



Don't lap just yet...



Red Wing

Guide

The perfect valve/casing repair ensures

- ▶ **The valves go up and down smoothly and lightly**
 - ▶ No matter how off-centered it is pushed down
- ▶ **Tolerances are maintained**
- ▶ **Bearing surfaces are either maintained or improved upon**

Our Rules

- ▶ **Maintain tolerances**
 - ▶ Don't make casings bigger or pistons smaller
- ▶ **Maintain good bearing surfaces**
- ▶ **Improve bad bearing surfaces if possible**

We hate to lap

- Tolerance compromise
- Clean-up



Lapping is too often used to compensate...

- For scaled/stained casings and pistons
- For incomplete casing dent removal
- For bent or untrue pistons
- For casings warped by
 - misaligned slides
 - bent bells/chassis stressing knuckles

Lapping often not necessary

- **Focus on fundamentals**
 - **Clean, stain-free parts**
 - **Round/true casings**
 - No dents, bends, stresses
 - **Round/true pistons**
 - **Good bearing surfaces**

This Clinic

1. Applications for lapping

2. Steps to take before lapping

- Ensuring repairs are as complete as possible
- Burnishing techniques to manage marginal surfaces

Piston/Casing Tolerances

Professional

- ▶ 0.0006" – 0.001"

Student

- ▶ 0.001" - .0015"

Shot - Needs Valve Job

- ▶ 0.0015" and up

Shot – Needs Valve Job, but Customer Chooses Not

- ▶ 0.0015" and up



Applications for lapping



Rule:

➔ **Know what is wrong**

Bad Valve Action

- Slow valves
- Occasionally sticky valves

Bad Valve Action

Observe your surfaces first

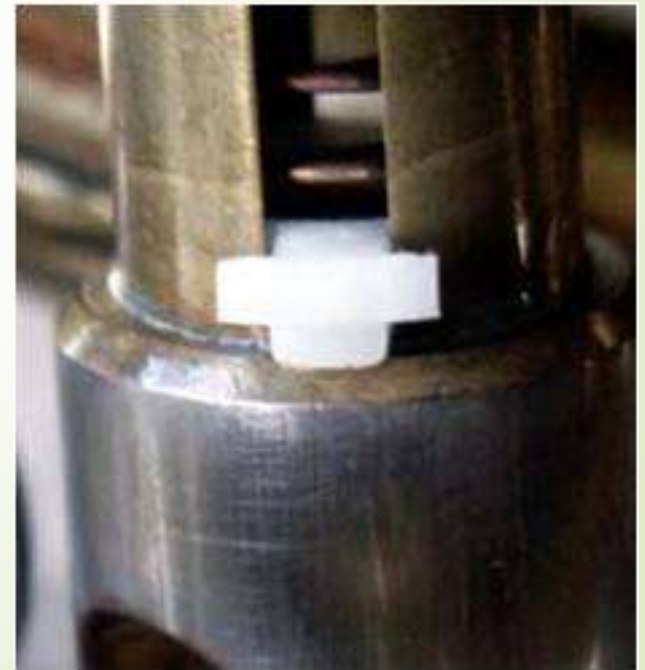
➔ good piston surfaces



Cross grain = surface scuffs

Usually not a problem

- **Cross grain** = surface scratches or scuffs
- Can burnish piston if needed



Bad Valve Action

➤ Bad piston surfaces



Cross hatch, stains, and missing plating

Cross-hatch = surface gouges

Cross-hatched pistons

1. Resurface with Ferree's sleeve + lapping compound
2. Resurface piston with lapping block + lapping compound
3. Burnish piston/casing together



Lapping Compounds

- **Garnet is our choice**
 - Ferree's L58 ultra-smooth (1000 grit)
 - Hetman 1200 grit (Allied)
- **BUT 1000 + garnet compounds no longer available**
 - Stay tuned...

Cross-hatch = surface gouges

➤ Cross-hatched pistons

- Resurface with Ferree's sleeve + lapping compound or
- Resurface piston with lapping block + lapping compound
- Burnish piston/casing together



Cross-hatched casing?

- Casing inspection
 - Bad casing wall surfaces



What to do. . .

- **First: Burnish casing/piston together**
 - Hard piston will burnish soft casing wall
- **Resurface casing with ground casing mandrel or Allied/Votaw barrel laps + lapping compound**
 - Laps sized to casings seem to work best here
 - **BUT** be mindful of tolerances.



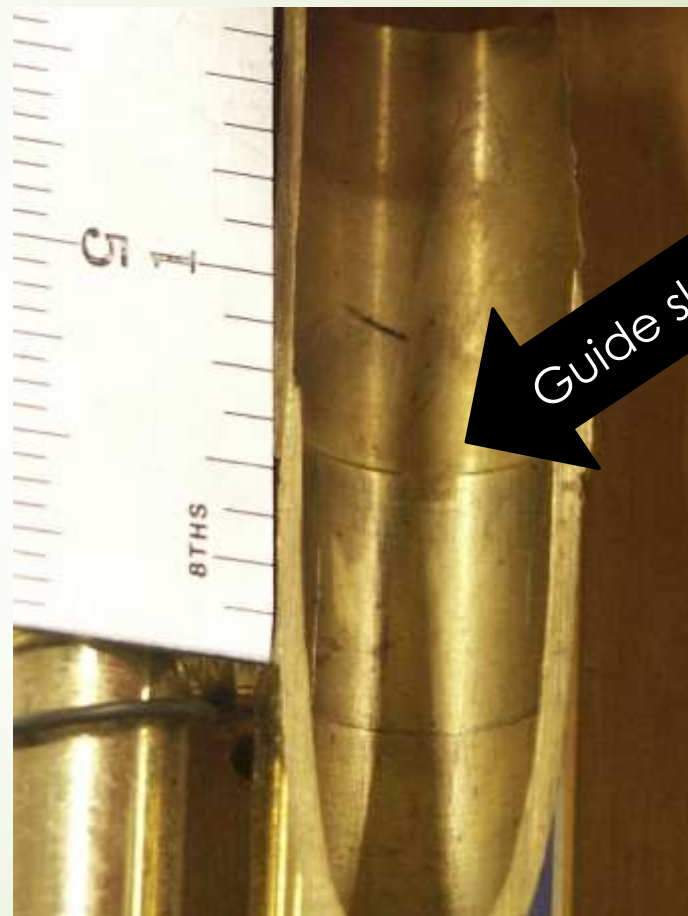
Valve sticks off-center

- Common with top-sprung casing walls that start at the valve guide or just below the valve guide



Valve sticks off-center

- ▶ **Not** common with this kind of casing
 - ▶ Likely an issue with the casing/piston surfaces
 - ▶ Address as discussed earlier



Solution 1 – Burnish First!

- Piston/Casing together
 - With oil
- Pressing firmly into the sticking
- Clean-up!



Solution 2 – Increase top space

➤ From Schilke

- Lap just the top $\frac{3}{4}$ " (preferred)
- Or burnish just the top $\frac{3}{4}$ " with a brass lap
 - Size laps recommended



Our goal is to make the top $\frac{3}{4}$ " of the valve casing bearing diameter about .0005" larger

Solution 3 – Slightly Bend Piston

➤ From Wayne Tanabe

- Pull piston up out of casing
- Tap lightly into sticking
- Tap other way if too far

Stained Monel[®] or Nickel silver

1. Remove stain chemically
2. Mechanically treat surface
3. Oil often
 - *Kerosene-based oils seem to work well*
 - *Synthetics too*



Missing nickel-plating

25

- **Spot buff bad areas**
 - To dish exposed base metal
 - and feather edges
- **Return to casing**



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Fixing Casings and Pistons

- ➔ If repairs are thorough...no lapping necessary

Instrument inspection



- Bent stem?
- Bent bell/slide/branch?
- Bent/twisted body/parts?
- Something stuck in the port?
 - Pencil, paperclip, toothpick, other
- Plier damage?
- Obvious dents
- Is the problem the piston or casing?
 - Swap pistons around to find out

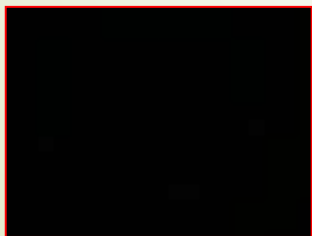
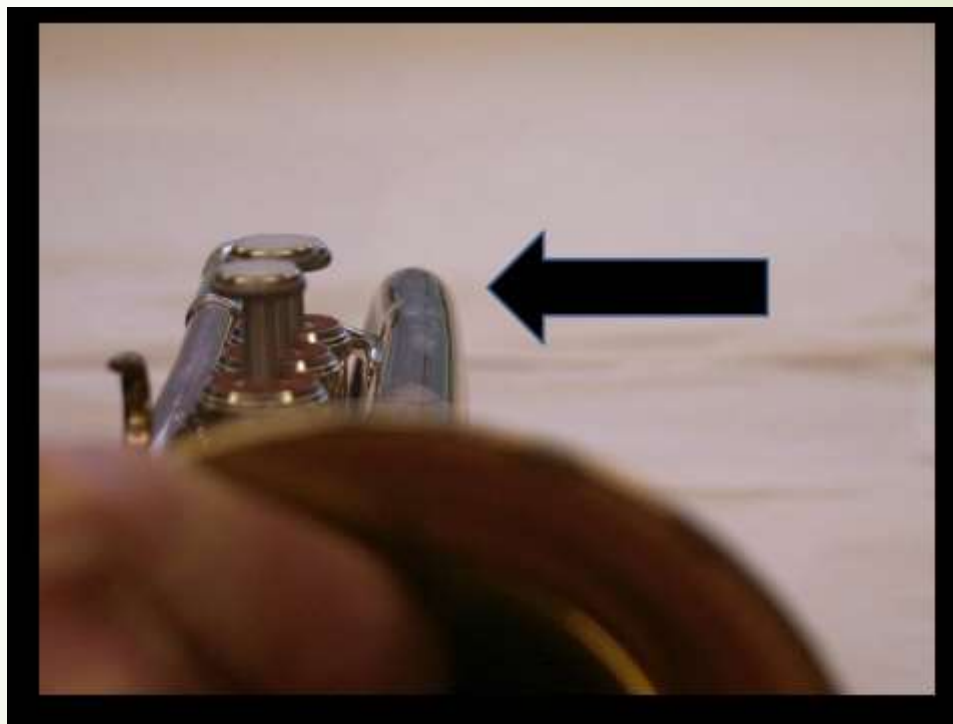


Before grabbing any tool

- **Remove obstructions**
- **If the piston is really stuck, wait**
 - Before removing the piston
 - Straighten and align stuff first
 - Bell/body/slides

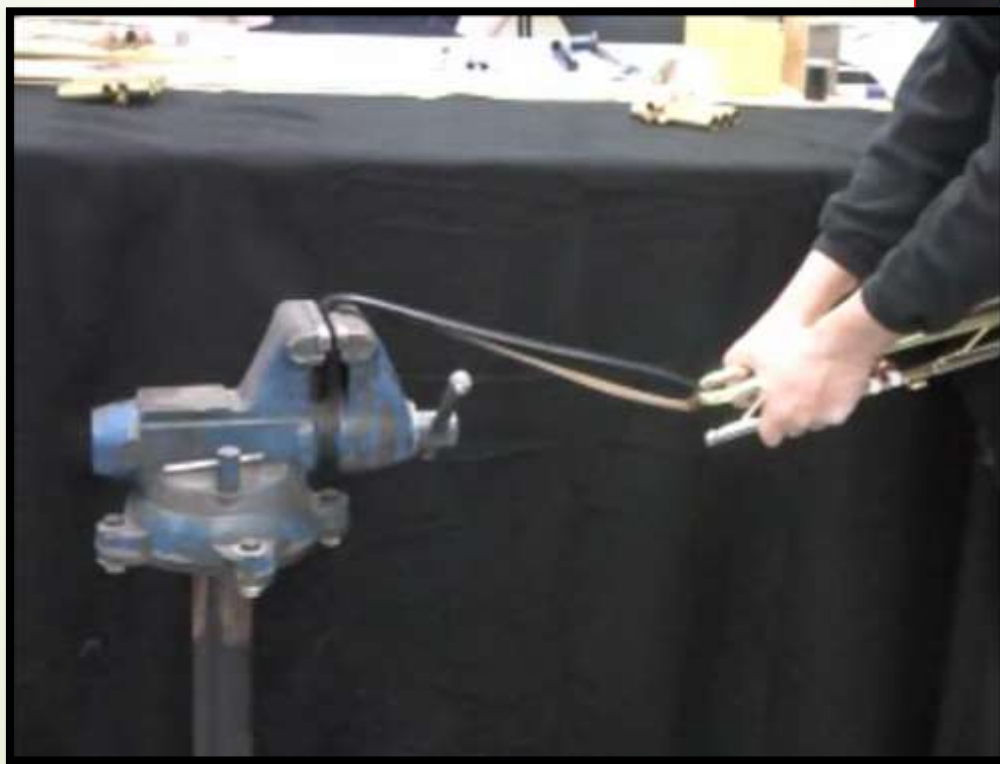
First: Straighten & align stuff

- ▶ **Bell bow/tail**
 - ▶ Traditional
 - ▶ *Loose vise*



First: Straighten & align stuff

- ▶ Bell bow/tail
 - ▶ “The Frushour snap”



First: Straighten & align stuff

- ▶ **Bell bow/tail**
 - ▶ **Trick:** heat ferrules and tubes



First: Straighten & align stuff

► Slides

- Total slide resistance should be sum of each individual tube's resistance



First: Straighten & align stuff

► Slides

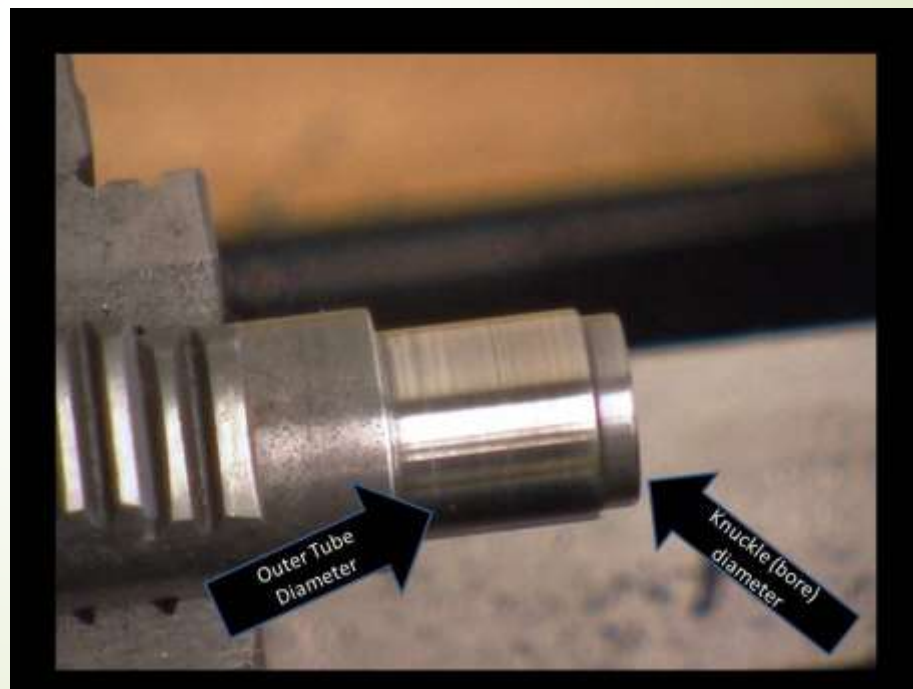
- #2 slide on trumpets/cornet
- Traditional method



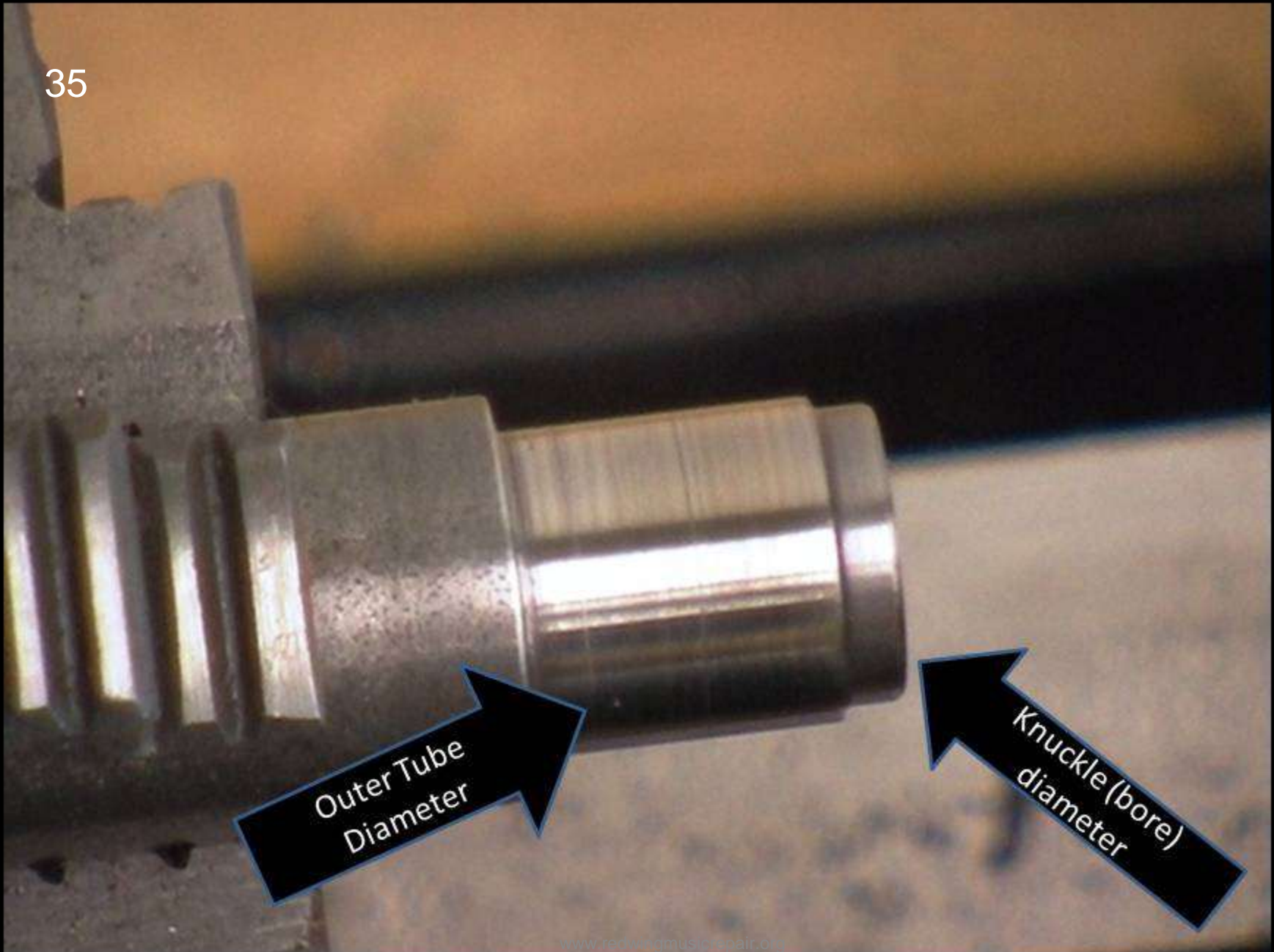
First: Straighten & align stuff

► Slides

- #2 slide on trumpets/cornet
- If the knuckle is collapsed



35

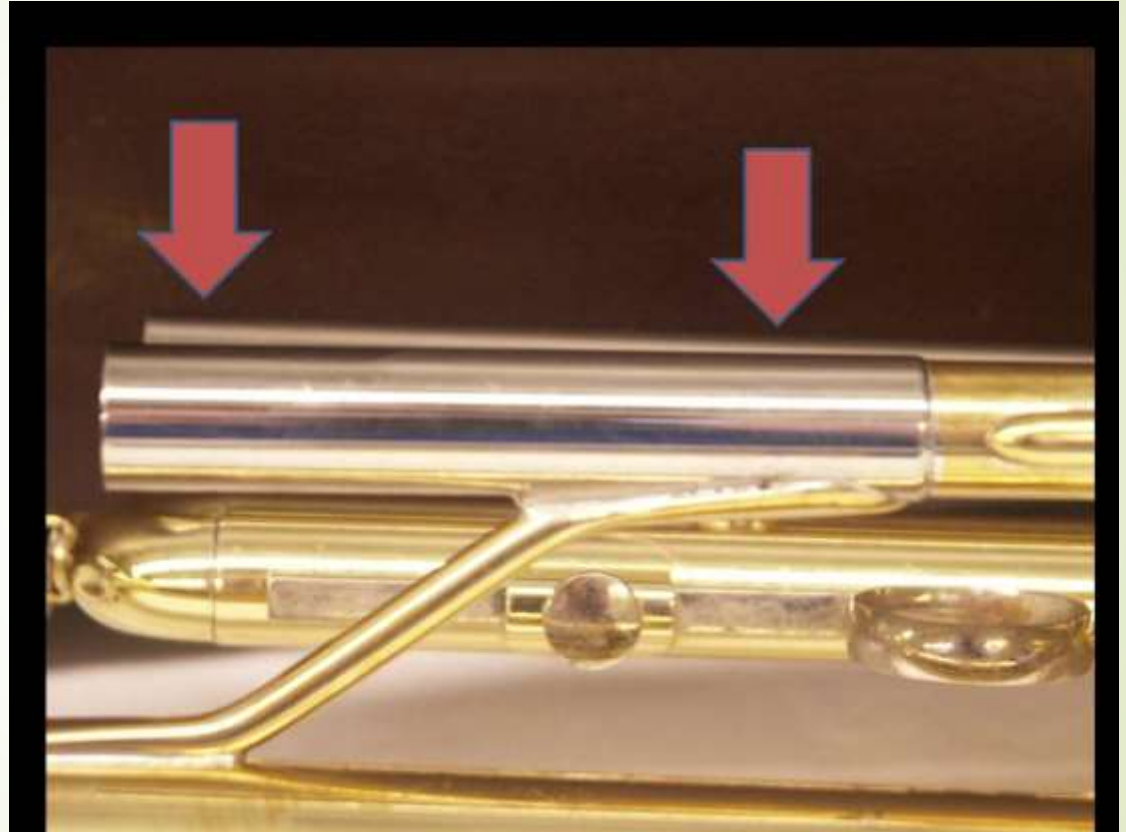


Outer Tube
Diameter

Knuckle (bore)
diameter

First: Straighten & align stuff

➔ Body



Now, get the pistons out!

- Chuck stem in bench motor
- Piston drivers
 - Allied
 - Make your own
 - BUT match piston outer diameter!
 - Mouthpiece puller
 - Wayne Tanabe/Kevin Blodgett
 - Do **not** use another piston



Removing casing dents

Rules:

- **Work with a clean instrument**
 - Part of the estimate
- **Casing is dent and obstruction free**

Typical order for us

1. Ferree's ground casing mandrel

Then if necessary:

2. Sharpened solder scraper or Badger State slotted mandrel

3. Votaw/Allied casing laps

- Used as a burnisher

The ground casing mandrel



The ground casing mandrel

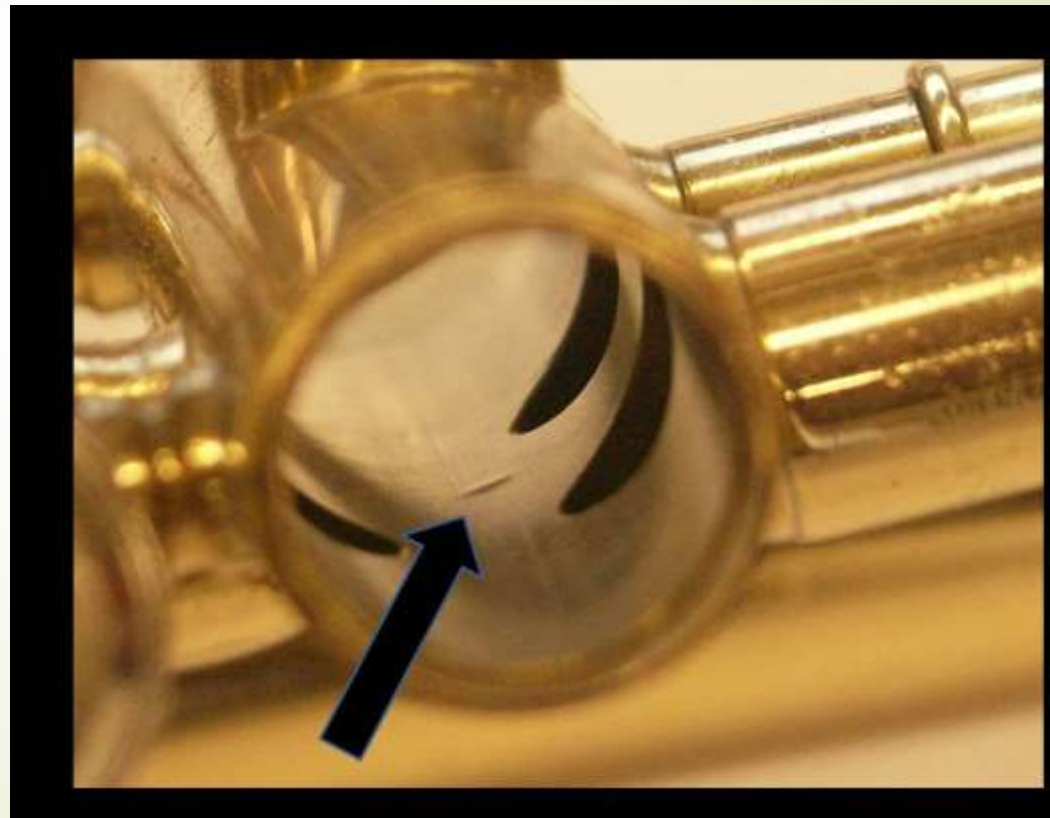
BRASSWIND TOOLS								
BRAND	COIL/ TRPL.	ALUMIN MELLO.	VALVE TROMB.	RARI	EUPH.	Fb BASS	BBb BASS	JUMBO BASS
Fan Am, Cont, Conn	.682	.714	.714	.828			.888	1.048
16A	.665							1.223
201 Short Action Japanese	.664				.808			
Bach, Mercedes I	.664	.741		.800 march				
Bergo	.658							
Besson—1st line	.685			.776	.923	1.385	1.360	1.365
Student line	.684	.684		.775	.804	.929	.978	
Student line 609 USA	.664							
4 Valve Baritone				.976				
Blesing	.645	.724	.842				.920	
Bosny & Hawkes, Regent	.645				.864		.978	
Bundy	.650		.665		.772		1.062	
Buescher-new	.650				.840		.978 tuba	
-old	.682						1.062	
Coursons	.668							
Czechoslovakia	.674							
Deq, Dynasty II, 2 Valve					.836			
East German	.686						.916 tuba	
Getzen	.650		.650	.791			.924	
Holton-new, made in USA incl Colleg 1602	.680							
Old Holton	.650	.668		.802		.832	.832	1.141
Old Collegiate	.668			.791				
New Colleg-Yamaha 1602H	.664							
Huff	.672							
Imperial Creations, Pochat	.644							
Jupiter	.649	.728	.728	.807	.906		1.003	
King Marching Baritone	.660	.660	.737	.815			.976	
Cleveland	.661			.738				.936
Lablanc	.660	.660						
Martin, Indiana	.660	.715	.812	.812			1.015	
Meini Weston							.916 tuba	
Mercedes II, Sigmet	.650		.665	.772			1.062	
Musica Austria	.673							
Ohls	.665	.665	.738	.839			.976	
Orsi	.645							
Reynolds by Ohls	.664	.664	.738	.839			.975	
Reynolds by Reynolds	.660			.832			.976	
Roth, Sears, RMC, Reynolds by Blessing, Wards	.645			.837				
Schenkelmars	.657			.893			.893 tuba	
Schilke	.645							
Selmer, French	.661							
Shanghai	.660							
Windor	.651							
Yamaha YB 102	.664	.680		.925		.947	1.039	.947 tuba
York	.631							

The whole shebang



The ground casing mandrel

- Step one: rough out the dent



The ground casing mandrel

- **Step two: visual inspection**
 - Go to plastic mallet combination if necessary



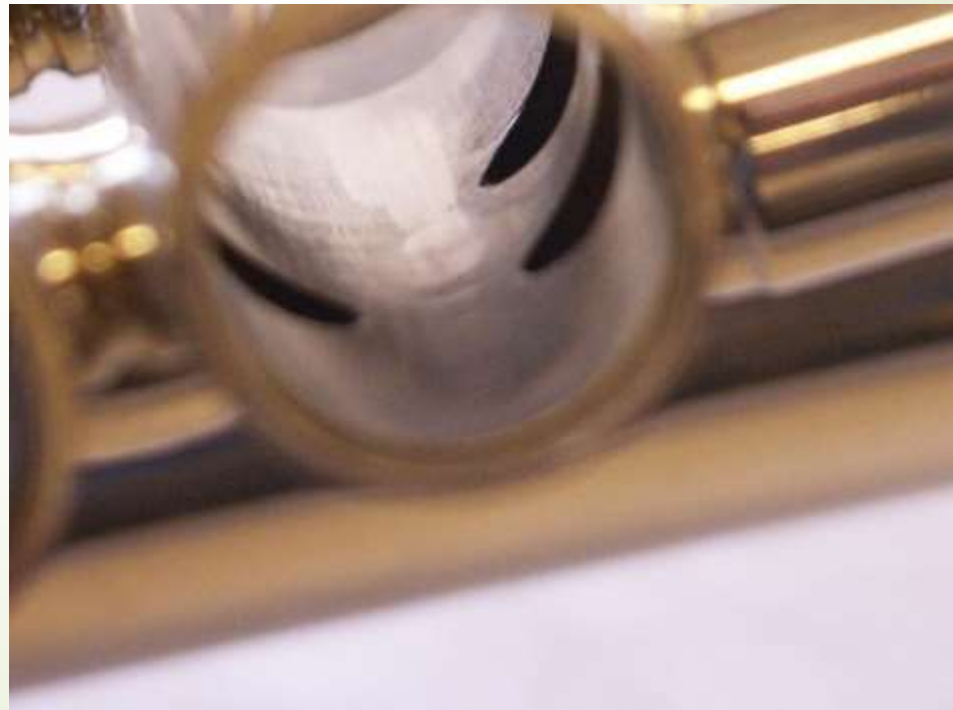
The ground casing mandrel

- **Step three: Visual inspection again**
 - If necessary: light steel hammer tap



The ground casing mandrel

- **Step four: visual inspection again**



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The ground casing mandrel

- Step five: inspect with the piston



The ground casing mandrel

- **This method...**
 - Removes dents more thoroughly
 - Less chance of warping casing
 - Less chance of driving knuckles/braces into adjoining casings

Usually we're done. . .but not always

49

- ⦿ Sometimes there's a little bit left
 - **Option 2: Shave what's left**
 - Slotted rod (Badger State)



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Usually we're done. . .but not always

50

◎ Sometimes there's a little bit left

- **Option 3: Spot burnish the area**
 - Allied or Votaw burnishers
 - Barrel laps
 - Sized laps work best



Knuckles and spanner braces

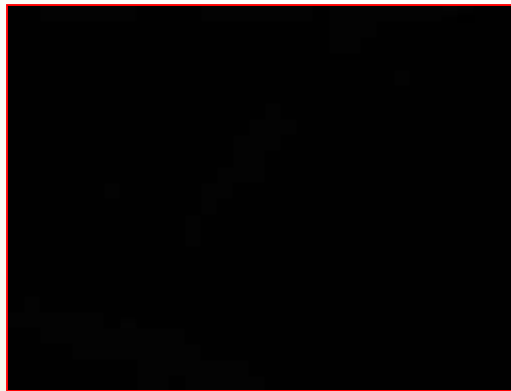
- ▶ **Can be pushed into casing wall**
 - ▶ Through bell/slide/body mis-alignment
 - ▶ Through extreme stress
 - ▶ Instruments dropped, stepped or sat upon



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Knuckles and spanner braces

- ▶ **Ground casing mandrel**
 - ▶ Edge tapping



Pistons: Three typical problems

- Bent
- Out-of-round
- Displaced from dents or other damage

- Pistons can bend when casings are dented
- *Pistons can bend/dent/warp when removed from damaged casings*

Always inspect pistons with casing repairs

Rule

- **Pistons must be straight and true**
 - Inspected as part of casing repair
 - Estimate accommodates repair

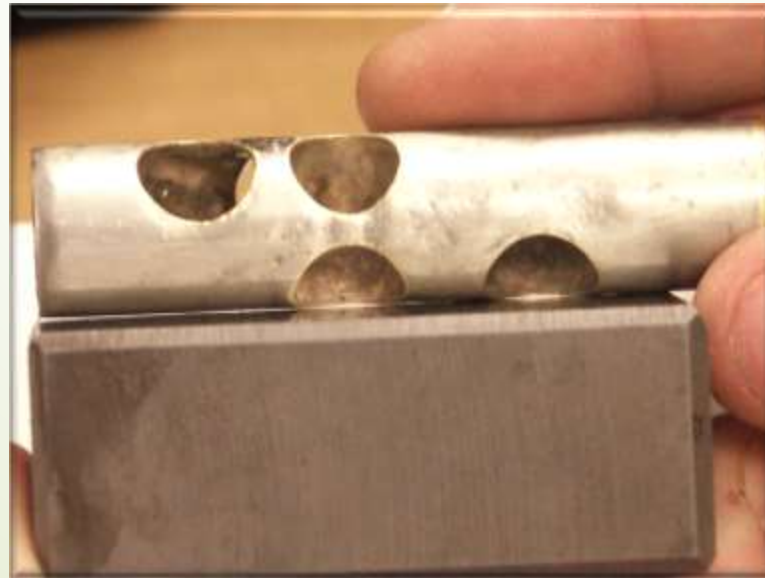
Now. . .pistons

- ▶ **Tip: Site on a back-lit bench block**
- ▶ What a **bent** piston looks like
 - ▶ Cavity and teeter 180° apart



Now. . .pistons

- ▶ What an **out-of-round** piston looks like
 - ▶ Have either cavity or teeter - but not 180° apart



Now. . .pistons

- ▶ What a **dented/displaced** piston looks like
 - ▶ Parts of it are too big from dents like this:



So, if the piston is bent

- Traditional straightening works fastest and best
- **Our rule:** *Before checking the piston in the casing, it is as straight as possible (inspected on a flat surface)*

We use the edge of the bottom casing bearing wall to straighten the pistons.

If the piston is out-of-round

► Ferree's casing sleeves

- Takes piston only so far
- Do **not** super-heat then quench
 - Pistons can shrink/sleeve can warp



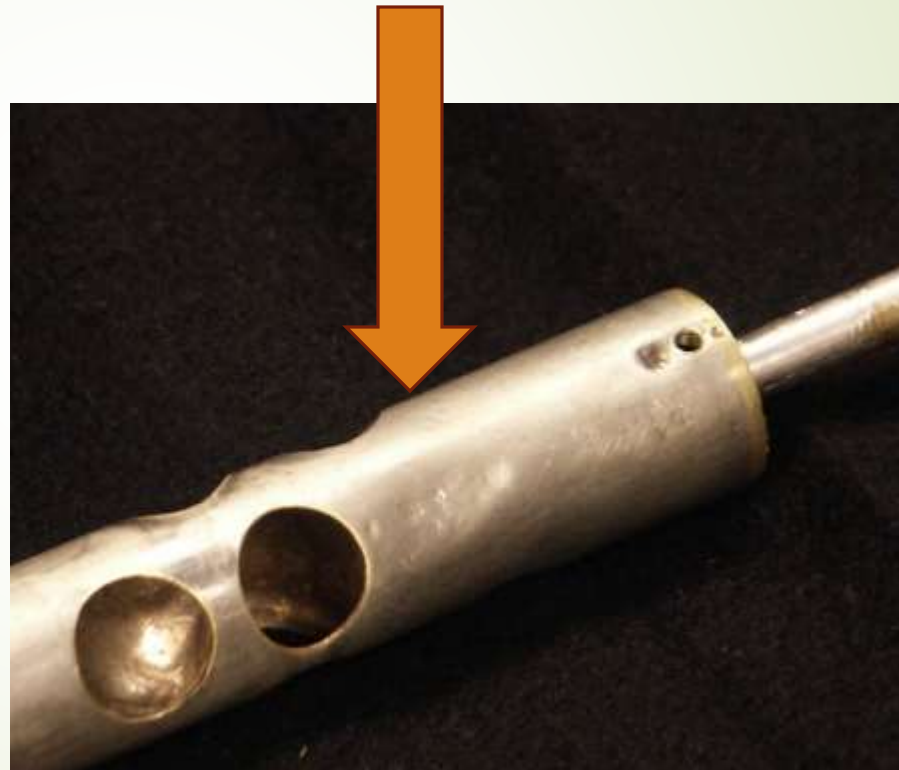
If the piston is out-of-round

- ▶ Ferree's casing sleeves
 - ▶ Split works better
 - ▶ If it warps, cut it in half



If parts are dented/displaced

61



When a valve job?

▶ Playing evidence:

- ▶ Poor response (low and high end)
- ▶ Sagging pitches (during crescendos)
- ▶ Problems lessen with heavy oil

▶ Our evidence:

- ▶ Slop/pressure
- ▶ Tolerances exceed 0.0015" or 0.002"

Evidence
of loose
valves.

Thank You!



► Questions?

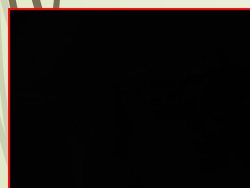
► Call us: 877-853-8324

► Email us:

bandinstrumentrepair2@southeastmn.edu



Parking Lot



Last resort

- **Burnish the piston round using the lathe**
 - A bit dangerous to the piston
 - Yet fun to try



Placeholder for now




General Tools & Instruments 93 Adjustable Pin Vise
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