



# Metalworking Tools & Techniques in the Woodworking Shop

**Presented By Jim Baldock**  
**November 12, 2005 Meeting**

Thank you all for letting me do this - I have had great fun.

First - I would like to thank Darrell McAnulty for his encouragement and help.

## ••• WARNING••• (The Weasel Clauses)

- I Am **not** An Expert!
- You **may** Disagree - tell me so!
- Ask Questions At Any Time
- Your Mileage May Vary!

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# PURPOSE

THE PURPOSE OF THIS TALK  
IS TO ACQUAINT YOU WITH  
THESE TOOLS AND HAVE YOU  
CONSIDER THEIR USE

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# Thanks for the HELP

We would like to thank the following  
Companies & Websites for Ideas and  
Pictures. Some may be Copyrighted  
and used without permission.

- L. S. Starrett.....<http://starrett.com/>
- Brown & Sharp.....<http://brownandsharp.com/>
- Lee Valley Tools.....<http://leevalley.com/>
- Rockler.....<http://rockler.com/>
- Woodcraft.....<http://woodcraft.com/>

# Thank You

- J&L Industrial Supply.....<http://jlindustrial.com/>
- MSC Industrial Supply.....<http://mscdirect.com/>
- Enco.....<http://use-enco.com/>
- Fastenal.....<http://fastenal.com/>
- Harbor Freight.....<http://harborfreight.com/>
- Simonds.....<http://simondsinternational.com/>
- James Town.....<http://jamestowndistributors.com/>
- Davistown Museum.....<http://davistownmuseum.org/>
- Rose Antique Tools.....<http://rosrantiquetools.com/>
- Fine Woodworking.....<http://taunton.com/>

# **The 15 Most USEFUL Metalworking Tools Used in Woodworking**

- 1. Combination Square**
- 2. Machinery's Handbook**
- 3. Hook Scale**

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The 15 most useful Metalworking Tools Used in Woodworking.

This is my list. If you all made the list it could be much different. And Now the List. It is somewhat in the order of importance to ME.

# **The 15 Most USEFUL Metalworking Tools Used in Woodworking**

**4. Feeler Gages**

**5. Combination Stone**

**6. Drill Set, Drill Doctor &  
Drill Chart**

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The 15 most useful Metalworking Tools Used in Woodworking.

- > 4. Feeler Gages -- Used in Measurement, Accurate set up and Machine Repair.
- > 5. Combination Stone -- Maintaining Machine Tables, Removing Rust & Sharpening.
- > 6. Drill Set & Drill Doctor
  - Fractional, Letter, Number & mm
  - Keep 'em Sharp
  - Tell 'em Apart

# **The 15 Most USEFUL Metalworking Tools Used in Woodworking**

**7. Machinist Vice**

**8. Machinist Calipers**

**9. Machinist Scraper Set**

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The 15 most useful Metalworking Tools Used in Woodworking.

- > 7. Machinist's Vice -- For Holding What's Hard to Hold.
- > 8. Machinist's Calipers -- For transferring measurements from one item to another.
- > 9. Machinist Scraper Set -- FILE HARD Scrape Metal Plastic & Wood



# **The 15 Most USEFUL Metalworking Tools Used in Woodworking**

**10. Metal Files**

**11. Dial / Digital Calipers**

**12. Dial Indicator & Stand**

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The 15 most useful Metalworking Tools Used in Woodworking.

- > 10. Metal Files -- What are Files? What are Rasps? What's the Difference?
- > 11. Dial / Digital Calipers -- Mechanical and Electronic
- > 12. Dial Indicator and Stand -- Plunger and Flicker; Mechanical and Electronic

# **The 15 Most USEFUL Metalworking Tools Used in Woodworking**

**13. Surface Plate**

**14. 1•2•3 Blocks & Shims**

**15. Scotch - Brite™**

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The 15 most useful Metalworking Tools Used in Woodworking.

- > 13. Surface Plate -- Cast Iron or Granite or maybe Glass
- > 14. 1•2•3 Blocks & Shims -- Brass (Router Workshop) or Square Keys or Metal Lathe  
Tools (tool steel)
- > 15. Scotch - Brite™ -- Metal, Plastic but be careful with staining on Wood; Clean the tools

## METALWORKING ALTERNATES (Nice to Have)

- Metal Lathe
- Milling Machine / Mill Drill
- Sand Blaster
- Welder (Gas, Mig, & Tig)
- Mechanic's Wrenches & Tools

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METALWORKING

And here is some wishful thinking.



## SQUARES

Some Quick Notes About SQUARES. Most shops have several squares. A Quick Look at some SQUARES and naming the common SQUARES we use. Some seem to be known by many names! / this is what I call these /

- Framing Square  
AKA steel square ?? I have an aluminum one  
framing should be 16" x 24" many other sizes out there  
1-1/2 leg = size of 2 x 4
- Speed Square a relative new type square AKA Carpenters Square
- Engineering Square AKA Machinist Square
- Tri Square  
Anyone know these by any other name?

# MORE SQUARES



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## > MORE SQUARES

- Drywall Square
- Sold as just SQUARE
- Double Square
- The newest the M3 Square

M3 \$38.50 @ Lee Valley // 39.99@Harbor Freight • GO FIGURE •

A few words about Harbor Freight - don't give up on them ...

sometimes they have good buy on named brand stuff. Some of it is TRUE JUNK and some of it can be fixed-

## The Combination Square



The most universally used measuring  
and squaring tool in any shop!  
At • **LEAST** • 20 Tools in One

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### THE COMBINATION SQUARE

Most shops have several squares. A good Combination Square is the one that is designated the MASTER SQUARE.

That is the one that is kept best protected and used to check the rest.

In our discussion of Combination Squares most of the pictures used are from the Starrett online catalog.

Starrett is widely known as the Cadillac of measurement and hand tools.

Laroy S. Starrett is credited as being the inventor of the COMBINATION SQUARE.

- > The most universally used measuring and squaring tool in any shop.  
AT LEAST 20 TOOLS IN ONE....

In winter of 1862, farmer, Laroy S. Starrett tinkered with building a food slicer in his barn. To help in the development of the 'The Hasher', Starrett hired a 'Pattern Maker'. During this time he became interested in the tool needs of 'Pattern Makers And Mechanics'. Starrett soon allied himself with the Athol Machine Company to produce the VEGIMATIC of its day.

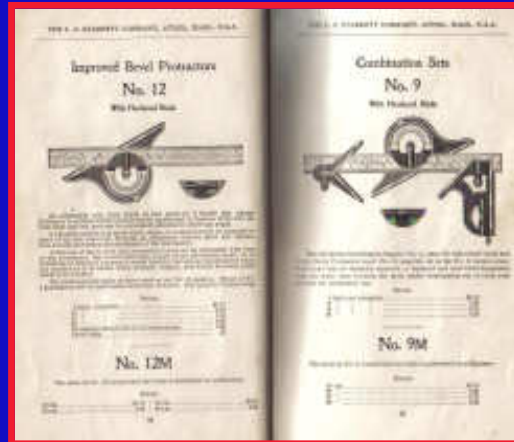
When the 'Hashers' production became under control, Starrett began to think of producing tools and other products.



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A Little History

By 1880 Starrett had his own thriving tool business with the 'Combination Square' as his major item. There have been very few changes to the 'COMBINATION SQUARE' to date.



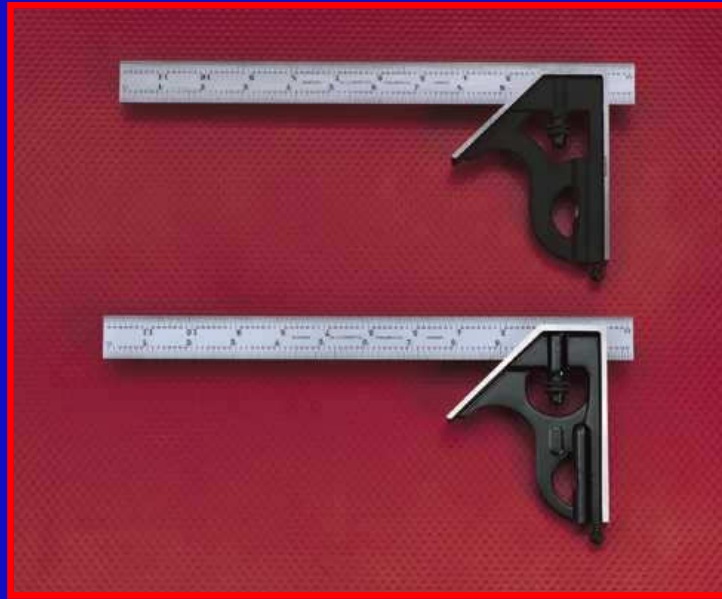
Catalog #17 Around 1900

16

In the early heyday of the combination square it is interesting to note that both Stanley and Brown & Sharp made parts for STARRETT Square.



## The Combination Square



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### The Combination Square

The L. S. Starrett Company is the CADALLAC of Combination Square Manufactures. Starrett offers many sizes and styles with differences in materials. Purveyors of Combination Squares use this to confuse things especially in their catalog sales. YOU the purchaser Should be acquainted with these manufacturing differences in order to compare prices.

#### REMEMBER!!

- Squares may look alike but may not be the same Value or Price •

Note: the two types of paint Japan and Crinkle.

also the subtle shape differences The top is Forged Steel & Hardened

The Bottom is Cast Iron

Articles in "Fine Woodworking", "Popular Science" and and other magazines have failed to properly describe these subtle differences so that proper comparisons may be made.

# The Combination Square Set

- Blade
- Squaring Head
- Centering Head
- Protractor Head



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## The Combination Square Set

The purchase of a Combination Square Set is a much more complicated subject than the ad in the sale catalogs would have us believe!

Note again, the Crinkle and Japan finishes.

Also note :: Cast Iron on the TOP, the BOTTOM is Forged Steel.

To be known as a COMBINATION SQUARE SET it must have the

- > • Blade
- > • Squaring Head
- > • Centering Head
- > • Protractor Head

Combination Squares with square head and center head

All may be purchased separately

# BLADES

## BLADES

(STARRETT)

BLADE LENGTH	THICK	WIDE	GRADUATIONS				FINISH		
			4R	16R	in/mm	mm	STEEL	SATIN CHROME	STAINLESS
4"	1/16	5/8	*	*			*	*	
6"	5/64	3/4	*	*			*	*	
12"	3/32	1	*	*			*	*	*
18"	3/32	1	*	*			*	*	
24"	3/32	1	*	*			*	*	*
24"	.100	1-1/4	*	*			*	*	
36"	3/32	1	*	*			*	*	
48"	3/32	1	*	*			*	*	
150mm (5-3/4")	2mm	19mm			*	*	*	*	
300mm (11-3/4")	2.4mm	25mm			*	*	*	*	
600mm (23-1/2")	2.4mm	25mm			*	*	*	*	

- 4R is scales in 1/8s, 1/16s, & 1/64s 1/32s
- 16R is scales in 1/32s, 1/64s, & 1/50s & 1/100s
- in/mm is scales in .5mms, 1/32s & 1mms, 1/64s
- mm is scales in .5mms & 1mms both sides

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## BLADES

- 4R Means scales in 1/8s, 1/16s, & 1/64s 1/32s
- 16R Means scales in 1/32s, 1/64s, & 1/50s & 1/100s \*\* 16R is also known as Aircraft scales.
- in/mm is scales in .5mms, 1/32s & 1mms, 1/64s
- mm is scales in .5mms & 1mms both sides

These are from The Starrett Catalog. Other Brand's product lines may differ.

Interchangeability depends upon the WIDTH & THICKNESS & MANUFACTURER.

The inch, the inch / mm and the mm blades are interchangeable.

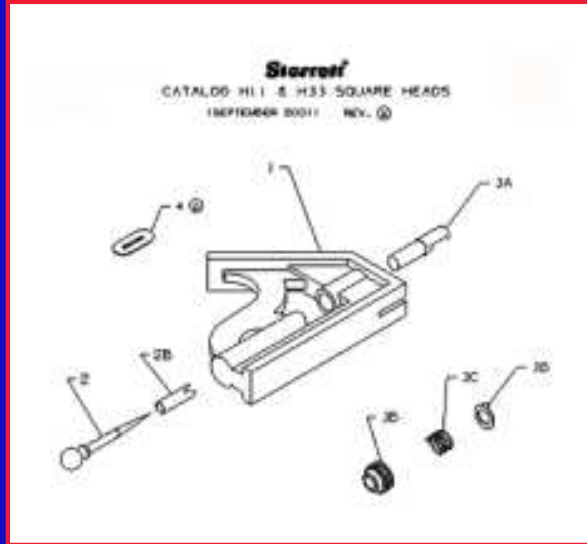
Blade markings may be Stamped, Etched or Engraved - All Starretts are Engraved  
Stamped are usually wider, less accurate and not filled for easier reading.

# SQUARING HEAD

- Blade Size
  - 5/8"
  - 3/4" / 19mm
  - 1" / 25mm
  - 1-1/4"

- Crinkle Black
- Japan Black

- Cast Iron
- Harden Steel



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> SQUARING HEAD

> EXPLODED VIEW

> • Blade Size

> 5/8"

> 3/4" / 19mm

> 1" / 25mm

> 1-1/4"

> • Crinkle Black

> • Japan Black

> • Cast Iron

> • Harden Steel

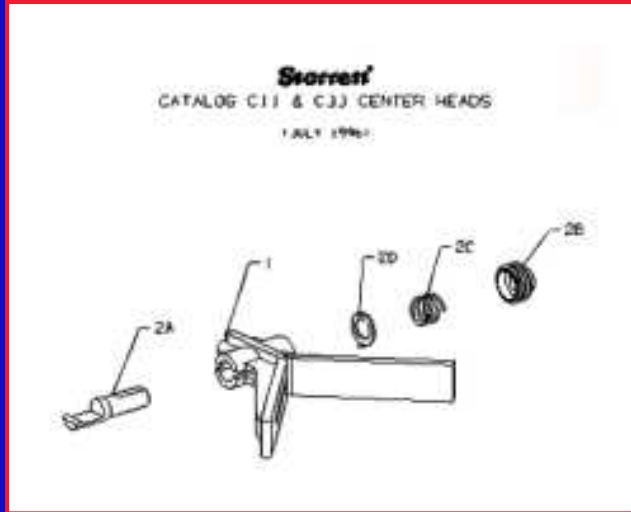
The 5/8 and 1-1/4 blade & head does not come as a combination set.

# CENTERING HEAD

- Blade Size  
5/8"  
3/4" / 19mm  
1" / 25mm

- Crinkle  
Black
- Japan Black

- Cast Iron
- Harden Steel



21

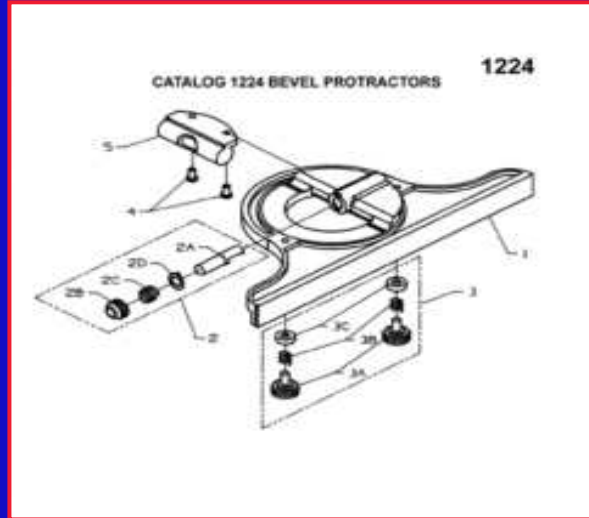
## CENTERING HEAD EXPLODED VIEW

- > • Blade Size  
5/8"  
3/4" / 19mm  
1" / 25mm  
1-1/4"
- > • Crinkle Black  
• Japan Black
- > • Cast Iron  
• Harden Steel

The 5/8 and 1-1/4 blade & head does not come as a combination set.

# PROTRACTOR HEAD

- 1' or 25mm
- Crinkle Black
- Japan Black
- Level
- Cast Iron
- Harden Steel
- Reversible
- Nonreversible



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## PROTRACTOR HEAD

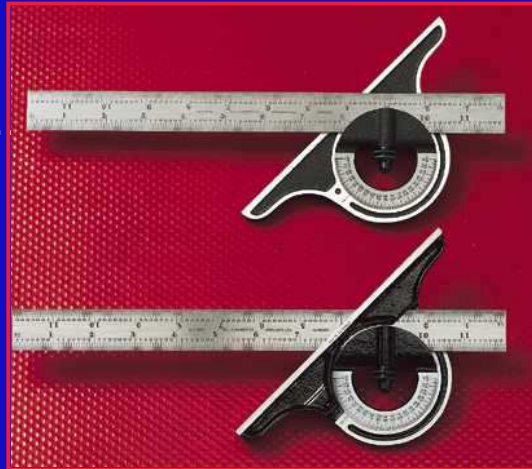
- > 1" or 25mm
- > • Crinkle Black
- > • Japan Black
- > • Level - Some Non Starretts Do Not have a level
- > • Cast Iron
- > • Harden Steel
- > • Nonreversible
- > • Reversible

This is discussed on the next slide.

# PROTRACTOR TYPE

- Non-Reversible...

- Reversible.....



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Note the different finishes crinkle and Japan.

Reversible means that an angle can be made from the same edge to the right and to the left. The blade goes through the center of the head allowing for a locating edge on each side of the blade.

- > • Non-Reversible
- > • Reversible

# STANDARD OPERATIONS

## Blade

- Measure
- Layout Proportional Widths
- Convert Decimal Inch to Fractional Inch & Back
- Convert Fractional Inch to mm & Back
- Use as Rule to Draw and Cut
- Light Gage for Straightness
- 3/32", 1" & 12" Spacer
- End to Edge Square
- Extension or Sight Gage for height (1•2•3 Blocks)
- Use as Winding Gage (Sticks)

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### Standard Operations Blade

- > • Measure
  - Layout Proportional Widths Proportional widths.  
7in board into 3rds / measure 9in at angle / mark 3in 6in
  - Convert Decimal Inch to Fractional Inch & Back
  - Convert Fractional Inch to mm & Back
  - Use as Rule to Draw and Cut
- > • Light Gage for straightness
  - 3/32", 1" & 12" Spacer
  - End to Edge Square
  - Extension or Sight Gage for height (1•2•3 Blocks)
  - Use as Winding Gage (Sticks)  
Winding Gage to detect twist in boards (needs 2 blades)  
24in BEST

> NEXT SLIDE



# STANDARD OPERATIONS

## Blade & Square Head

- Mark Lines at 45°
- Mark Lines Parallel to Edge
- Mark Lines Perpendicular to Edge
- Mark Multiple Spacing
- Transfer Lines Around Edge
- Level
- Plumb
- Square
- Scribe
- Depth Gage

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# STANDARD OPERATIONS

## Blade & Centering Head

- Scribe 4 Lines to Find Center of Round
- Scribe 4 Lines to Find Center of Rectangle
- Check 90°
- Check 45°

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# STANDARD OPERATIONS

## Blade & Protractor

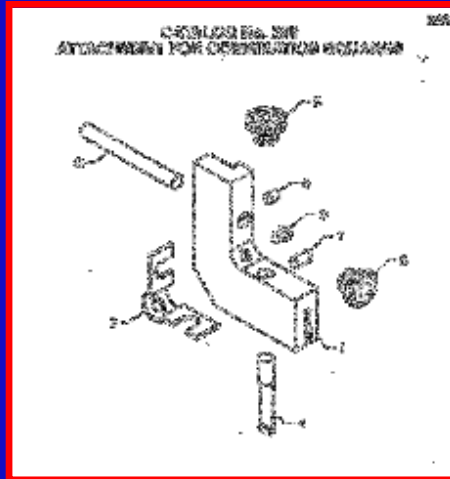
- Use Protractor, Level and Blade to Find Unknown Angle ( Relative to Horizontal )
- Use Protractor and Blade to Find Unknown Included Angle
- Use Blade as Bridge Between 2 Diameters or Surfaces for Angle or Level
- Use Head as Level in Small Space
- Use as Another Square Head to Make Inside / Outside Gage

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## COMBINATION SQUARE Attachment - Second Blade



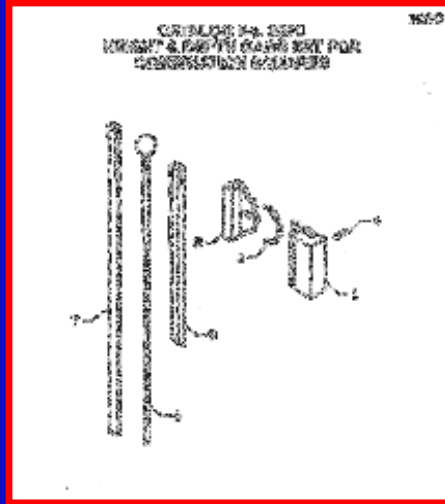
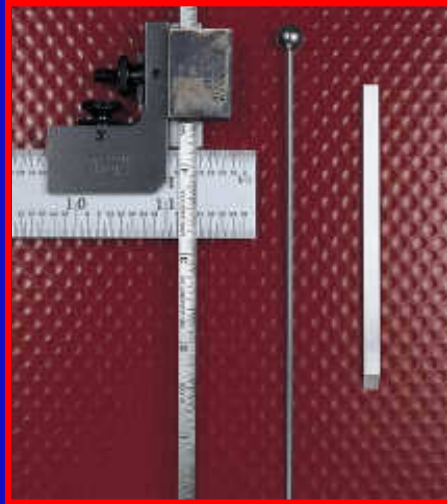
Holds another blade  
perpendicular to the  
combination blade



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# COMBINATION SQUARE

## Attachment - Height & Depth



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### COMBINATION SQUARE

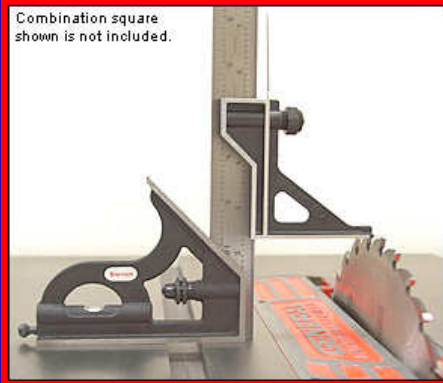
#### Attachment - Height & Depth

> Pix

> Drawing

Attachments for the ATTACHMENT

> NEXT SLIDE



# Hi • Gage

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## Hi • Gage

Lee Valley \$21.50

Rockler \$19.95

Set Blade Height

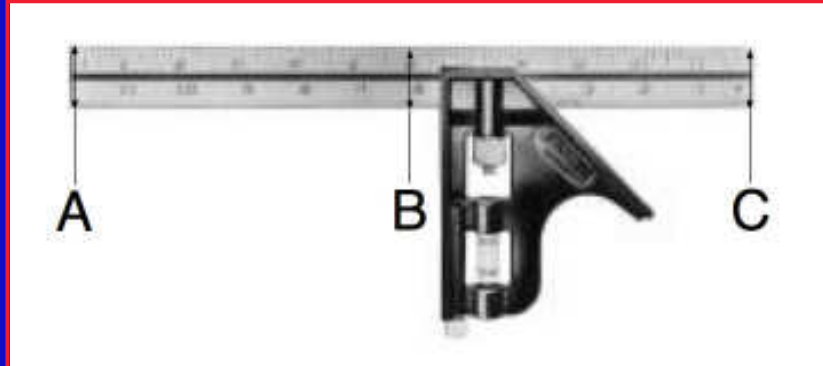
Set Depth

Rip Fence

Calipers

I needed to take .003 from tongue thickness.

## CHECK BLADE :: Parallel Measure Width in Several Places After Stoning



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CHECK BLADE :: Parallel

Measure Width in Several Places After Stoning

BLADE

1. Visually Inspect
2. Edges must be free of Hickies, Bumps and Lumps  
Lightly and squarely rub a fine flat stone down the edge. You can feel any burrs or hickies. Lightly Stone until smooth on all sides.
3. Check the Two sides for Parallel in Several Places  
Measure several places

SQUARING HEAD, CENTERING HEAD & PROTRACTOR HEAD

1. Visually Inspect
2. Rub out the Hickies CAREFULLY!!

## **CHECK BLADE :: Straightness**

Use .0015 Feeler on Machine Table, Thick  
Glass, or Drill Rod  
(check both sides)

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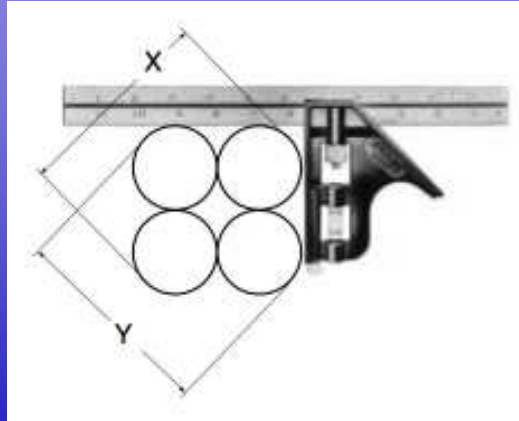


# CHECK for SQUARE

- Use a Known Accurate STREIGHT EDGE  
Scribe Line - Flip - Scribe Parallel Line
- Use a Known Accurate SQUARE  
Feeler Gage  
Check For Wobble
- Use *4 Accurate Disks Method*

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## 4 ACCURATE DISKS to Find If Square



$$X - Y = | 2 \text{ (the error) } |$$

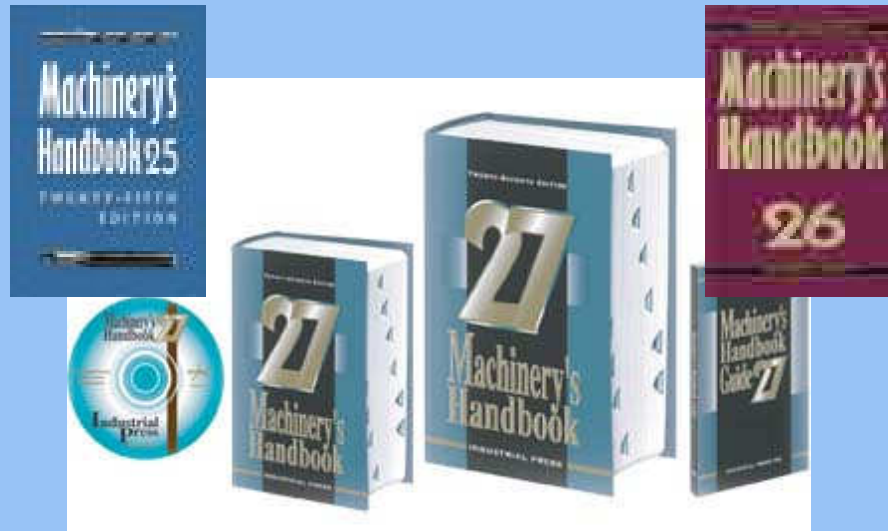
34

## BALDOCK'S CHOICE Combination Square Set

- PAINT :: Japan :: Crinkle
- BLADE :: Stainless :: Chrome :: Steel
- BLADE :: 4R :: 8R :: In/mm :: mm
- BLADE :: 12 :: 18 :: (2) 24 :: 36
- HEADS :: Cast Iron :: Steel
- PROTRACTOR :: w / Level :: Reversible  
:: Non-Reversible
- OPTIONS :: Attachment :: Depth Gage  
:: Hi-Gage :: Blade Connector

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# Machinery's Handbook



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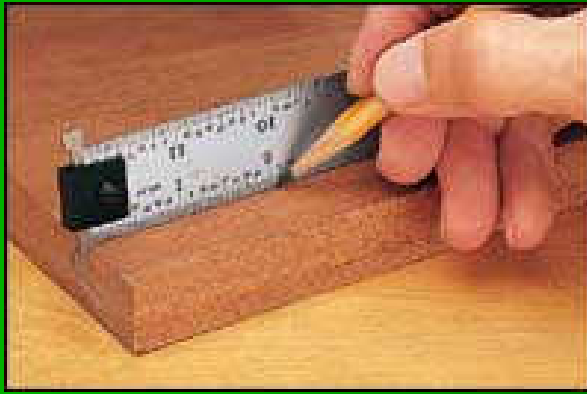
# **MACHINERY'S HANDBOOK**

World's Best Reference!!

- ❖ Math
- ❖ Materials
- ❖ Fasteners
- ❖ Conversions
- ❖ Files & Burs
- ❖ Hardware
- ❖ Grinding
- ❖ Machine Design
- ❖ Machine Repair
- ❖ Bearings
- ❖ Mechanics
- ❖ Drilling
- ❖ Sharpening
- ❖ Electricity

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# HOOK RULE



One Hook Rule

Two Hook Rule

6"  
12"  
18"  
24"

Two Hook Rule Shown

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# FEELER GAGES



Several Types of  
Feeler Gages

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## COMBINATION STONE



NORTON :: Fine - Medium

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## COMBINATION STONE

size• type• grit

Size :: 4 x 1 x 1/2

:: 6 x 2 x 1

:: 8 x 2 x 1

Type :: Aluminum Oxide Tan / Brown (India)

:: Silicone Carbide -Gray / Blue

:: Arkansas -Gray / White / Translucent

Grit :: 60        :: 320

:: 80        :: 600

:: 100       :: 1000

:: 120       :: 2000

:: 200       :: 6000

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# TWIST DRILL SETS

Fraction • Letter • Number • Metric



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## TWIST DRILL SETS

Fraction • Letter • Number • Metric

Check out Harbor Freight

## DRILL DOCTOR



The Best  
for the  
Price

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DRILL DOCTOR

The Best for the Price

I have the upright one and you can get a LH holder  
Best prices on the Internet

Anyone Know of similar or better sharpener?

# TWIST DRILL CHART

Fraction • Letter • Number • Metric

The image shows a Starrett Twist Drill Chart. It is a reference tool for selecting drill sizes. The chart is organized into columns for different units of measurement: Fraction (e.g., 1/16, 1/8, 1/4), Letter (e.g., A, B, C), Number (e.g., 1, 2, 3), and Metric (e.g., 1.0, 1.5, 2.0). The chart also includes a section for 'Holes in Plate' with various drill sizes and a section for 'Holes in Bar' with various drill sizes. The Starrett logo is prominently displayed at the top of the chart.

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## TWIST DRILL CHART

Fraction • Letter • Number • Metric

Use this to sort them out

Overlap - 'E' and 1/4 are the same

Caterpillar Standard

# MACHINIST VISE



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Machinist Vise

I think this is the best buy at HARBOR FREIGHT there's 2 of them

ITEM 36990-5VGA \$56.99

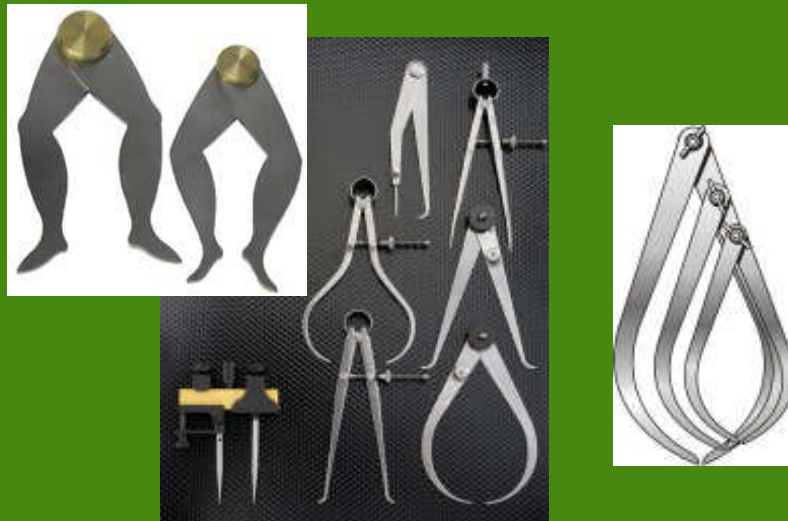
5" MULTIPURPOSE VISE

One of the most versatile vises on the market. Unique design comes equipped with 5" parallel jaws,

V-shaped pipe jaws, and a solid steel anvil. Jaws and locking base swivel 360° for the best angle on your work.

- \* Jaw opening: 0" to 4-1/8"
- \* Throat depth: 3-1/4"
- \* Jaw width: 5"
- \* Pipe vise capacity: 5/8" to 5"
- \* Overall dimensions: 9-1/2"H x 16-1/4"W x 7-3/8"D
- \* Base: 7-3/8" W x 7-1/2" D
- \* Shipping weight: 66 lbs.

# MACHINIST CALIPERS



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## MACHINIST CALIPERS

Are used to transfer distances to the measuring equipment

Internal

Lathe Work

Steps in Diameter

# MACHINIST SCRAPERS



- Triangle
- Flat
- Half Round

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## MACHINIST SCRAPERS

Usually sold in a set of 3.

Are FILE HARD

Designed to remove small amounts of metal.

Scrapes like a wood scraper.

# MACHINIST SCRAPERS

- Scrape & Clean Glue
- Remove Finish
- Remove Rust
- Turn Bur on Wood Scraper
- Burnishing
- Break Formica Corners
- Sharpen

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# FILES



Always Use A HANDLE!!

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Some quick notes about files. This could be the subject of a 2 hour talk itself. American Pattern File is the term for what we normally call a file. Both Files and Rasps are made of hardened steel. In general we could say that Files are for metal and that Rasps are for wood - Although there is a VERY large Overlap in usage. The difference in the two being the placement of the teeth. The teeth on files are placed in rows across the face at an angle. One row is one tooth. The teeth of a Rasps are usually straight across. Rasps have individual teeth making up a row. Rasps with random placed teeth are called Pattern Makers Rasps. With Files the distance between the rows of teeth makes the first major File classifications. The closer the spacing of the rows, the finer the cut. Coarser files are often called BASTARD FILES. The fine files are named SMOOTH FILES. The middle ones are called SECOND CUT .

Files with a single row of teeth are called a MILL FILES. Files with teeth in two directions are referred to as DOUBLE CUT FILES. Cabinet Files also refer to the coarser of the flat files There are many many files, often with odd names such as FEATHER, RAT TAIL, and RIFFLER, these refer to special shapes. There are files designed for aluminum, lead, plastic, bondo and a multitude of other materials. Files come in many cross sections for many special uses.

# DIAL / DIGITAL CALIPER



Measure:

- ☐ Inside Diameter
- ☐ Outside Diameter
- ☐ Depth

$\pm .001$  accuracy

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# DIAL INDICATOR Plunger



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## DIAL INDICATOR Plunger

> NEXT SLIDE

XX and back to the plunger

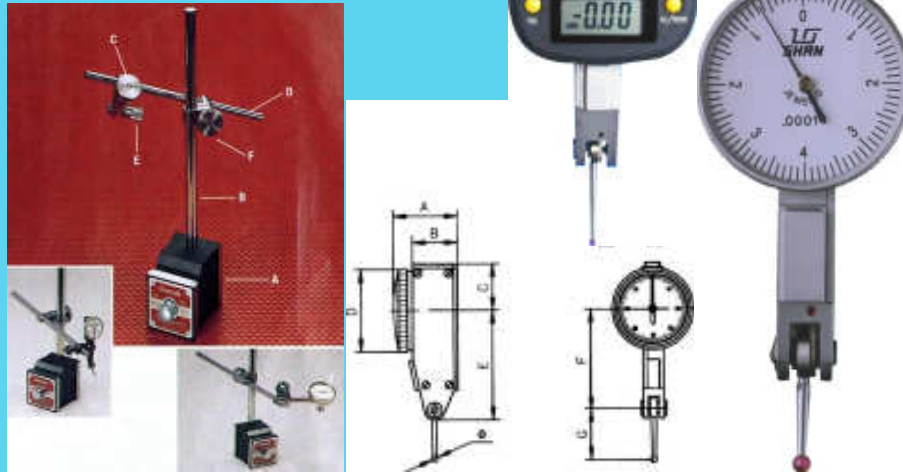
Note the fine JIG for setting the cutter height on the JOINTER

Also Note how it is used in truing the saw

They can be digital too

>>NEXT SLIDE

# DIAL INDICATOR Flicker



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## DIAL INDICATOR Flicker

< BACK 1 SLIDE

The Flicker

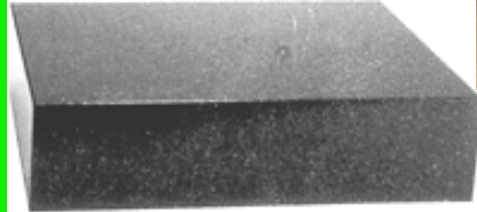
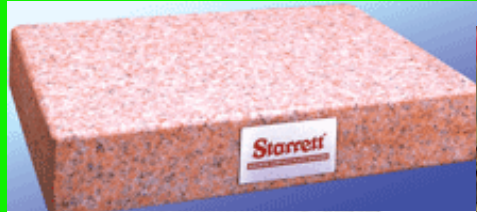
Note that care must be taken in presenting the stylus to the work, to be sure of a correct reading.

They too come in DIGITAL  
INCRIMENTS

- .001 Thousandth
- .0005 Half Thousandth
- .0001 One Ten Thousandth / Tenth

# SURFACE PLATES

Cast Iron



Granite



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Surface Plates

Granite

Cast Iron

# **SURFACE PLATE**

## **Uses in Woodworking Shop (Planometer)**

- Scary Sharp
- Tune Tools (Wood Plane)
- Check Master Tools
- Accurate Layout
- Flattening Stones
- With Dykem to check Flatness of Metal

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### **SURFACE PLATE**

Uses in the Woodworking Shop  
(Planometer)

Scary Sharp Wet & Dry sand paper  
Tune Tools (Wood Plane)  
Check Master Tools  
Accurate Layout  
Flattening Stones  
With Dykem to check Flatness of metal

## 1•2•3 BLOCKS

- Use as Spacer
- Use as Square
- Use to hold Square
- Use to hold at Angle



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## BRASS KEY STOCK

- 1/16, 1/8, 1/4, 3/8, & 1/2
- Use for Set Up
- Stack 1/16•1-11/16



OR

Tool Steel Lathe Tools



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### BRASS KEY STOCK

As Seen on PBS's 'The Router Workshop'

- > Brass Pix &
- > • 1/16, 1/8, 1/4, 3/8, & 1/2
- Use for Set Up
- Stack 1/16•1-11/16
- Woodcraft Brass Set Up Gages \$10.99

Comes in 12" & 36" Lengths As Key Stock

- > Veritas Lee Valley Set Up Blocks \$36.50
- > OR (What I think is the best buy)

40641-2VGA \$2.99 M2 High Speed Steel



# SCOTCH-BRITE

- De-Rust
- Clean
- Polish
- De-Bur
- Many - Many Shapes, Sizes, Grits & Uses



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There are may be problems with color tarnish on wood TEST TEST TEST

THAT'S ALL FOLKS!!