

Machine Dossier for BEM2a-53
(Benton Pantograph)

Part IV: Re-Engineering

Chapter 2: Interfaces

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IV.2• Interfaces

IV.2.A• What Is An Interface?

If the Benton pantograph was a piece of software, this section would define its API (Applications Programming Interface). That is, it defines all of the information necessary for someone to design a new device which would enhance the capabilities of the machine. The interface overlaps with the specifications (see Division 1, Part 7: Specifications), but where the specification is intended for the rigger, millwright, and operator the interface is intended for the design engineer. The interface is also implicit in the CAD models and (re)manufacturing information developed in Division IV, Part 3, but that information describes how to rebuild the machine as it is. The interface definition allows the machine to be enhanced.

Four aspects of the Benton will be considered:

- The matrix holder receiver
- The quill aperture
- The quill drive (to existing ATF and 1990s quills)
- The followers

Of course, these interface definitions are also useful if any of these components is missing. This is the case with BEM2a-53, which requires the making of a new matrix holder (without an existing model to copy), the making of new followers (again, without models), and the fitting of a quill drive.

IV.2.B• The Matrix Holder Receiver

This interface describes what the 1xx.YY Matrix holder (MH) must fit into. I'll call this the “matrix holder receiver” (MHR), but it is not a single part. It is a combination of sizes and relative locations of the 040.XX Matrix holder elevating block, 040.XX Matrix Holder Elevating Block Cheeks, 040.XX Matrix Holder Backstop, 3XX.YY Quill Collet Holder (face), and 3XX.YY Quill Collet (face).

Summary of Parameters¹

Parameter	Measured	Design?	MTool	Notes
MHR width	2.223		A B	
MHR depth	2.518	2.5	C D	
MHR height (slide top to quill)	1.056		A B	
Elevating block slide (EBS) height	0.127			
EBS angle	30°			
EBS width, over 0.125 pins	0.972		A B E	calc.
MH slide width, inside 0.125 pins	0.431			meas.
MH clamp thickness	0.132			
MH clamp width	0.900			
MH clamp bottom minimum	0.139			
MH clamp bottom maximum	0.151			
Cutting Tool Stickout (0.093" ø)	0.21		A F	
Elevating wheel graduations	0.000,1			
Elevating wheel maximum travel	0.150,9	0.150,0		
Maximum ATF Depth-of-Drive		0.1251		120pt

Summary of Nonessential Features

Parameter	Measured	Design?	MTool	Notes
Elevating Block Slide Relief Depth	0.002			
Elevating Block Slide Relief Width	0.082			
Matrix Holder Clamp Depth	1.14			

Measuring Tools Used

¹All values are in inches unless noted. Numbers are expressed in the traditional American format, with a period for a decimal point and commas separating three-figure groups. A 0 in the ones position is always shown (zero is just another number and decimal points disappear easily.)

ID	Tool	Accuracy Resolution
A	Mitutoyo Cat. 500-160-30 6" digital caliper	0.001 0.000,5
B	Starrett 154 Adjustable Parallel Set	unspecified
C	vernier depth gauge	unknown, ≈ 0.001
D	feeler gauges (China) unknown	
E	gage pins, class Z	
F	measurement of photographs	

(Worknotes 2023-02-07).

(Currier 2011, PAGE).

IV.2.C• The Quill Aperture

This interface describes what a Quill must fit into and what cutters it must be able to receive in order to perform the same work as an ATF-manufactured Quill. So, for example, it describes what you need to know in order to fit a high-speed air spindle to the machine (if you wanted to).

The term “aperture” was suggested by Theo Rhak.²

The diameter of the genuine ATF quill, No. 53, which came with BEM2a-53 is: 0.899,0”.

The diameter of the HEBCO quills is 0.897,0 – 0.897,5”.

For reference, 22.8mm (a diameter for which NSK/Nakanishi spindles are available) is 0.897,6”.

IV.2.D• The Quill Drive

This interface defines the drive coupling at the back of both the original ATF-manufactured quills and the 1990s vintage quills.

IV.2.D.i• The Followers

This interface defines the fit of followers into the wand.

QUESTION: Does a wide follower’s foot need a ball joint?

²Theo Rhak, email to DMM on 2023-03-13 15:49:40 -0400.