CHAPTER

21 *Layout and machining hint for the* Kimble Engine Rotary Valve

Here are some special instructions showing how a Rotary Valve for the Kimble steam engine was made. Perhaps this will add a little to your knowledge of machine shop work. It is a small lesson in layout and machine setup. It is also a very small part and will try your patience. A very accurate turning of the Valve was made to a close fit in the Engine Body. The outlines of the cuts were laid out to help avoid errors. Experienced machinists may not need as much detail since they can often do such jobs by just reading the dials on the feed screws.

Using a tiny vise and Vernier height gauge on a surface plate, the outlines of the cuts were made in layout dye on the Valve. The Unimat SL vertical column and head were used to machine the steam passages. An indexing fixture was mounted in the cross-slide milling attachment. In this case, a 48-tooth lathe change gear was used, 12 tooth spaces indexing 90° for the cuts. Any gear with the number of teeth divisible by four can be used.

Following is an outline of the operations:

In **Step 1**, the Valve is mounted squarely in a miniature vise which is square in all directions and set on end as shown. Bring the Vernier gauge scriber down until it just kisses the top of the Valve and record the reading on a sketch such as 3.426". Don't try to find a zero base, just read the Vernier scale as is. Subtract half of the Valve diameter and you have 3.239", which is the center. Set your Vernier at 3.239" and scribe across the end and on each side as shown.

Step 2. Lay the vise on its side and repeat the operations, giving you the two centerlines and the Valve scribed into equal divisions. Keep track of the side **X** on which the vise rested. Record your readings on a sketch.

In **Step 3**, the vise is set normal and the same method used to scribe the centers on the sides of the Valve.

Step 4 uses the same position of the vise as Step 3. By adding half of the 3/32" mill cut to 3.555", one side of the cut can be scribed. Likewise, .047" subtracted gives the lower side. These lines are scribed in the three areas where cuts will be made.

Step 5 returns to the position in Step 1 and the runout of the cut can be scribed for the intake. Prick punch and scribe the 3/32" half circle for the two exhaust ports.

Step 6 goes to the position in Step 2 and the runout for the exhaust passages scribed.

Through all six steps, the Valve remains tight in the vise. If you check the layouts and wish to go back, you can return to any line you made by setting the Vernier to the readings you recorded. There are good articles in books on reading a Vernier so no attempt is made here.

Step 7. If you are satisfied with your layout, the Valve can be removed from the vise. The Valve is now mounted in the indexing fixture, squarely mounted in the cross-slide milling attachment. In this case, it is basically a cast iron block with a close-fitting arbor flanged at one end to take the Unimat 3-jaw chuck and shouldered, keyed, and threaded at the other end to take one of the lathe change gears. An attached arm guides the indexing pin.

First, snug up the Valve in the chuck and square up the centerline on the end of the Valve with a square resting on the lathe bed. When carefully squared up, tighten the jaws.

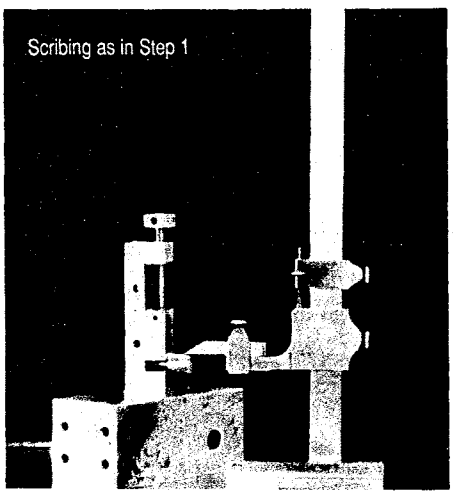
Pick up the intake center you made in Step 3, using a wiggler. Once this is established, do not touch the cross-slide. This position will be used for all three milling operations. Drill the 1/16" steam passage.

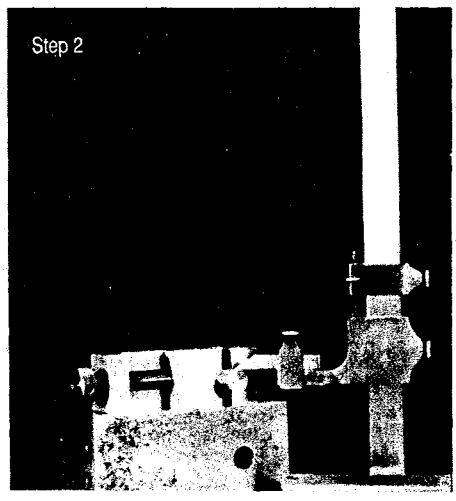
Mount the 3/32" end mill in the chuck and bring the piece in until it just touches the end of the mill. Set the carriage stop at 0 and back it up .047" or the thickness of a 3/64" drill. Take light cuts until the carriage stop is reached.

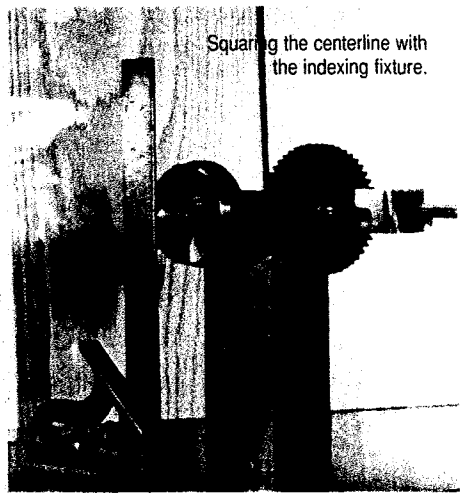
Step 8. Rotate the piece 90° as shown for milling one of the exhaust passages. Set the carriage stop at .078" and mill in easy steps, feeding the piece down into the cutter. Run the cuts until the cutter matches the half circle you scribed in Step 5.

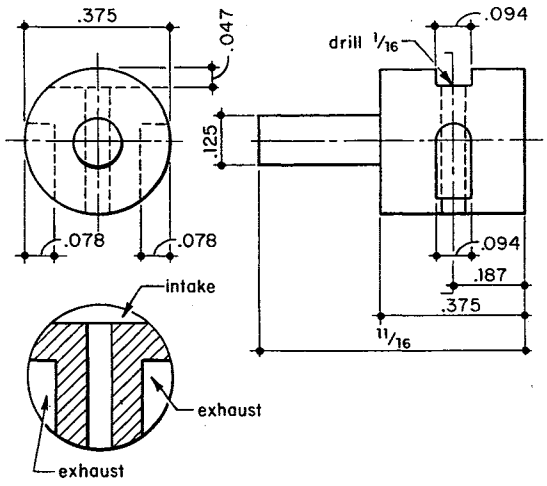
Rotate the piece 180° and repeat, feeding the piece up into the cutter.

If you have other ideas, try them out. In any case, the steps outlined here can apply to many layout jobs you may run across.

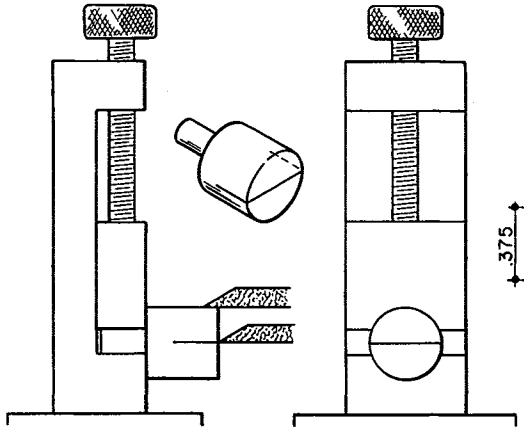

Scribing as in Step 1


Step 2

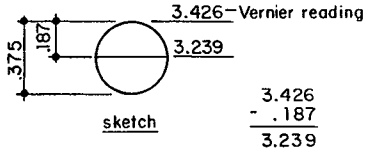

Squaring the centerline with the indexing fixture.



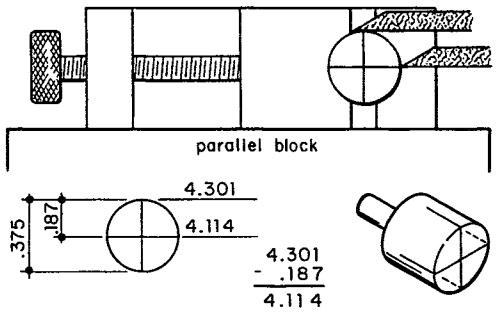
VALVE



STEP 1

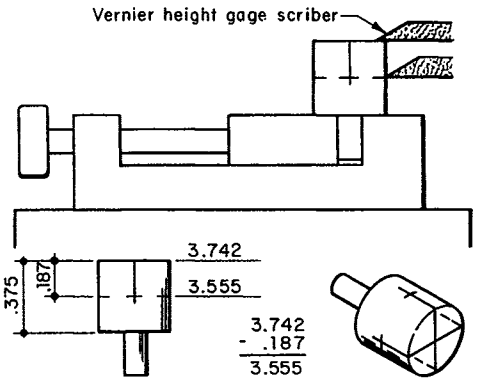


3.426
- .187
3.239



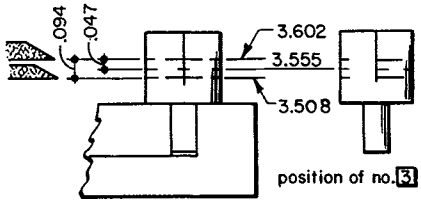
4.301
- .187
4.114

2



3.742
- .187
3.555

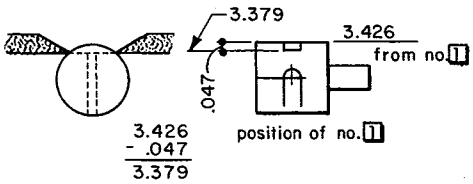
3



3.555 (from no. 3)
- .047
3.508

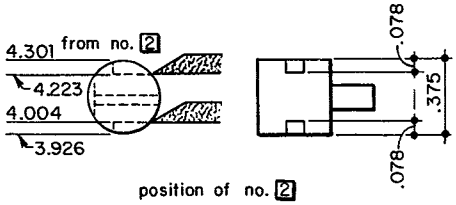
3.555
+ .047
3.602

4



3.426
- .047
3.379

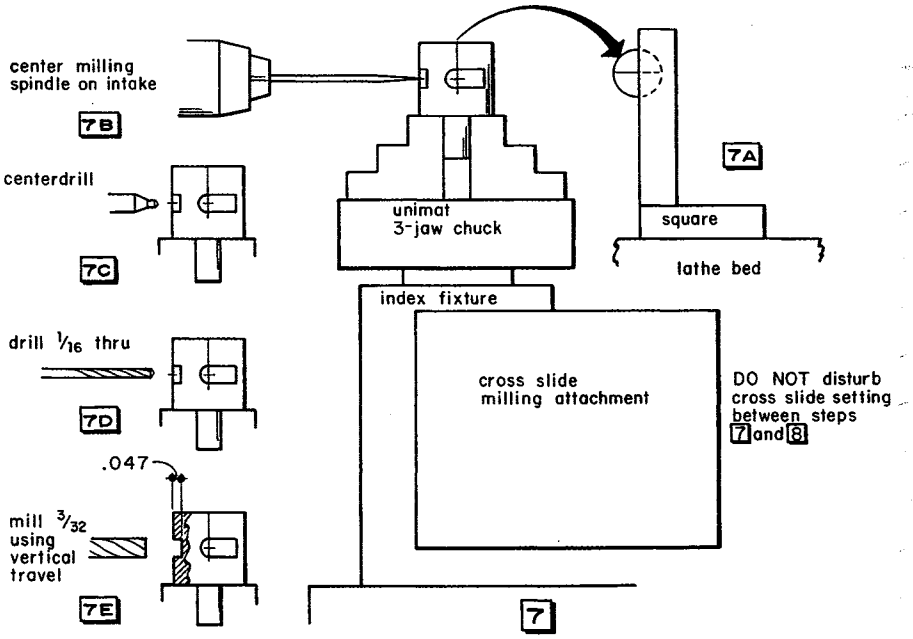
5



4.301
- .078
4.223

4.301
- .375
3.926
+ .078
4.004

6



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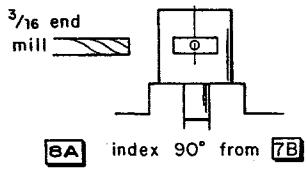

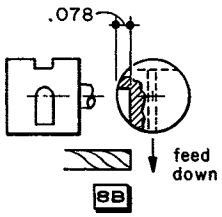

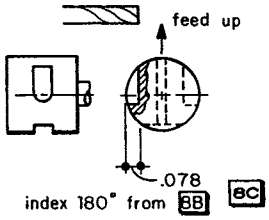

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