



# Combination Squares

What sets apart a \$75 tool from one that costs \$6?

BY STEVE LATTA

A combination square is one of the most frequently used tools in my arsenal. I carry a 4-in. version in my apron pocket and a 12-in. square with an additional 24-in. blade in my toolbox. As the name implies, this tool combines the capabilities of a machinist's square and a flat, straight rule. Throw in a rarely used bubble level and a scratch awl, and you have a tool that tackles a variety of common shop tasks, such as machinery setup, layout, marking and measuring. Although it is a relatively basic tool, there are myriad differences in the manufacturing details, sizes and styles that you can buy. You can get a simple tool for as little as \$6.50, or you can spend \$75. If you opt for all the extras, the cost climbs to \$200.

### What you get for the money

The two main components of a combination square are the head and the blade—what manufacturers call a two-piece set—and that's all you get with most of the lower-priced tools. Once you jump into the higher price brackets, all of the major brands also offer center heads and protractor heads. The addition of these two items makes up what's called a four-piece set, which typically sells for slightly more than double the cost of a two-piece set.

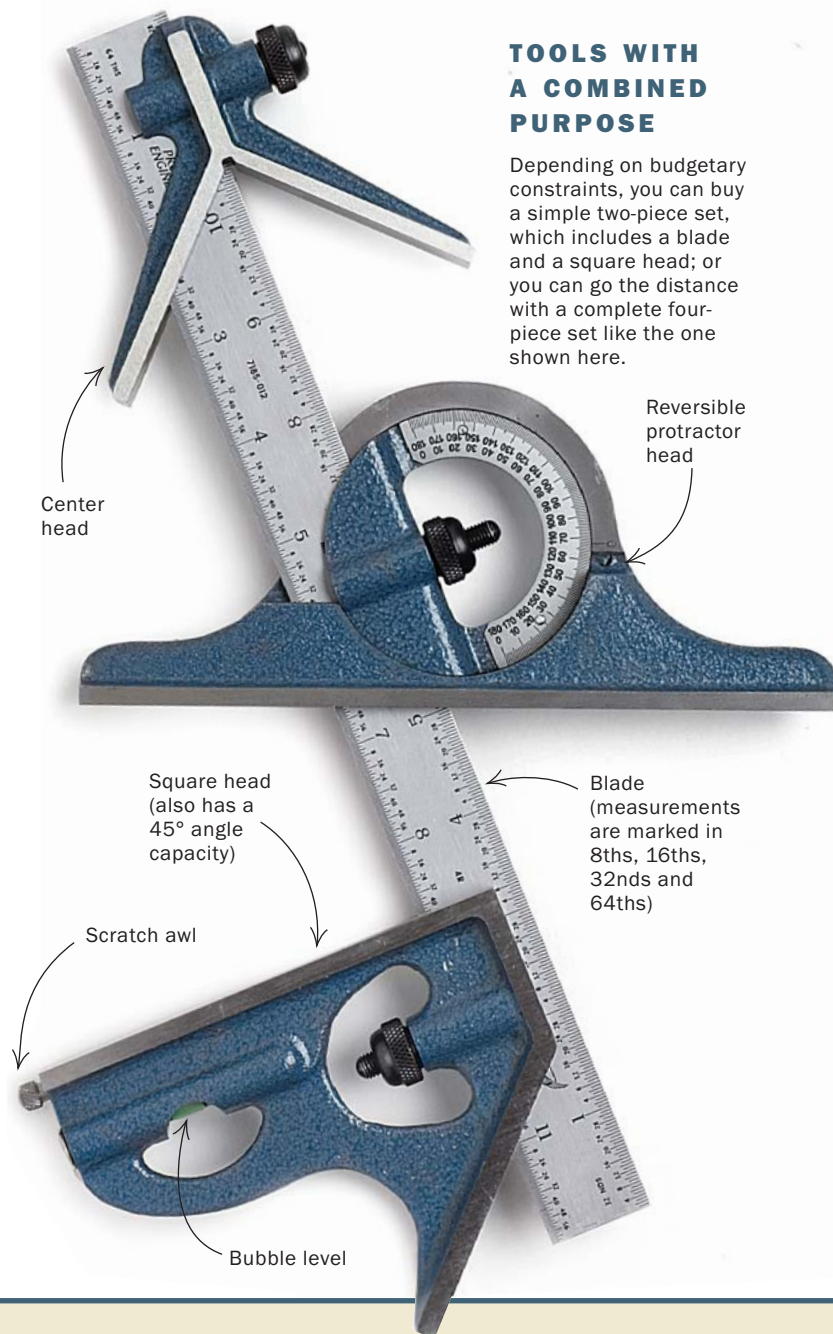
A center head locates the center of turning blanks and large dowels, but a lot of other tools work just as well. My center head is buried away until that once-a-year lecture to my students on layout tools. A protractor head is handy at times and is classified as either reversible or nonreversible. On a reversible head, the blade slides between two machined surfaces and can be adjusted anywhere along an edge within a range of angles that span about 110°. With a reversible head, it's easy to transfer lines across the face of a single piece of stock or from one workpiece to another simply by flipping the tool. With a nonreversible head, the blade sits on one side of a machined surface, so you can't flip the tool to transfer angled layout lines. Most sets include a reversible head, but some manufacturers offer sets with a nonreversible head—you should confirm what's included before ordering one.

### Blades should be easy to read

Blades come in a variety of sizes ranging from 4 in. to 36 in. long. The better manufacturers offer blades in one of two finishes—satin

### TOOLS WITH A COMBINED PURPOSE

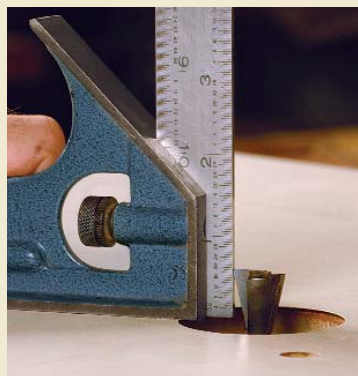
Depending on budgetary constraints, you can buy a simple two-piece set, which includes a blade and a square head; or you can go the distance with a complete four-piece set like the one shown here.



Checking a frame for square

### A tool of unequalled utility

A combination square is a vital tool for performing the most basic shop operations, such as layout, marking, measuring and machinery setup. Its versatility is unparalleled by any other single tool. The photos below and at left illustrate a few of the many tasks this tool is particularly suited to do.



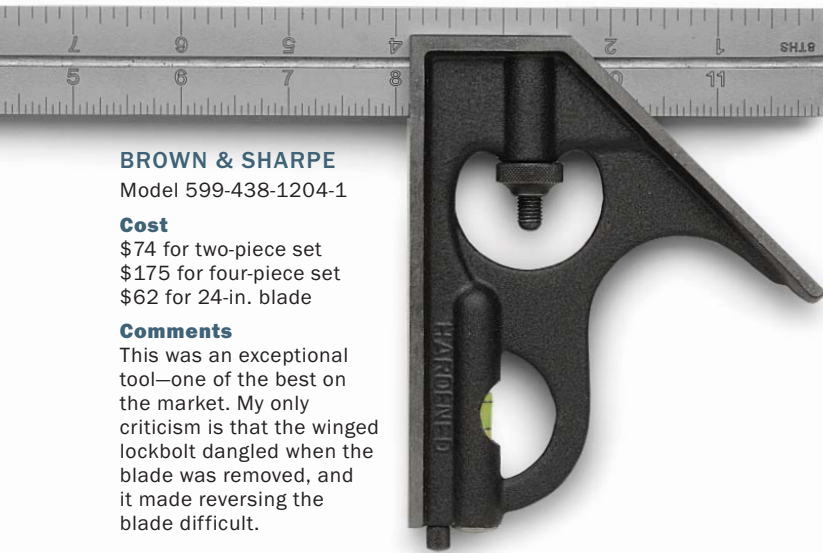
Setting the height of a router bit



Checking the depth of a groove



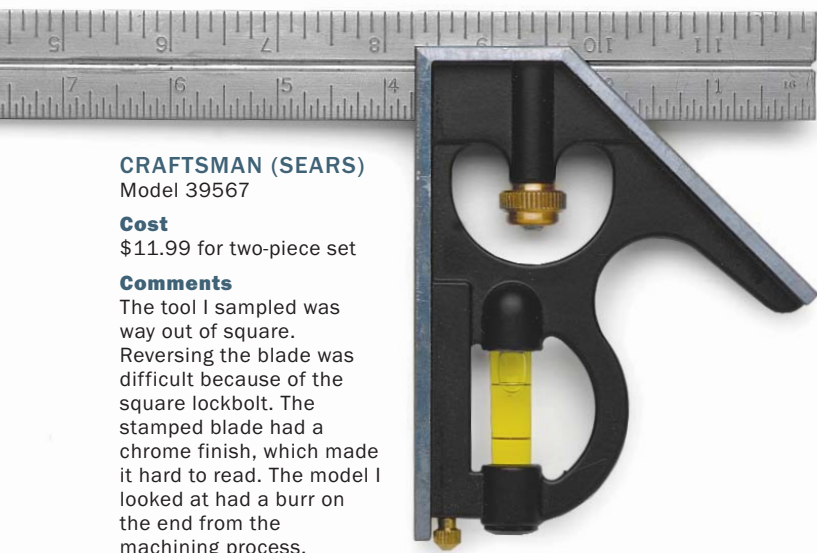
Marking shelf-pin locations



**BROWN & SHARPE**  
Model 599-438-1204-1

**Cost**  
\$74 for two-piece set  
\$175 for four-piece set  
\$62 for 24-in. blade

**Comments**  
This was an exceptional tool—one of the best on the market. My only criticism is that the winged lockbolt dangled when the blade was removed, and it made reversing the blade difficult.



**CRAFTSMAN (SEARS)**  
Model 39567

**Cost**  
\$11.99 for two-piece set

**Comments**  
The tool I sampled was way out of square. Reversing the blade was difficult because of the square lockbolt. The stamped blade had a chrome finish, which made it hard to read. The model I looked at had a burr on the end from the machining process.

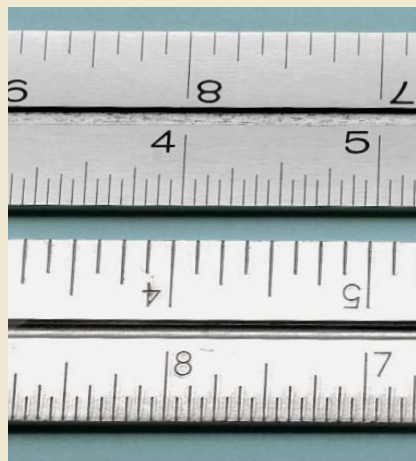


**EMPIRE**  
Model 240-12

**Cost**  
\$6.50 for two-piece set

**Comments**  
This was a bottom-of-the-line tool with an inadequate locking mechanism. A plastic insert allowed movement and will wear down quickly. Overall, the tool was awkward to use. The stamped steel blade was difficult to read, and the model I used had a burr on the end from the machining process.

## STAMPED OR ETCHED BLADE?



*The reliability of the blade is directly related to manufacturing techniques. A satin-chrome finish is easier to read than a shiny, reflective finish. The graduations on the satin-finish Mitutoyo blade (top) have been acid-etched and paint-filled to make them more readable. The stamped surface of the Empire blade (bottom) is hard to read.*

chrome or polished. Of the two, satin chrome is preferable because it doesn't reflect glare under shop lights and is much easier to read. Blades are made in a variety of graduations with 4R (8ths, 16ths, 32nds and 64ths) being the most common in the United States. You also can buy blades marked solely with metric scales or in several different combinations of Imperial (or what some manufacturers call English) and metric.

Brown & Sharpe, Mitutoyo, Products Engineering Corp. and Starrett machine their blades in multiple steps. According to a company spokesman, Starrett's oversize blades are cut from grooved bar stock. The bar is then varnished and has the graduations cut into it with a CNC machine. The markings are acid-etched for further definition. The blades are ground to final length and then chromed or satin-chromed. Afterward, the graduation marks are blackened in. On inexpensive squares, the blades are stamped out of a blank—graduations and all—and clear-coated to prevent tarnishing. These blades often come with a burr on the end (caused by the stamping process) that needs to be removed with a file, and many are difficult to read.

In application, different length blades can serve specialized functions. Although a 12-in. blade is the most common for general cabinet work, a 4-in. one is every bit as essential: It's unsurpassed for laying out joinery and hardware, setting up machines and checking small drawer openings. For case work involving dados, laying out shelves and transferring dimensions, an extra 24-in. blade comes in handy. A satin-chrome 24-in. blade costs between \$50 and \$80, depending on the manufacturer, and is well worth the money. You'll wonder how you ever lived without one.

## Heads are cast or forged

The square heads of some of the cheaper tools are die-cast aluminum or zinc, or plastic. Heads of the more expensive squares are either cast iron or forged-and-hardened steel. Cast iron is a softer material but more than adequate for a lifetime of wood-working. Forged-and-hardened bodies are more durable and more expensive (typically about \$10 more), and often preferred by metal shops. Heads come with a flat, glossy, textured or satin finish in an assortment of colors, depending on the manufacturer. For metalworking, where oil is prevalent, the smooth finish is easier to

keep clean. For woodworking applications, I don't see any particular advantage in choosing cast iron over forged and hardened, or textured over smooth: It boils down to personal preference.

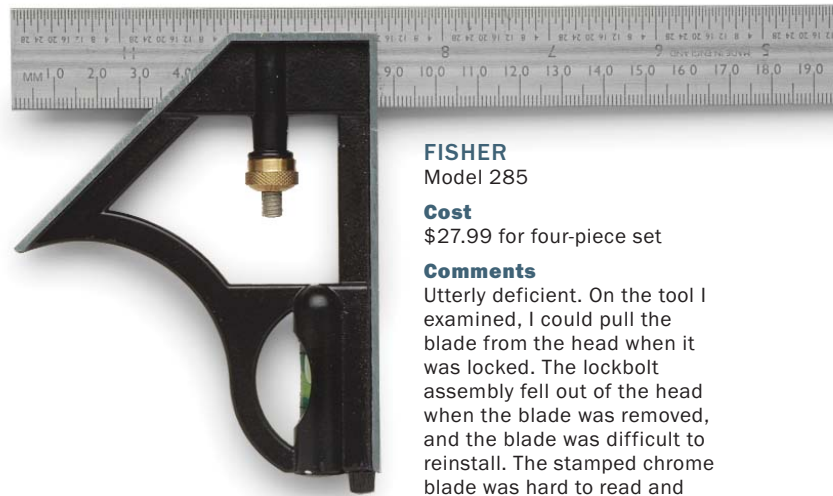
### Lockbolt designs vary

The lockbolt assembly consists of a central bolt, spring and knurled knob. The lockbolt secures the blade to the head and is an all-too-often overlooked yet essential element for the smooth function of the tool. Like most cabinetmakers, I regularly pull the blade out of the head and use it as a ruler. It is critical that the lockbolt assembly stay in place when the blade is removed. On many models, the assembly dangles or, in the case of the Fisher, falls out. If the blade is to slide back in smoothly, the lockbolt cannot rotate, and manufacturers achieve this in a variety of ways (see the photos on p. 72). Empire and Craftsman use a square lockbolt to prevent rotation. Brown & Sharpe, and a whole herd of copycats, place a wing on the bolt that keeps it from both rotating and falling out when the blade is removed. Starrett and Mitutoyo add a washer that slides over the bolt and keeps it from rotating.

Does all of this jargon about lockbolts really matter? Absolutely. I'm constantly flipping my blade from side to side to set sawblades, shaper cutters and router bits. To flip the Starrett blade, I had to slide it out, pull down the lockbolt and rotate the shaft 180°. It took seconds and was a process that became instinctive. With the Brown & Sharpe tool, the knurled nut must be loosened to the point where it just about comes off, and then the winged shaft can be pushed above the head's face and rotated. When I used these squares over the course of a week, several of the nuts came loose in my hand when I tried to flip the blade. To reverse the blade on several of the models tested, the assembly had to be taken apart and removed from the head, then reassembled with the lockbolt reinserted 180° to its original position. It was an annoying process.

### Buy as much square as you can afford

Fortunately, buying a combination square is likely to be a one-time purchase because all of the better models will outlast you. I recommend picking up a 4-in. pocket model along with a 12-in. four-piece set that comes with a center head and a reversible protractor head.



**FISHER**  
Model 285

**Cost**  
\$27.99 for four-piece set

**Comments**  
Utterly deficient. On the tool I examined, I could pull the blade from the head when it was locked. The lockbolt assembly fell out of the head when the blade was removed, and the blade was difficult to reinstall. The stamped chrome blade was hard to read and had a burr on the end from the machining process.



**JOHNSON LEVEL AND TOOL**  
Model 400/40-0535

**Cost**  
\$9.99 for two-piece set

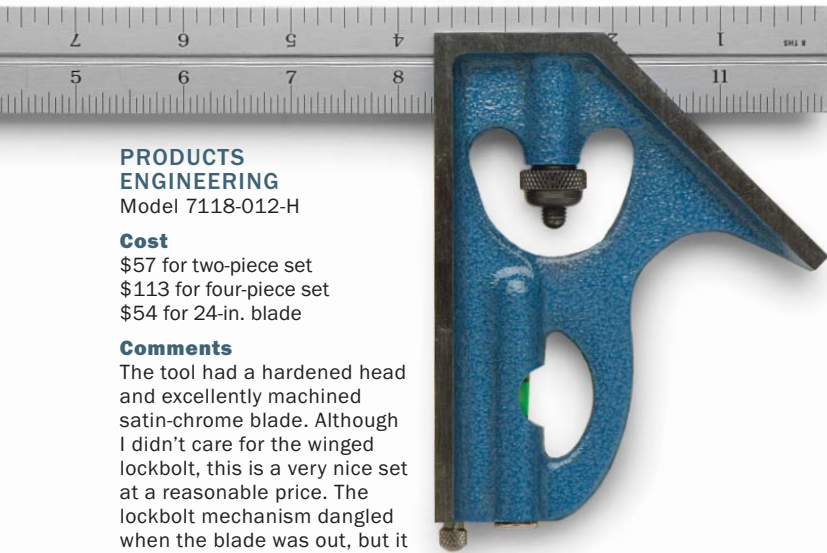
**Comments**  
The tool I tested was out of square and had an arched blade. The stamped chrome blade was difficult to read.



**MITUTOYO**  
Model 180-112 head  
with 180-501 blade

**Cost**  
\$65.50 for two-piece cast iron  
\$76.50 for two-piece forged  
\$176 for four-piece set  
\$64.50 for 24-in. blade

**Comments**  
Nice tool in terms of head and blade machining and finish (hardened, satin-chrome), but in use, the blade often came loose. The two-piece lockbolt assembly prevented the lockbolt from rotating and allowed it to be reversed easily.



**PRODUCTS ENGINEERING**

Model 7118-012-H

**Cost**

\$57 for two-piece set  
\$113 for four-piece set  
\$54 for 24-in. blade

**Comments**

The tool had a hardened head and excellently machined satin-chrome blade. Although I didn't care for the winged lockbolt, this is a very nice set at a reasonable price. The lockbolt mechanism dangled when the blade was out, but it never fell out.



**STANLEY TOOLS**

Model 46-123

**Cost**

\$16.21 for two-piece set

**Comments**

This was the best tool among the inexpensive models. Extra steps were taken in the manufacture of the blade, leading to a superior product. Although the lockbolt rotated freely, it did not fall out of the head. The blade was reversed easily.



**L.S. STARRETT CO.**

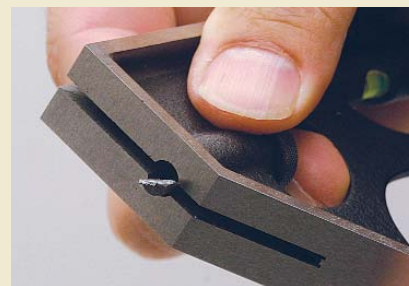
Model 434-12-4R

**Cost**

\$64 for two-piece cast-iron  
\$78 for two-piece forged  
\$169 for four-piece set  
\$70 for 24-in. blade

**Comments**

This model had a hardened head and a chrome blade. The small, tabbed washer prevented the lockbolt from rotating and allowed easy reversal of the blade. I think this is hands down the best tool on the market. It was very easy to use and to read.



**LOCKBOLTS**

The lockbolt fastens the blade to the head. When you need to remove and reinsert a blade, most manufacturers provide a system to keep the lockbolt from turning around and falling out. The Craftsman and Empire tools have a square bolt (top). The Brown & Sharpe and Products Engineering Corp. models have a small wing on the end of the bolt (middle), so you have to push it clear of the edge to turn it around for another blade setting. The Starrett tool (bottom) is Latta's favorite. It has a spring-loaded tabbed washer on the lockbolt that serves as a positive locator.

Add to that a 24-in. satin-chrome blade, and you should be good to go for all of your machinery setup and layout operations. Regrettably, inexpensive models don't come in many of these sizes or offer other heads. Fisher is the only low-budget model I could find that came as a four-piece set, and the quality was not good.

What if you don't have \$200 to buy a full set? For \$16.21, the Stanley is a pretty good tool overall. In fact, it is the model I specify for my incoming students at the school where I teach. It has a nice satin-chrome blade that can be reversed relatively easily. The sample I purchased was a little out of square, but a few licks with a file took care of that. (For more on squaring up a square, go to [finewoodworking.com](http://finewoodworking.com).) If money is not a major factor, the upscale brands (Brown & Sharpe, Products Engineering Corp., Mitutoyo and Starrett) are in a different league. When I consider my individual work habits, I prefer the Starrett tools. I pull and flip my blades regularly, and the Starrett just works more smoothly in my opinion. If asked to label one of these as a "best buy," I'd give that award to Products Engineering Corp. It's a good tool, and at \$113 for the four-piece set, it costs about \$60 less than a Starrett or Brown & Sharpe tool. Over a lifetime of work, however, \$60 isn't really that much.

When you order a square, make sure you get what you really want. Woodworking catalogs notoriously provide inadequate information regarding a specific product. Ask about the graduations and blade finish as well as the construction of the head. A great deal can go sour if that satin-chrome blade you expected turns out to be polished. Commercial suppliers, such as MSC Industrial Supply (800-645-7270; [www.mscdirect.com](http://www.mscdirect.com)), offer many models from each of the major manufacturers. □

Steve Latta teaches woodworking at the Thaddeus Stevens College of Technology in Lancaster, Pa.

For tips on tuning up a combination square, go to [www.finewoodworking.com](http://www.finewoodworking.com).