. To find them, search Onshape for "Dunker Matrix Deposition Case" or the public documents of Onshape user David M. MacMillan, or go to it directly at:

<https://cad.onshape.com/documents/0c412a5cb0e263a0c7c3711a/w/ae499bc626bab1ca697671e0/e/3dc0540e4ed9ffe5bfb65163>

## Obligatory Fine Print

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The design of the Dunker Matrix Electroforming Case is public domain.

All material by the author not otherwise noted is licensed under the Creative Commons Attribution-ShareAlike 4.0 International license.

The CAD model and new drawings by the author of the Dunker Matrix Deposition Case are licensed under the Creative Commons Attribution 4.0 International license.

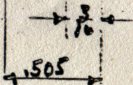
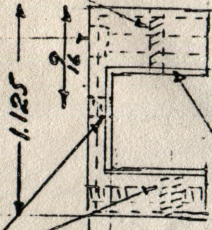
Reprinted material by Paul Hayden Duensing and Andrew W. Dunker is licensed under the Creative Commons Attribution-NonCommercial-ShareAlike 4.0 International license.

#4-32 TAP  
LOCATE FROM DET. 7

COUNTERBORE  
TO SUIT SCREW (2)

#8-32 TAP (2)

.640



862 (A)

1 X 45° BEVEL  
32  
3 SIDES

TAP #6-32  
LOCATE FROM DET. 3

TAP #4-32 (2)  
BOTH ENDS

#29 DRILL (.136) (2)

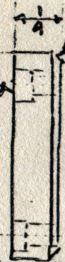
1 X 45° BEVEL IN ASSEMBLY  
WITH DETAIL 2 (4 SIDES)

DET. 1 TIN-BRONZE, 1 REQ'D

5/16

1 X 45° BEVEL  
32  
4 SIDES

COUNTERBORE TO SUIT  
SCREW (2)



740

#29 DRILL (2)

DET. 3 PLEXIGLASS, 1 REQ'D

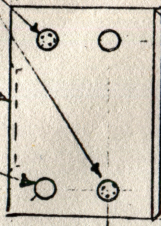
TAP #6-32 (2)  
LOCATE FROM  
DET. 1 IN  
ASSEMBLY

1 X 45° BEVEL  
32  
IN ASSEMBLY

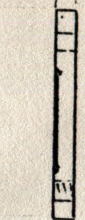
1 DRILL (2)  
LOCATE  
IN ASSEMBLY

.857

1 X 45° BEVEL  
32  
3 SIDES

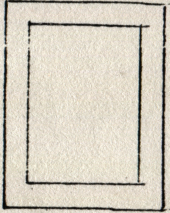


.110



DET. 2 TIN-BRONZE, 1 REQ'D

.875  
.750



1.125

1.250

1/4

.124

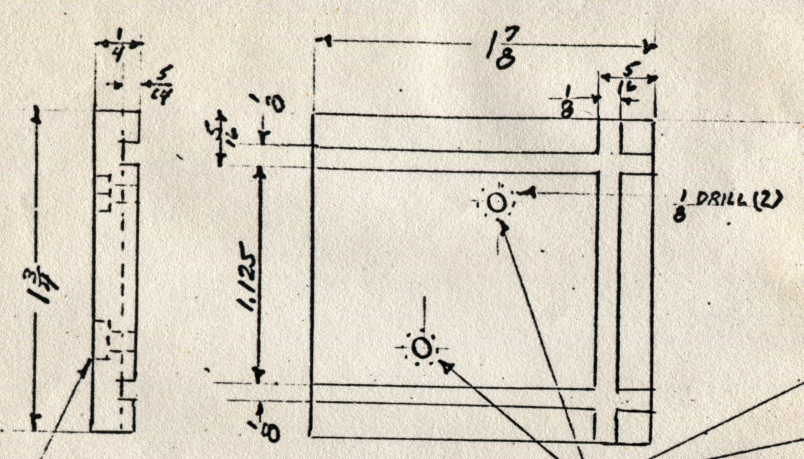


DET. 4, PLEXIGLASS, 1 REQ'D

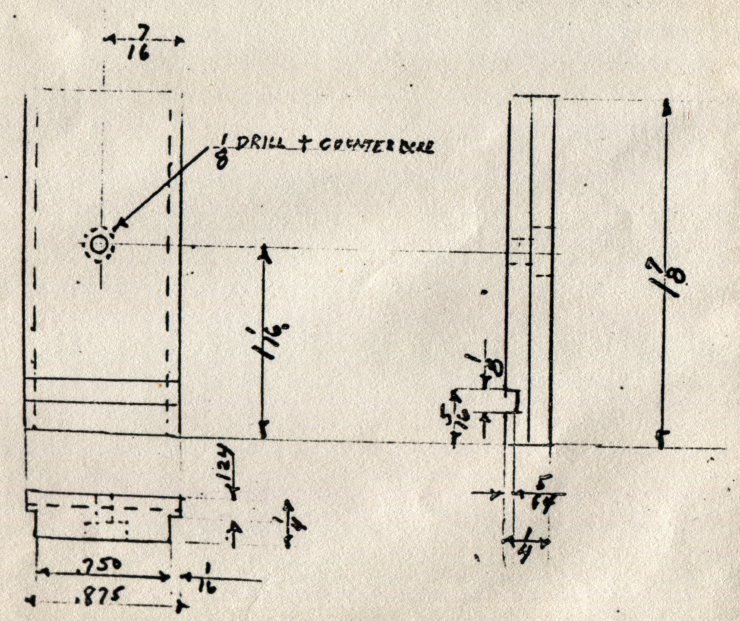
DEPOSITION CASE DETAILS

(A) - CORRECT FOR .050 DRIVE MATS.

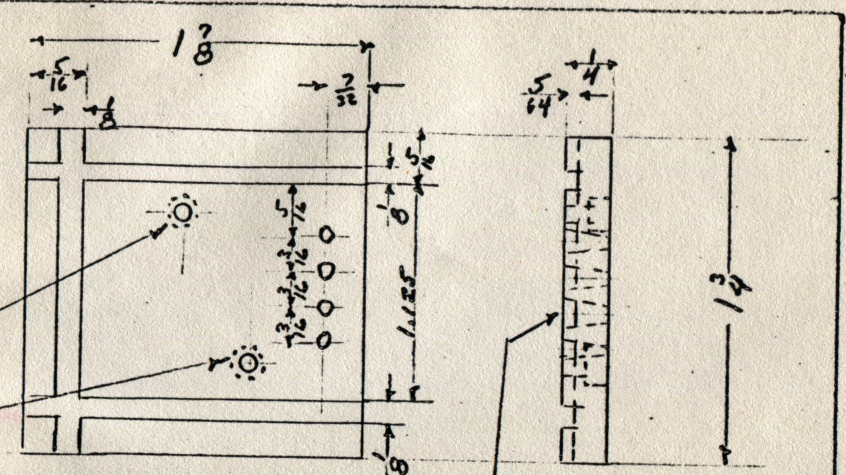
ANDREW W. DUNKER



COUNTERBore TO SUIT (2)  
 LOCATE IN ASSEMBLY  
 4 HOLES  $\frac{1}{8}$ "  
 DETAIL 5, PLEXIGLASS, 1 REQ'D



DET. 7 PLEXIGLASS, 1 REQ'D



DET. 6, PLEXIGLASS, 1 REQ'D  
 DRILL  $\frac{3}{32}$  4 HOLES  
 TAPER REAM  $\frac{1}{16}$  FROM  
 THIS SIDE

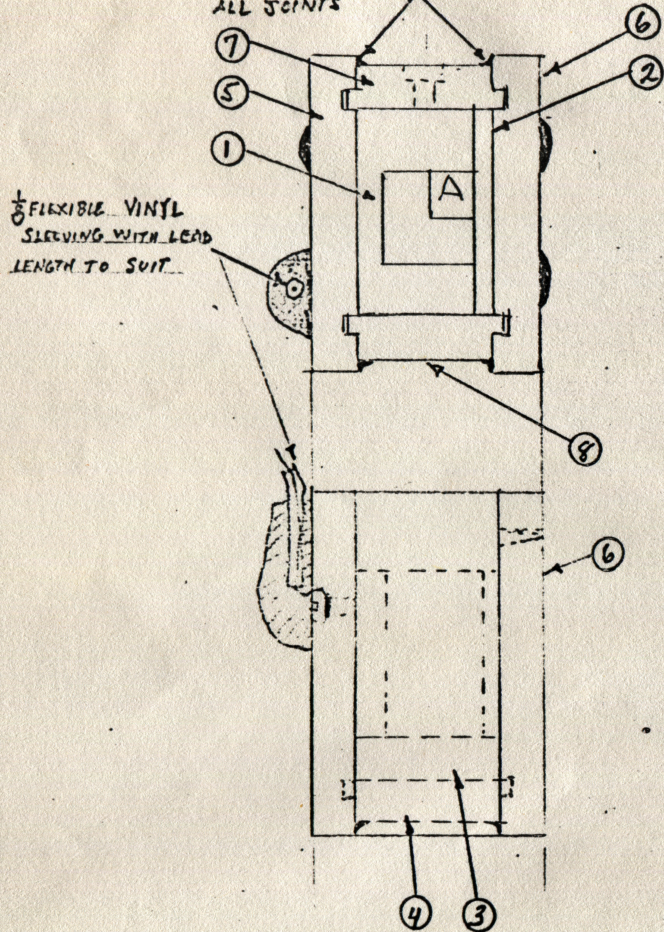
DET. 8, SAME AS DET. 7, BUT OMIT  
 SCREW HOLE  
 PLEXIGLASS, 1 REQ'D.

DEPOSITION CASE DETAILS

ANDREW W. DUNN

2

WAX SEALS ON ALL JOINTS



ASSEMBLY - TOP VIEW

ASSEMBLY - FRONT ELEVATION

SCREWS REQ'D (BRASS OR BRONZE)

2 - #6-32 X  $\frac{5}{8}$  LONG

2 - #6-32 X  $\frac{3}{8}$  SHORTENED TO  $\frac{11}{32}$  OR LESS

2 - #4-36 X  $\frac{1}{2}$  LONG

3 - #4-36 X  $\frac{3}{16}$  LONG

1 - #8-32 X  $\frac{1}{8}$  SET SCREW

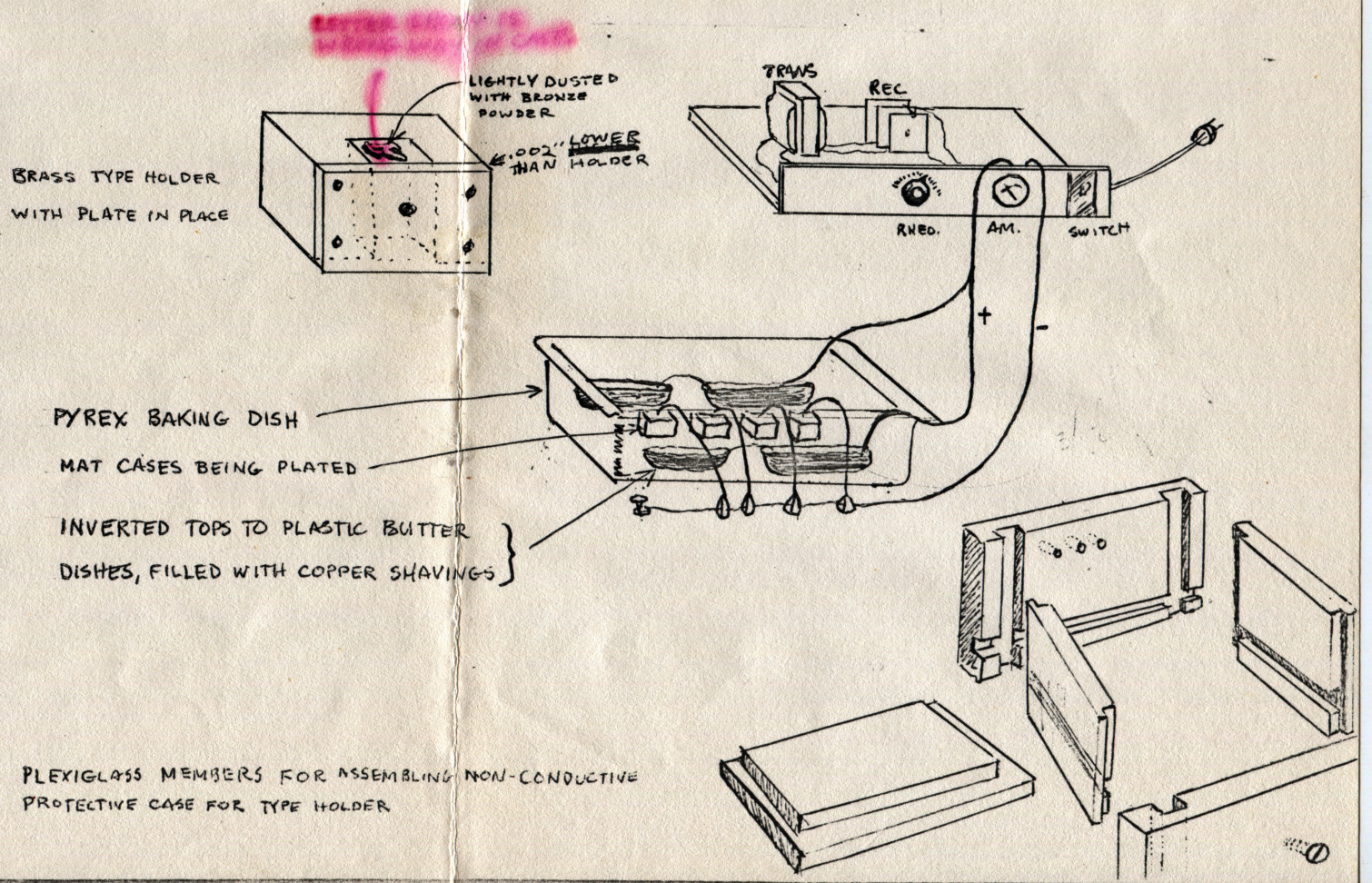
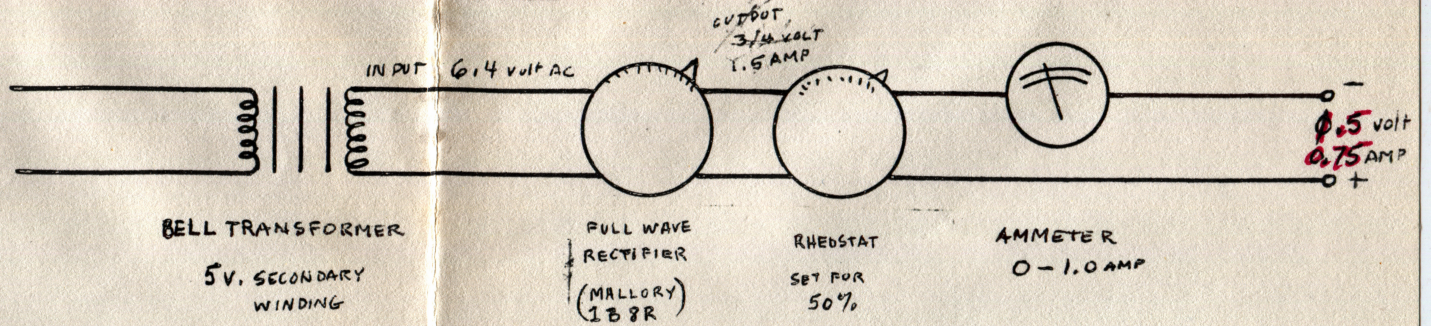
1 - #8-32 X  $\frac{1}{4}$  SET SCREW

DEPOSITION CASE DETAILS

ANDREW W. DUNNER

131

The private press and typefoundry of  
**Paul Hayden Duensing**  
 426 ~~Dorset St.~~, Kalamazoo, Michigan



**MATRIX DIMENSIONS**

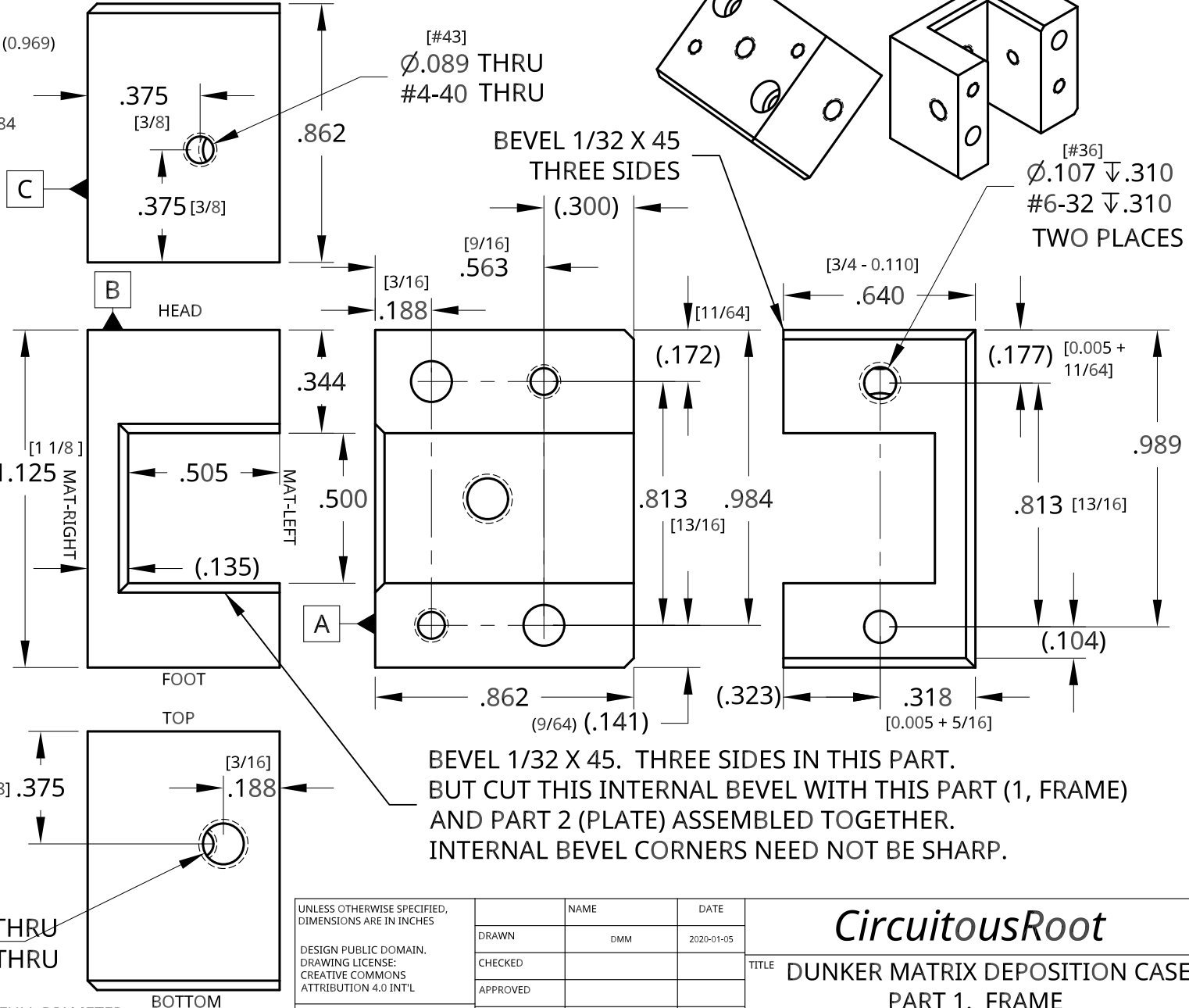
WIDTH: 0.750 (3/4)  
 LENGTH: 1.125 (1 1/8)  
 THICKNESS: GROW TO 7 POINTS (0.969)  
 SIDE BEARING: 0.110  
 HEAD BEARING: 0.344  
 DEPTH OF DRIVE: 0.050  
 1 AMERICAN PRINTERS' POINT IS 0.013,84

**DRILL #29 (.136) THRU  
 COUNTERBORE 15/64  
 (.235) FOR .135  
 TWO PLACES**

**#29  
 Ø.136 THRU  
 #8-32 THRU**  
**#43  
 Ø.089 THRU  
 #4-40 THRU OR  
 FROM BOTH SIDES.  
 TWO PLACES**

**#29  
 Ø.136 THRU  
 #8-32 THRU**

BLIND HOLE DEPTHS ARE TO START OF FULL DIAMETER.  
 DUNKER'S ORIGINAL FRACTIONAL DIMENSIONS AND  
 MY DIMENSIONAL COMPUTATIONS ARE GIVEN IN [BRACKETS].  
 DIMENSIONS IN (PARENTHESES) ARE NO-TOLERANCE REFERENCE  
 DIMENSIONS WHICH SHOULD NOT BE USED IN MACHINING.



**BEVEL 1/32 X 45. THREE SIDES IN THIS PART.  
 BUT CUT THIS INTERNAL BEVEL WITH THIS PART (1, FRAME)  
 AND PART 2 (PLATE) ASSEMBLED TOGETHER.  
 INTERNAL BEVEL CORNERS NEED NOT BE SHARP.**

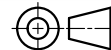
UNLESS OTHERWISE SPECIFIED,  
 DIMENSIONS ARE IN INCHES

DESIGN PUBLIC DOMAIN.  
 DRAWING LICENSE:  
 CREATIVE COMMONS  
 ATTRIBUTION 4.0 INT'L

DO NOT SCALE DRAWING

BREAK ALL SHARP EDGES AND  
 REMOVE BURRS

THIRD ANGLE PROJECTION



| NAME               | DATE   |
|--------------------|--------|
| DRAWN              | DMM    |
| CHECKED            |        |
| APPROVED           |        |
| MATERIAL           | FINISH |
| BRONZE<br>OR BRASS |        |

| TITLE   |            |      |
|---|------------|------|
| DUNKER MATRIX DEPOSITION CASE<br>PART 1. FRAME<br>36 X 36 POINT MAXIMUM |            |      |
| SIZE  | DWG. NO.   | REV. |
| A   | DUNKERMDC1 | 2    |
| SCALE   | SHEET      |      |
| 2:1   | 1 of 1     |      |

*CircuitousRoot*

2

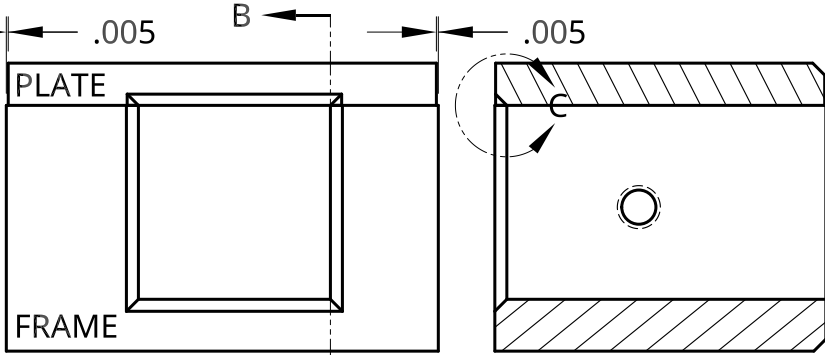
PLATE IS CENTERED LENGTHWISE ON THE FRAME, .005 EACH SIDE.

THICKNESS DIMENSION IS IMPORTANT. IT IS THE LEFT SIDE BEARING OF THE MATRIX.

1

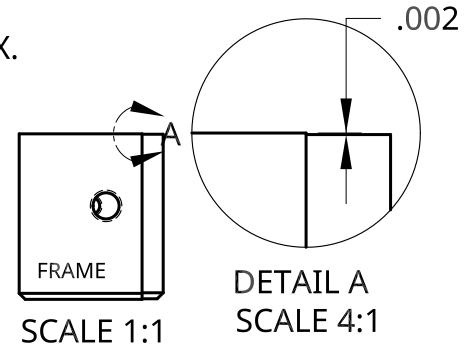
B

B

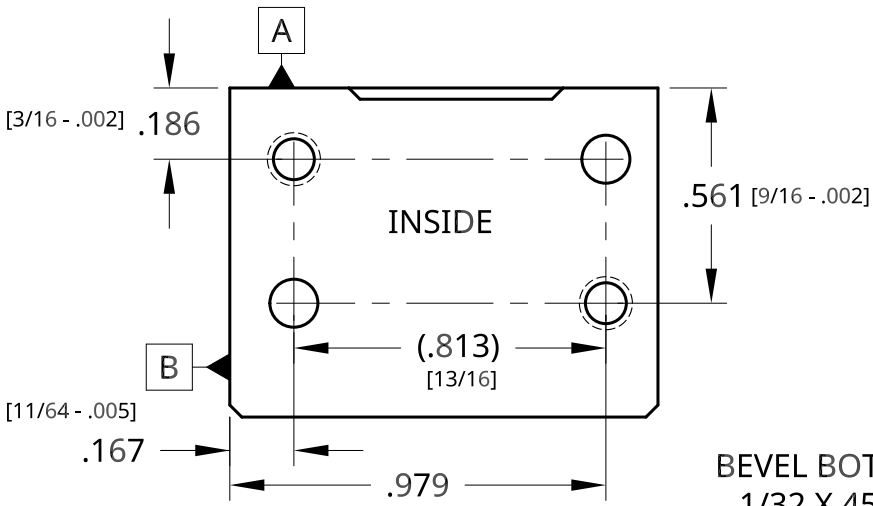


SECTION B - B

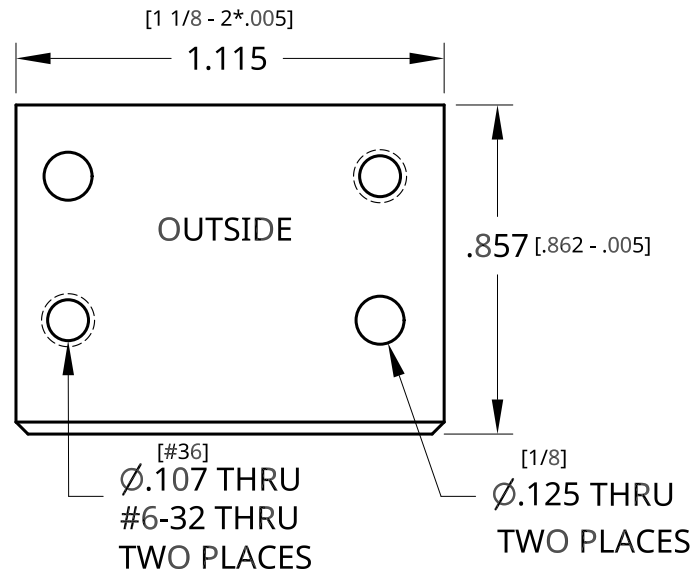
MILL TOP ("INSIDE") BEVEL WITH FRAME AND PLATE ASSEMBLED SO THAT BOTTOM OF PLATE BEVEL MATCHES 1/32 FRAME BEVEL. SEE DETAIL C (ABOVE RIGHT AND FAR BELOW LEFT).



AS ASSEMBLED, THE TOP OF THE PLATE IS 0.002 LOWER THAN THE TOP OF THE FRAME (AND THUS (0.003) ABOVE THE BOTTOM).



BEVEL BOTTOM 1/32 X 45 DEG THREE SIDES



A

A

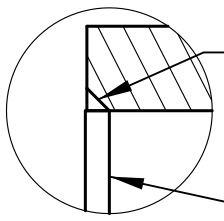


PLATE BEVEL, 45 DEG.  
FRAME BEVEL 1/32 X 45 DEG.

DUNKER'S ORIGINAL FRACTIONAL DIMENSIONS AND MY DIMENSIONAL COMPUTATIONS ARE GIVEN IN [BRACKETS]. DIMENSIONS IN (PARENTHESES) ARE NO-TOLERANCE REFERENCE DIMENSIONS WHICH SHOULD NOT BE USED IN MACHINING.

|  |                      |                 |        |            |
|--|----------------------|-----------------|--------|------------|
| UNLESS OTHERWISE SPECIFIED, DIMENSIONS ARE IN INCHES | DRAWN                | DAVID M.        | DATE   | 01/04/2020 |
|  | CHECKED              |                 |        |            |
|  | APPROVED             |                 |        |            |
|  | DO NOT SCALE DRAWING |                 |        |            |
| BREAK ALL SHARP EDGES AND REMOVE BURRS               |                      |                 |        |            |
| THIRD ANGLE PROJECTION                               | MATERIAL             | BRONZE OR BRASS | FINISH |            |

|   |            |      |
|---|------------|------|
| <b>CircuitousRoot</b>                             |            |      |
| TITLE DUNKER MATRIX DEPOSITION CASE PART 2. PLATE |            |      |
| SIZE  | DWG NO.    | REV. |
| A   | DUNKERMDC2 | 2    |
| SCALE   | SHEET      |      |
| 2:1   | 1 of 1     |      |

2

1



2

1

TOP

THIS INTERFERENCE IS DUE TO USING SCREWS WITH LARGER HEADS THAN THOSE DUNKER USED. IT SHOULD NOT AFFECT FUNCTION.

BOTTOM

.740

DRILL #29 (.136) THRU COUNTERBORE 15/64 (.235) FOR .135 TWO PLACES

FOOT

.984

MAT-RIGHT  
(TYPE-LEFT)

(.813)

[13/16]

MAT-LEFT  
(TYPE-RIGHT)

BEVEL (CHAMFER)  
1/32 X 45 DEGREES,  
FOUR SIDES

1.115

[11/64] .172

HEAD

.250

[1/4]

[5/16]

.313

A

DUNKER'S ORIGINAL FRACTIONAL DIMENSIONS AND MY DIMENSIONAL COMPUTATIONS ARE GIVEN IN [BRACKETS]. DIMENSIONS IN (PARENTHESES) ARE NO-TOLERANCE REFERENCE DIMENSIONS WHICH SHOULD NOT BE USED IN MACHINING.

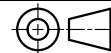
UNLESS OTHERWISE SPECIFIED,  
DIMENSIONS ARE IN INCHES

DESIGN PUBLIC DOMAIN.  
DRAWING LICENSE:  
CREATIVE COMMONS  
ATTRIBUTION 4.0 INT'L

DO NOT SCALE DRAWING

BREAK ALL SHARP EDGES AND  
REMOVE BURRS

THIRD ANGLE PROJECTION



|          | NAME     | DATE       |
|----------|----------|------------|
| DRAWN    | DAVID M. | 01/05/2020 |
| CHECKED  |          |            |
| APPROVED |          |            |

MATERIAL  
ACRYLIC OR  
POLYCARBONATE

FINISH

# CircuitousRoot

TITLE DUNKER MATRIX DEPOSITION CASE  
PART 3. TYPE HOLDER BOTTOM

SIZE A DWG NO. DUNKERMDC3 REV. 2

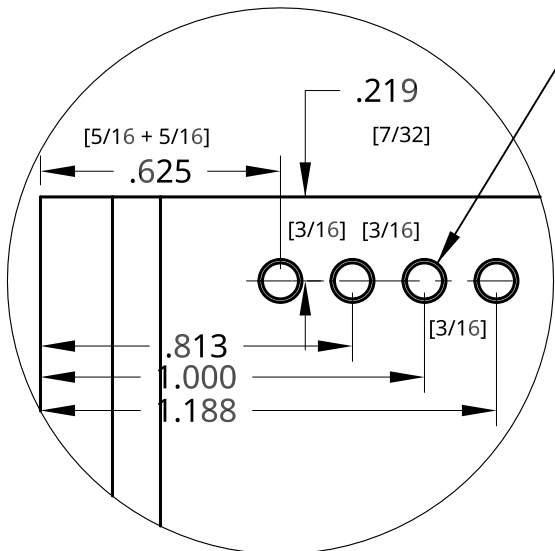
SCALE 3:1 SHEET 1 of 1

2

1

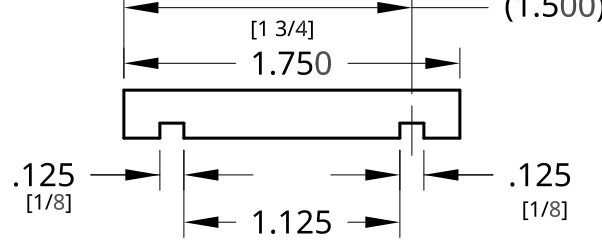
2

1



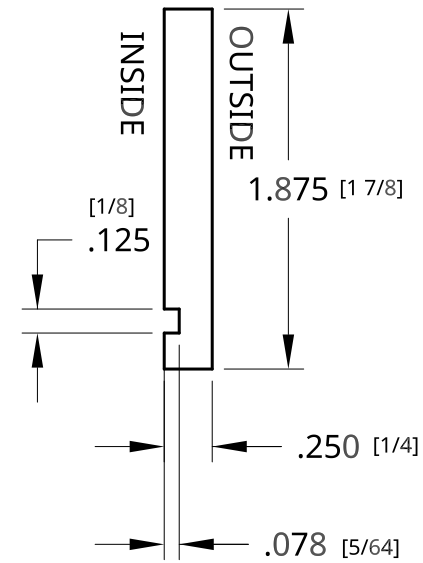
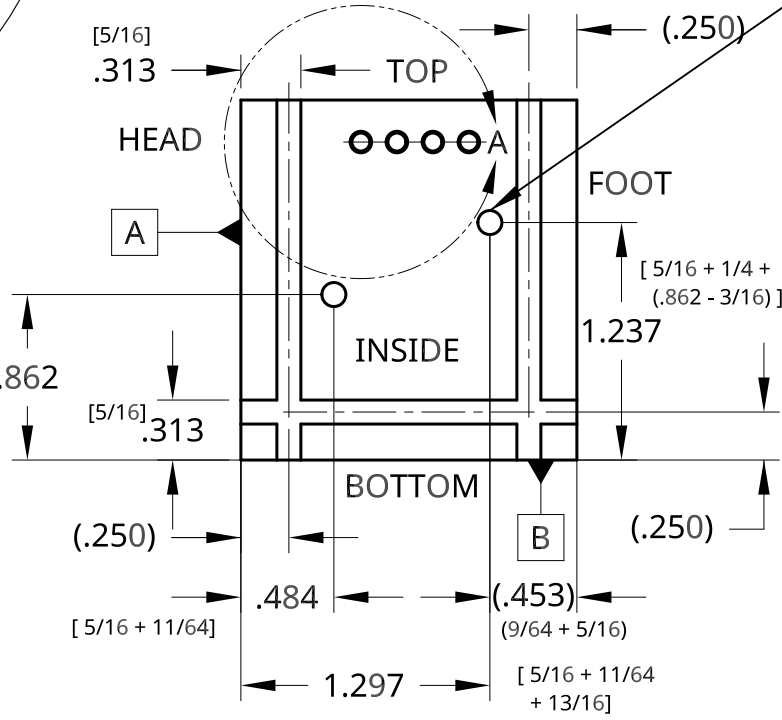
DETAIL A  
SCALE 2:1  
FLOW HOLES

DRILL 3/32 THRU.  
TAPER REAM #4/0 FROM THIS SIDE  
FOUR PLACES



[DUNKER SPECIFIED 1.125 DECIMALLY.  
IT IS THE MATRIX LENGTH, AND IS IMPORTANT.]

ATTACHING HOLES:  
DRILL 1/8 THRU  
COUNTERBORE FROM OTHER  
SIDE 7/32 (.219) FOR .110  
TWO PLACES



[ 5/16 + 1/4 + (.862 - 9/16) ]  
ACTUALLY, DUNKER LOCATED  
THE TWO ATTACHING HOLES  
"IN ASSEMBLY" AND DRILLED  
AND COUNTERBORED THEM  
TO FIT.

DUNKER'S ORIGINAL FRACTIONAL DIMENSIONS AND  
MY DIMENSIONAL COMPUTATIONS ARE GIVEN IN [BRACKETS].  
DIMENSIONS IN (PARENTHESES) ARE NO-TOLERANCE REFERENCE  
DIMENSIONS WHICH SHOULD NOT BE USED IN MACHINING.

|  |  |   |            |                              |                 |
|--|--|---|------------|------------------------------|-----------------|
| UNLESS OTHERWISE SPECIFIED,<br>DIMENSIONS ARE IN INCHES                                |  | NAME                                    | DATE       | <b>CircuitousRoot</b>        |                 |
| DESIGN PUBLIC DOMAIN.<br>DRAWING LICENSE:<br>CREATIVE COMMONS<br>ATTRIBUTION 4.0 INT'L |  | DRAWN<br>DAVID M.                       | 01/06/2020 |                              |                 |
| DO NOT SCALE DRAWING   |  | CHECKED                                 |            | SIZE<br><b>A</b>             |                 |
| BREAK ALL SHARP EDGES AND<br>REMOVE BURRS  |  | APPROVED                                |            | DWG NO.<br><b>DUNKERMDC4</b> |                 |
| THIRD ANGLE PROJECTION   |  | MATERIAL<br>ACRYLIC OR<br>POLYCARBONATE | FINISH     | REV.<br><b>2</b>             |                 |
|  |  |   |            | SCALE<br>1:1                 | SHEET<br>1 of 1 |

2

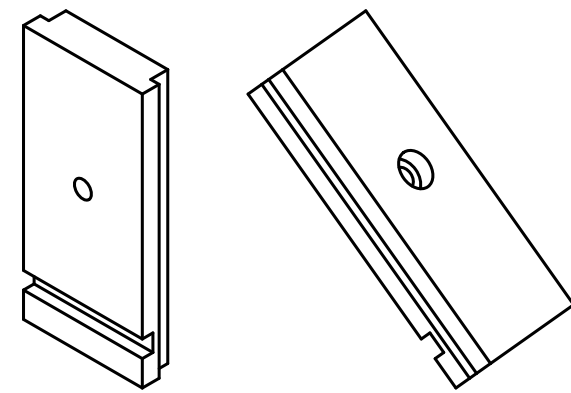
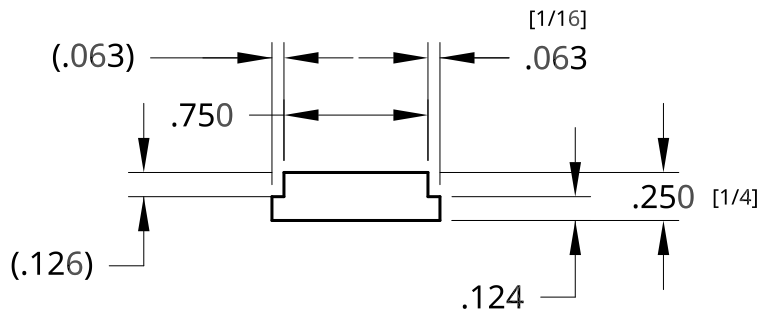
1

B

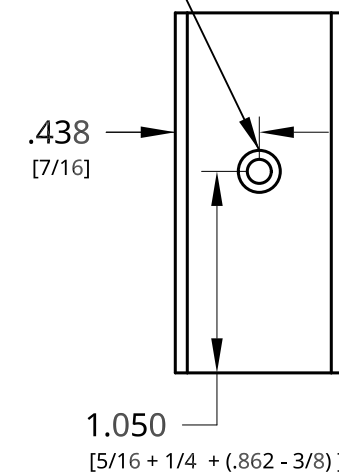
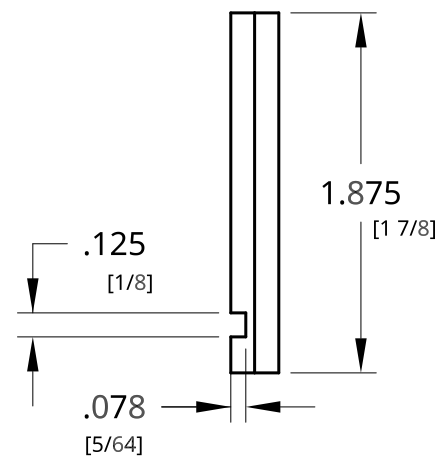
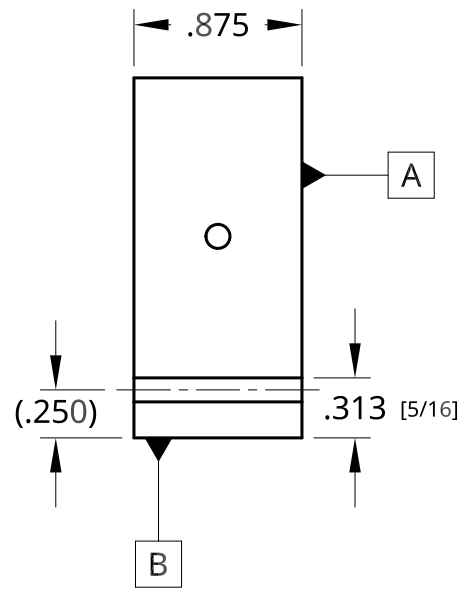
B

A

A



DRILL 1/8 THRU  
COUNTERBORE  
7/32 (0.219) FOR 0.110  
FROM THIS SIDE



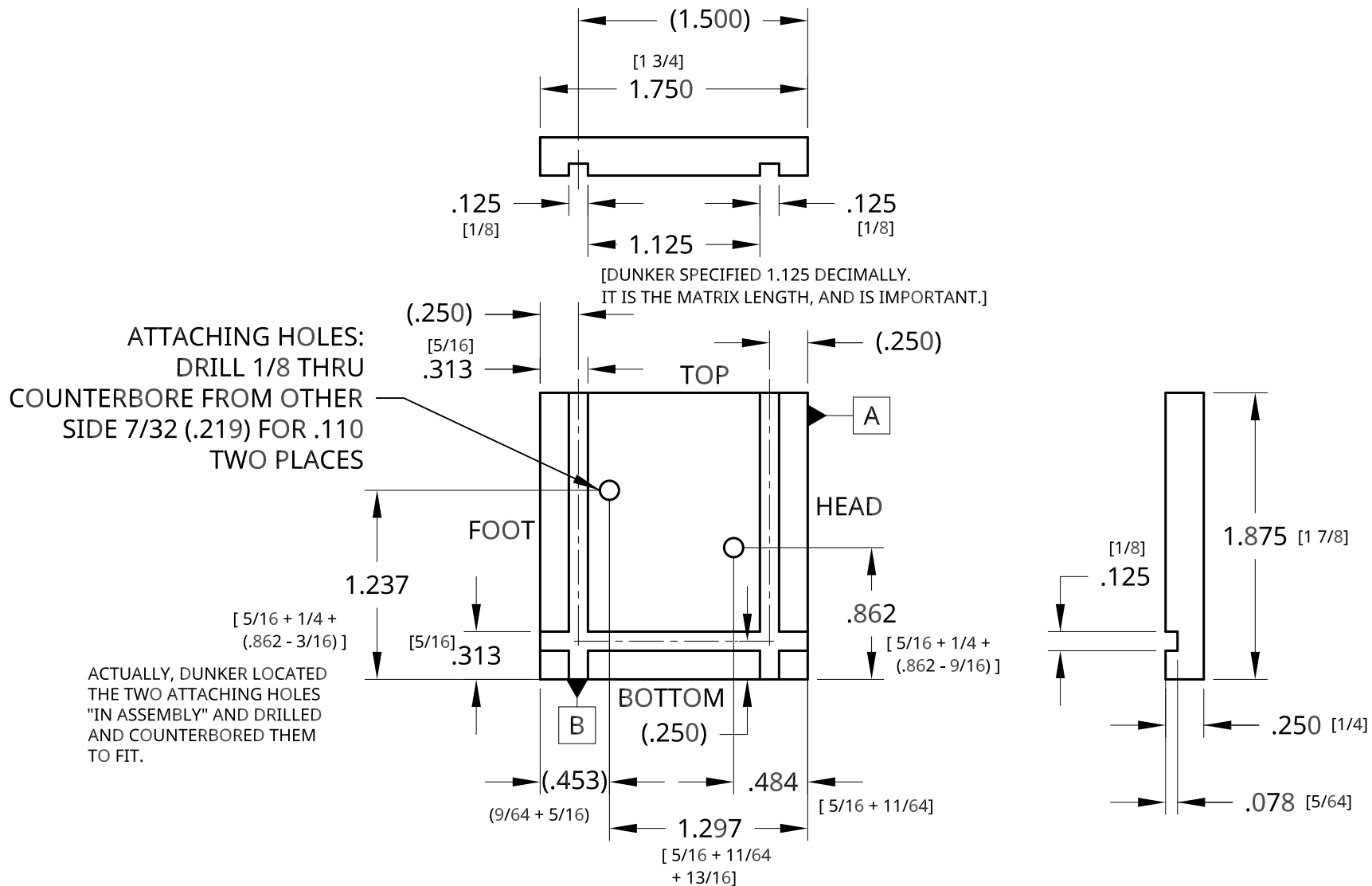
[DUNKER'S DRAWING CALLS OUT 1 1/16 (1.063), WHICH MUST BE AN ERROR.]

DUNKER'S ORIGINAL FRACTIONAL DIMENSIONS AND MY DIMENSIONAL COMPUTATIONS ARE GIVEN IN [BRACKETS]. DIMENSIONS IN (PARENTHESES) ARE NO-TOLERANCE REFERENCE DIMENSIONS WHICH SHOULD NOT BE USED IN MACHINING.

|  |                          |          |                       |  |                           |               |
|--|--------------------------|----------|-----------------------|--|---------------------------|---------------|
| UNLESS OTHERWISE SPECIFIED, DIMENSIONS ARE IN INCHES | NAME                     | DATE     | <b>CircuitousRoot</b> |  |                           |               |
|  | DRAWN                    | DAVID M. |                       |  |                           | 01/06/2020    |
|  | CHECKED                  |          |                       | TITLE DUNKER MATRIX DEPOSITION CASE PART 5. BOX SIDE B (MATRIX HEAD) |                           |               |
|  | APPROVED                 |          |                       | SIZE <b>A</b>  | DWG NO. <b>DUNKERMDC5</b> | REV. <b>2</b> |
|  | DO NOT SCALE DRAWING     |          |                       | SCALE 1:1  | SHEET 1 of 1              |               |
| BREAK ALL SHARP EDGES AND REMOVE BURRS               |                          |          |                       |  |                           |               |
| THIRD ANGLE PROJECTION                               | MATERIAL                 | FINISH   |                       |  |                           |               |
|  | ACRYLIC OR POLYCARBONATE |          |                       |  |                           |               |

2

1



DUNKER'S ORIGINAL FRACTIONAL DIMENSIONS AND  
MY DIMENSIONAL COMPUTATIONS ARE GIVEN IN [BRACKETS].  
DIMENSIONS IN (PARENTHESES) ARE NO-TOLERANCE REFERENCE  
DIMENSIONS WHICH SHOULD NOT BE USED IN MACHINING.

UNLESS OTHERWISE SPECIFIED,  
DIMENSIONS ARE IN INCHES

DESIGN PUBLIC DOMAIN.  
DRAWING LICENSE:  
CREATIVE COMMONS  
ATTRIBUTION 4.0 INT'L

DO NOT SCALE DRAWING

BREAK ALL SHARP EDGES AND  
REMOVE BURRS

THIRD ANGLE PROJECTION



NAME

DATE

DRAWN

DAVID M.

01/07/2020

CHECKED

APPROVED

*CircuitousRoot*

TITLE  
DUNKER MATRIX DEPOSITION CASE  
PART 6. BOX SIDE C  
(MATRIX-RIGHT / TYPE LEFT)

SIZE

DWG NO.

A DUNKERMDC6

REV.

2

SCALE 1:1

SHEET

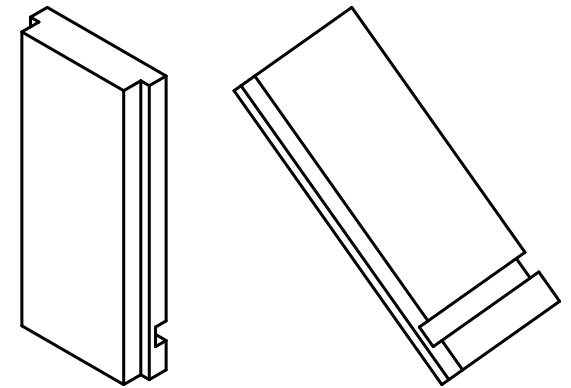
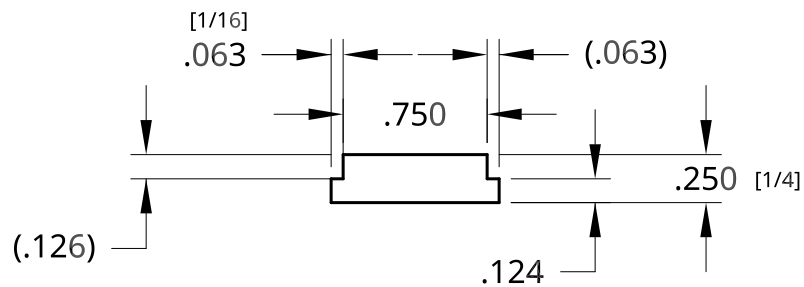
1 of 1

2

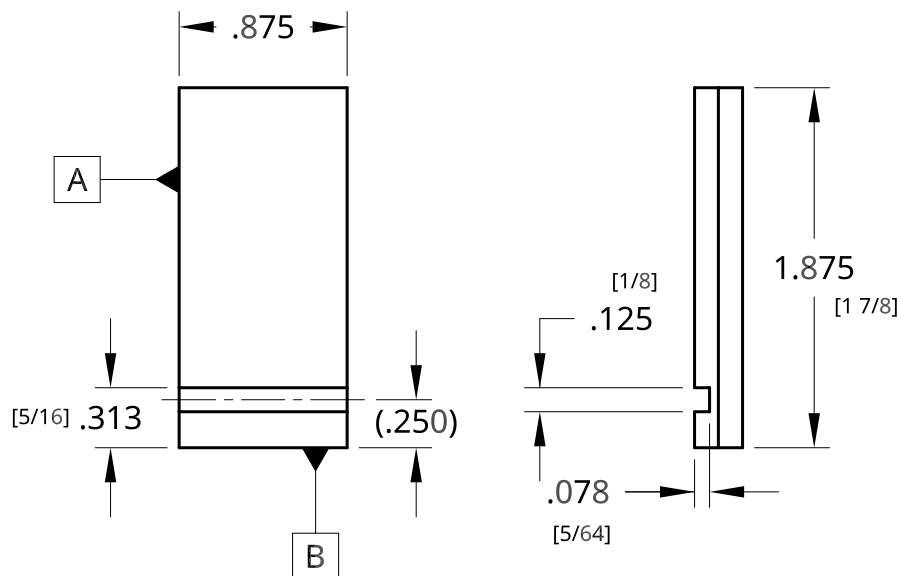
1

2

1



NO HOLES



DUNKER'S ORIGINAL FRACTIONAL DIMENSIONS AND MY DIMENSIONAL COMPUTATIONS ARE GIVEN IN [BRACKETS]. DIMENSIONS IN (PARENTHESES) ARE NO-TOLERANCE REFERENCE DIMENSIONS WHICH SHOULD NOT BE USED IN MACHINING.

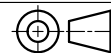
UNLESS OTHERWISE SPECIFIED, DIMENSIONS ARE IN INCHES

DESIGN PUBLIC DOMAIN.  
DRAWING LICENSE:  
CREATIVE COMMONS  
ATTRIBUTION 4.0 INT'L

DO NOT SCALE DRAWING

BREAK ALL SHARP EDGES AND REMOVE BURRS

THIRD ANGLE PROJECTION



|          | NAME     | DATE       |
|----------|----------|------------|
| DRAWN    | DAVID M. | 01/07/2020 |
| CHECKED  |          |            |
| APPROVED |          |            |

| MATERIAL                 | FINISH |
|--------------------------|--------|
| ACRYLIC OR POLYCARBONATE |        |

*CircuitousRoot*

TITLE DUNKER MATRIX DEPOSITION CASE  
PART 7. BOX SIDE D  
(MATRIX FOOT)

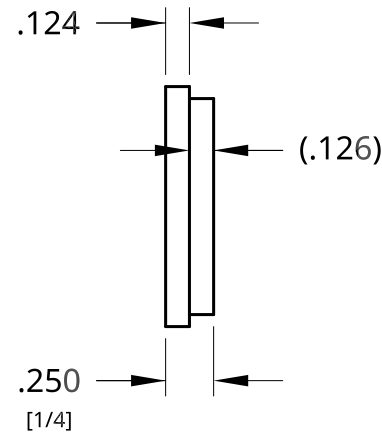
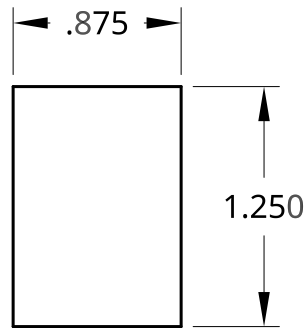
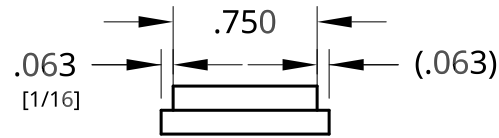
| SIZE      | DWG NO.      | REV. |
|-----------|--------------|------|
| A         | DUNKERMDC7   | 2    |
| SCALE 1:1 | SHEET 1 of 1 |      |

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THIS IS THE ONLY FRACTIONAL DIMENSION IN DUNKER'S DRAWING OF THIS PART.

DUNKER'S ORIGINAL FRACTIONAL DIMENSIONS AND MY DIMENSIONAL COMPUTATIONS ARE GIVEN IN [BRACKETS]. DIMENSIONS IN (PARENTHESES) ARE NO-TOLERANCE REFERENCE DIMENSIONS WHICH SHOULD NOT BE USED IN MACHINING.

|  |                      |      |                          |      |            |  |  |                       |     |         |   |      |   |
|--|----------------------|------|--------------------------|------|------------|--|--|-----------------------|-----|---------|---|------|---|
| UNLESS OTHERWISE SPECIFIED, DIMENSIONS ARE IN INCHES | DRAWN                | NAME | DAVID M.                 | DATE | 01/07/2020 |  |  | <i>CircuitousRoot</i> |     |         |   |      |   |
|  | CHECKED              |      |                          |      | TITLE      |  |  |                       |     |         | DUNKER MATRIX DEPOSITION CASE PART 8. BOX SIDE E (BOX BOTTOM) |      |   |
|  | APPROVED             |      |                          |      |            |  |  | SIZE                  | A   | DWG NO. | DUNKERMDC8  | REV. | 2 |
|  | DO NOT SCALE DRAWING |      |                          |      |            |  |  | SCALE                 | 1:1 | SHEET   | 1 of 1  |      |   |
| BREAK ALL SHARP EDGES AND REMOVE BURRS               |                      |      |                          |      |            |  |  |                       |     |         |   |      |   |
| THIRD ANGLE PROJECTION                               | MATERIAL             |      | ACRYLIC OR POLYCARBONATE |      | FINISH     |  |  |                       |     |         |   |      |   |
|  |                      |      |                          |      |            |  |  |                       |     |         |   |      |   |

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B

B

A

A