THE REPAIR SHOP

FLUSH BANDING A WOODWIND INSTRUMENT

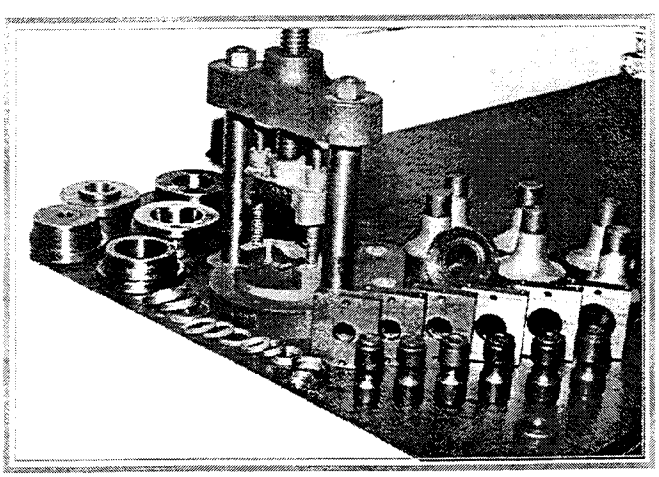
by Lars Kirmser

One of the more sensitive operations performed in the course of woodwind repair is the **flush banding** process. Unless the technician uses precise judgement and possesses a thorough knowledge of the flush banding technique, he is likely to cause severe damage to the instrument when attempting such a repair.

Is Flush Banding Really Necessary?

Many times a woodwind will develop a simple surface check and cause the owner great concern. This concern may be justified if the instrument is subjected to further radical environmental conditions (e.g. extreme temperatures and/or humidity). To worry about this is usually not justified under normal playing conditions. If the client takes reasonable precautions such as oiling the bore as required, and not subjecting the instrument to extreme temperatures and/or humidity, this surface check will come and go seasonally as the instrument exchanges small amounts of moisture. This certainly is not a case where flush banding is recommended.

These same seasonal fluctuations will be observed with regard to the tenon rings, tenon caps and bell rings. These should be shrunk **only** after the instrument has reached an equilibrium. Many repairmen have made the mistake of shrinking tenon rings and/or bell rings prior to shipping the particular instrument back to its owner who lives in a much more humid climate (e.g. coastal cities, Hawaii, etc.). The result, of course, is having to pay freight back and forth for an adjustment at a later date. Dry winter months also are deceiving with regard to loose rings. Caution should be observed during those times.



Flush Band Machine and dies.

If the body of a woodwind is cracked (as opposed to a simple surface check) the **flush band method** is considered by many to be the most effective way to handle the situation. This process consists of shrinking a *seamless* nickel silver band into a precut groove on the body of the damaged woodwind joint. Sterling Silver bands are used on Oboes and English Horns. This band is designed to hold the crack together so that it will not spread further. Flush bands are 'flush' with the outside of the instrument and are strategic ally placed so as not to interfere with the key mechanism or tone holes of the cracked instrument. One band is often sufficient for smaller cracks, however, for extended cracks more than one is usually required.

There are those who prefer the **pinning method** of crack repairing. It would be a mistake to claim that either method is unequivocally superior to the other since it depends entirely upon the degree of excellence with which either method is applied.

Selecting the Properly-Sized Band

Ideally, the band should be just large enough to clear the outside diameter of the instrument body at the point where the groove will be cut. This is not always possible, because, depending upon your supplier, you can only buy bands in nine (9) or ten (10) different sizes. So, we are forced to select the smallest band that will clear the outside diameter of the body. These measurements can be easily determined by using a good quality **vernier** caliper.

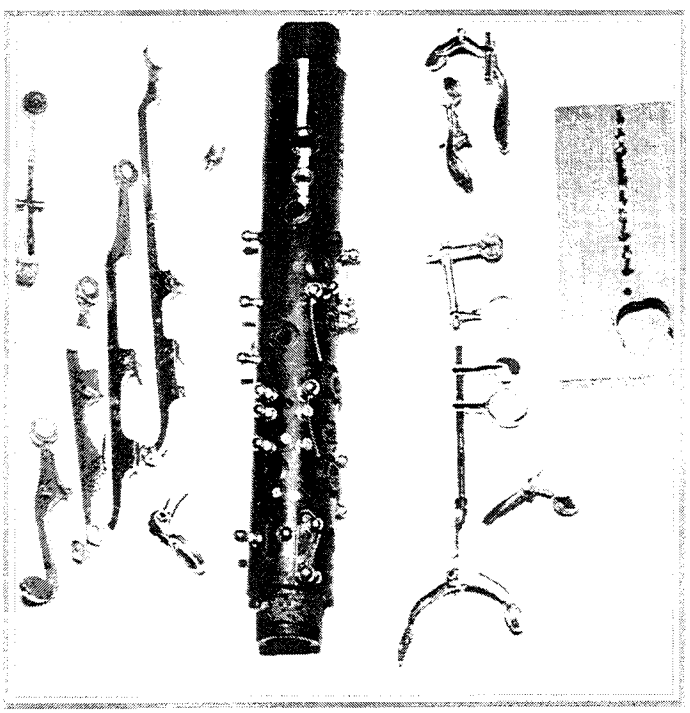
Preparing the Joint

Prior to cutting the groove, it is necessary to remove all the keys and posts that will prevent the band from slipping over the body. It will usually be necessary to remove all of the keys and all the posts up to the point where the groove is to be cut. On the oboe, it is frequently necessary to remove all of the posts as well, because of the large crown on the upper portion of the joint. Some repairmen will cut the crown down *slightly* to permit the ring clearance if the oboe is equipped with raised tone holes (ring keys). Consideration should be made with regard to the aesthetic appearance of the instrument when, and if it is necessary to cut this crown down.

Locating the Groove

Probably 99% of all cracks experienced by the repairman will be through the register and octave vents of the B♭ Soprano Clarinet and Oboe. This seems to be the area that is more frequently subjected to wide ranges of moisture, and is structurally weak because of the many tone holes located in a relatively small space. Depending upon the extent of the crack, one or two bands is all that is usually necessary. Because of the number of tone holes and posts located in this part of the instrument, we are quite limited as to the placement of our

bands. If it is possible to avoid defacing the manufacturers trade mark and/or serial number, do so. On rare occasions the technician may find that it is necessary to relocate posts (ex-



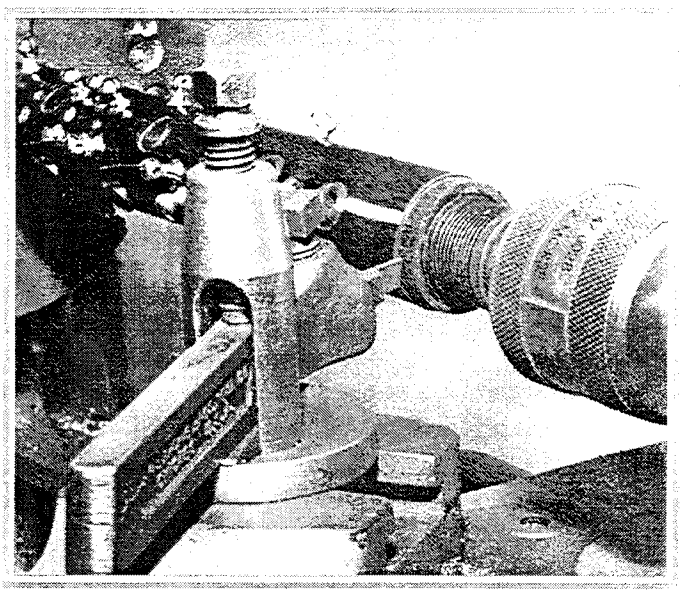
Preparing to cut the grooves.

tending or shortening hinge tubing as the result) to accommodate the flush band. As a general rule it is not wise (or usually feasible) to relocate tone holes for obvious reasons.

Caution should be exercised when cutting a groove close to tone holes. Not only might the band interfere with the seating of the pad, but one can easily damage the tone hole when shrinking the band into a *tight* groove. If the band must be shrunk near a tone hole, it will be necessary to rephrase the tone hole with a special tone hole, counter bore prior to rehanging the keys. If possible, keep the flush band 1 to 1.5mm from the edge of the tone hole counter bore.

Cutting the Groove(s)

In preparation to cutting the groove, the cracked joint is centered in a 4-jaw chuck. If a 3-jaw chuck is used, make sure that it is true! The tail stock of the lathe houses a tapered live center

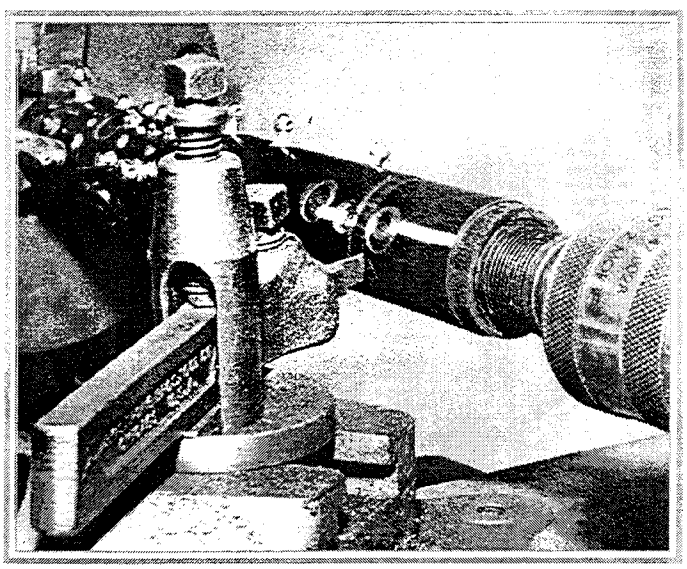


Make small cuts and measure frequently.

so that the joint rotates freely. It is **absolutely** necessary that the joint runs true. Use a good quality centering gauge and fixture when setting up. Use the part of the joint where the groove will be cut as the primary point of measurement.

When calculating the required width of the groove, the 'widening-effect' that is experienced when a metal band is shrunk must be taken into consideration. An important fact to be aware of, is that the volume of the metal band remains the same after shrinking as it was prior to shrinking. The only significant change is in the dimension of the metal. When the diameter of the band is reduced, the width (and to a slight degree the thickness) of that band is increased.

The dimensions and alloys of flush bands have been somewhat standardized among the major wholesalers, consequently we are able to use a common formula for determining the



Cut the groove with a square, narrow bit and at a medium to medium high speed.

dimensions of the groove for most of the available bands. The alloys used are usually 18% nickel-silver for Clarinet bands, and sterling silver for the Oboes and English Horn bands. Sterling silver is utilized for the Oboes and English Horns because they require a more radical shrink; silver being softer than nickel-silver, is easier to shrink.

The Problem: We have a B^{b} Soprano Clarinet with a crack in the upper joint. The joint where the band is to be installed measures 29mm O.D. With a cut of 1.8mm we are able to reduce this O.D. down to 25.4 mm. Our preshrunk band measures 30mm I.D. which means that we will have to reduce the I.D. of that band by 4.6mm or 15% of its I.D. If the width will expand directly proportionally to the shrinkage, which it does with minor discrepancies, we should expect the band to widen by 15% of its original width (5mm) or 75mm.

As stated earlier sterling silver bands are used on the Oboes and English Horns because of the radical shrinkage required. When figuring out the width of the Oboe groove, the only measurement that is not the same is the depth of cut. Whereas the Clarinet groove is always 1.8mm, we use a shallower cut of 1.5mm deep for the Oboes and English Horns.

The Problem: We want to install a sterling silver band on an Oboe which measures 20.8mm in O.D. With a 1.5mm cut, we will bring the O.D. down to 17.8mm. Our preshrunk band measures 23.8mm I.D. We will therefore have to reduce the I.D. of this ring by 6mm (25%). If the width will expand directly proportionately to the shrinkage, which it does with minor discrepancies, we should expect the band to widen 25% over its original width (5mm) or 1.25mm more.

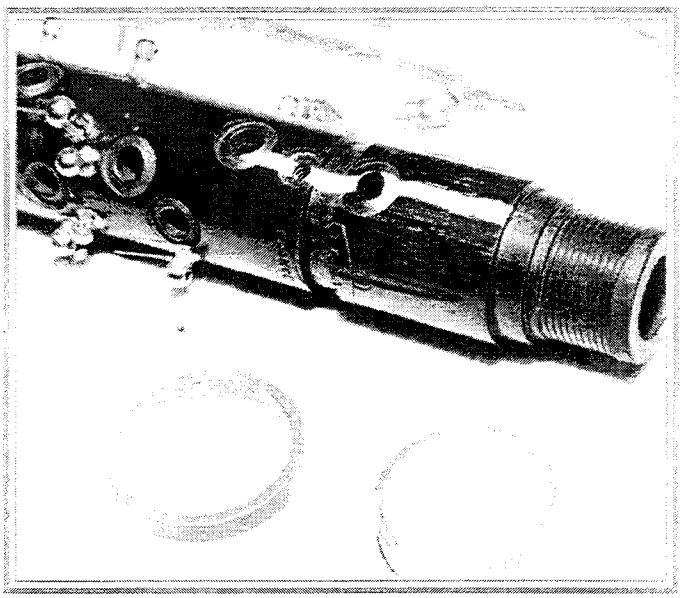
Shrinking the Band

Start by selecting the largest set of closing dies that will shrink the ring. Some companies manufacture the dies so that they have two plateaus or steps per die so that you may just turn the die around in the press to get the next smaller diameter.

The die fits into a sub-press which in turn fits into the larger flush band shrinking press. Take special care to line the steel pilots on the sub-press into the corresponding holes (usually 2) on the closing dies.

In cases where the band has a distinctly larger diameter than the nearest size closing die (esp. on Oboes, English Horns and the larger Clarinets) it may be necessary to cause the band to become oval-shaped by squeezing it in a vise (while positioned on the cracked joint) prior to the initial shrink. By causing the band to become oval-shaped, it will fit better into the closing die. If this step is not performed in such an instance, you are likely to ruin the band as you attempt the initial shrink.

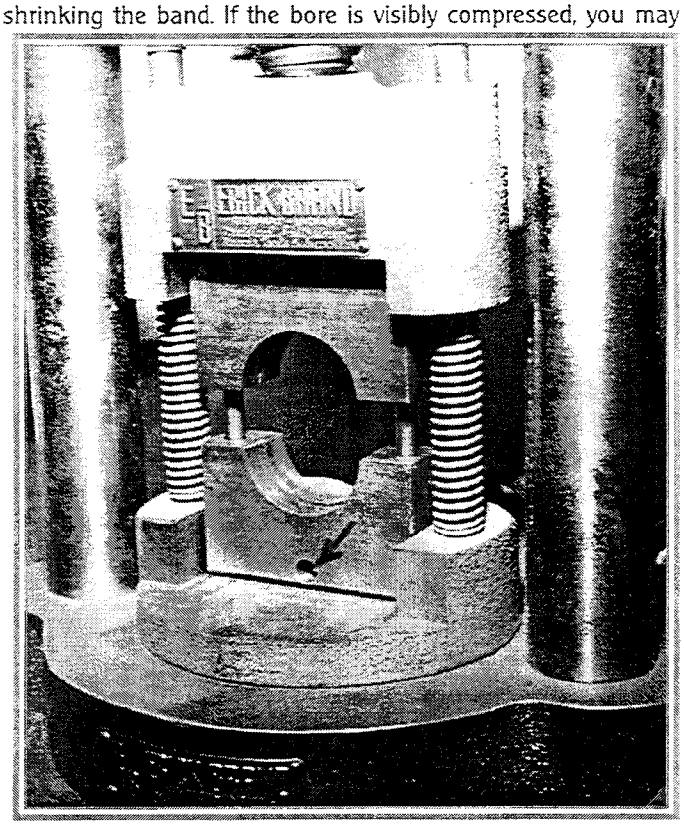
After the band is placed in the closing die, shrink the band by turning the press screw with a firm 1/4 turn. After each 1/4



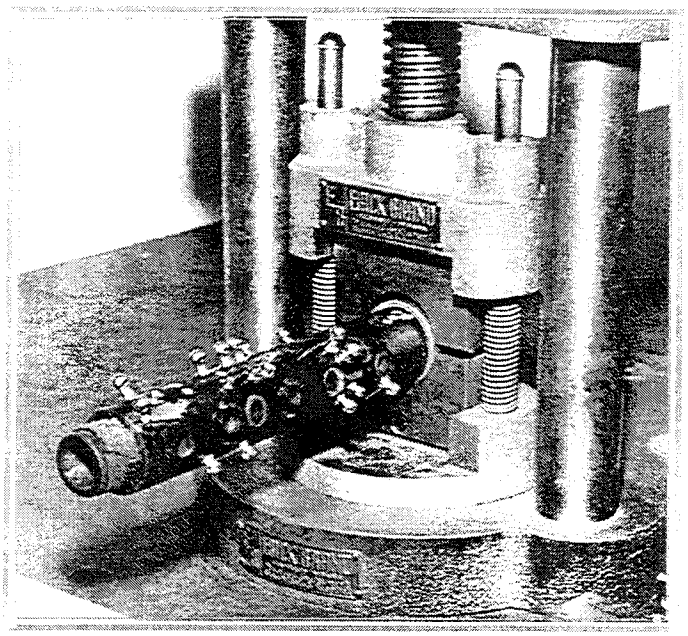
The finished cuts

turn rotate the instrument and band in the closing die so as to avoid getting distortion. Continue this process by gradually reducing the size of the closing -die until the band is pressed firmly into place. An indication of too much compression or distortion is the audible 'cracking' sound of the wood, or chips of grenadilla wood flying past your face.

Avoid compressing the bore of the instrument in the process of shrinking the band. If the bore is visibly compressed, you may



Closing dies in the sub-press (note guide pin)



Instrument in position for shrinking

not only be altering the harmonic qualities of the instrument, but you may be setting up critical stresses within the body joint. If this does happen, finish the bore to its' original dimensions.

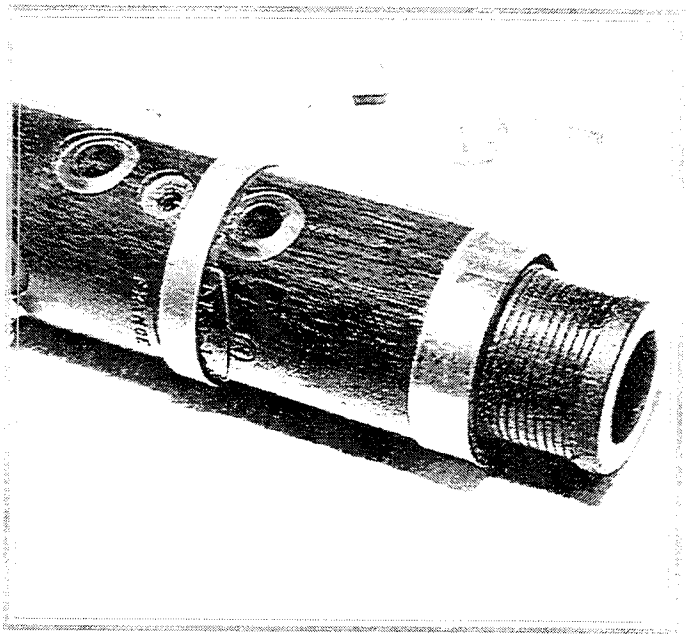
If you are unable to shrink the ring small enough (because the closing die is a shade too large) it is possible to cut small brass or nickel strips and to place them between the band and the closing die as shims. This can work quite well with a little practice.

Finishing the Band

After you are satisfied that the band(s) is properly shrunk on the instrument, center the joint on the lathe and turn the excess metal off with a sharp finishing bit. Allow for a few thousandths that will be removed in the final polishing and buffing stage. If the joint is out-of-round, or you are unable to center it properly on the lathe, remove only as much metal as the situation will permit; finish it by hand filing or polishing the remaining metal until it is nearly flush with the body joint. Caution should be exercised to keep generated heat to a minimum when turning or polishing the excess metal from the band. If you can see the wood resins bubbling at the edge of the band, it is too hot.

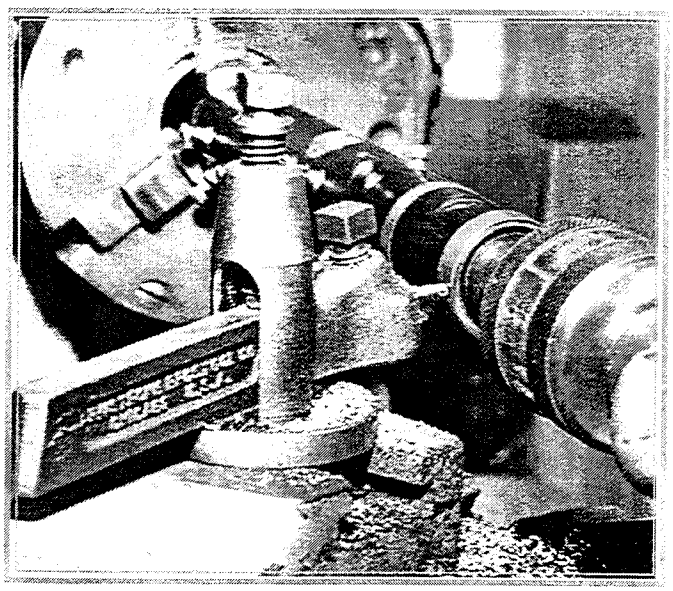
As a final step, buff the bands with Tripoli and white compound until they shine beautifully.

If after finishing the band, you find that it does not quite fill the groove, fill the space with crack filler. If any of the bands have been installed across the phrasing of tone holes, use a pad seat counter bore to reface the tone hole(s). If done properly, the flush band will not only inhibit the instrument from further cracking but some say that it actually makes the instrument look more handsome!

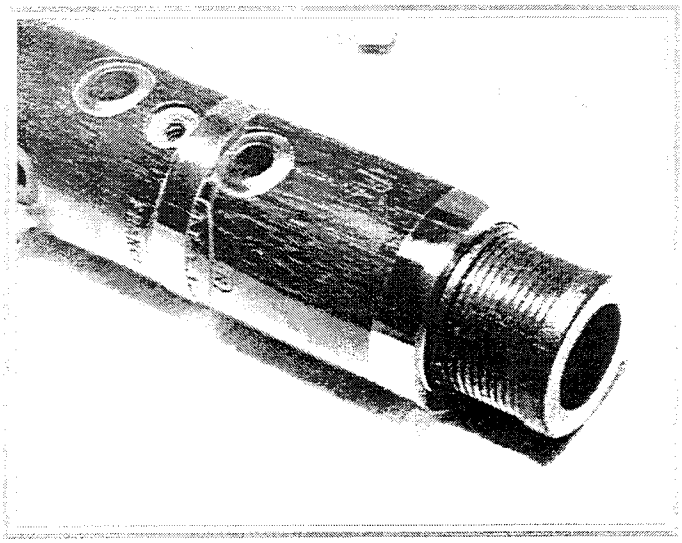


After the bands have been shrunk.(If more than one band is used, space them as evenly as possible)

As a first attempt I strongly suggest that you practice on a junk instrument. Now that you are familiar with the process, don't you think you ought to get a crackin'? Belay that!



Removing excess metal



The completed repair

For you individuals who want something to really get your teeth into, here are the formulas for figuring the anticipated change in width of a flush band after shrinking. This information is necessary for the technician to know exactly how wide (to compensate for width expansion) to make the groove in the body when flushbanding a woodwind.

Let: r_1 be the initial outside radius of the band
r_2 be the initial inside radius of the band
w be the initial width of the band

Let Δr_1 be the amount you decrease the outside radius*.
then Δr_2 (the amount the inside radius decreases)
is given by $\Delta r_2 = \frac{3r_1 + r_2}{r_1 + 3r_2} (\Delta r_1)$
and w (the amount w increases) is given by
$\Delta w = \frac{2}{(r_1 + 3r_2)} (\Delta r_1) (w)$

Here's a numerical example:

Start with Outside Diameter = 33mm then $r_1 = \frac{33}{2} = 16.5$mm
Inside Diameter = 30mm then $r_2 = \frac{30}{2} = 15.0$mm
w = 5mm

Suppose you shrink the Outside Diameter down to 29.4mm (the O.D. of the body at the groove, plus the thickness of the band)

then $\Delta r_1 = \frac{33}{2} - \frac{29.4}{2} = 16.5 - 14.7 = 1.8$mm

the change in r_2 $(\Delta r_2) = \frac{3r_1 + r_2}{r_1 + 3r_2} (\Delta r_1) =$

$\frac{3(16.5) + 15.0}{(16.5) + 3(15.0)} (1.8) = (\frac{64.50}{61.50}) (1.8) = (1.0488) (1.8) = 1.8878$mm

the new inside radius is $r_2 - (\Delta r_2)$ which equals 15.0 - 1.8878 = 13.112mm (the new Inside Diameter = 26.2244mm)

the change in width $(\Delta w) = \frac{2}{(r + 3r)} (\Delta r_1) (w) =$

$\frac{2}{16.5 + 3(15.0)} (1.8) (5) = 0.2927$mm

the new width is w + (Δw) = 5 + 0.2927mm = **5.2927mm**