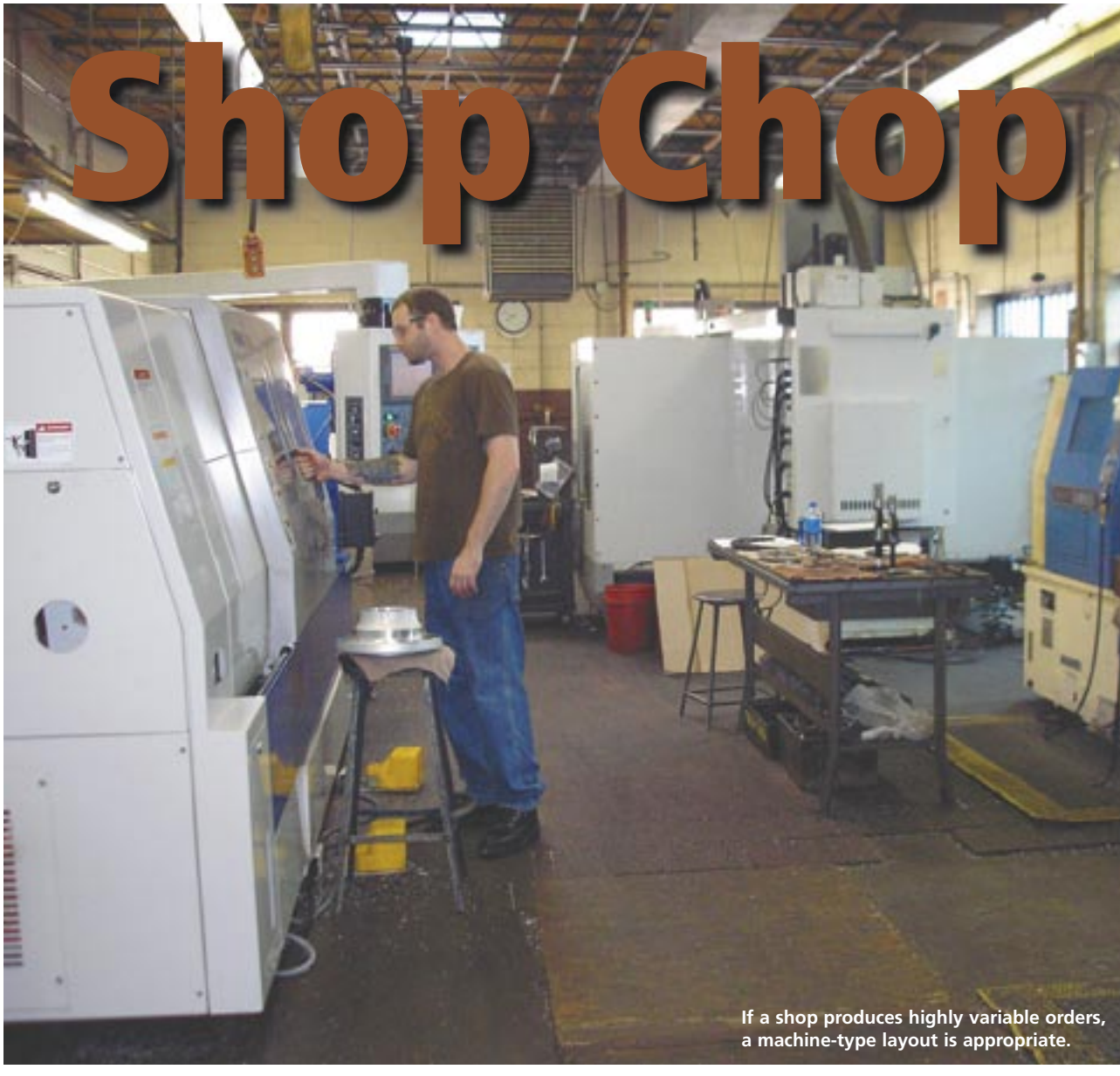
➤BY TIM SIMMERMON

Shop Chop



If a shop produces highly variable orders, a machine-type layout is appropriate.

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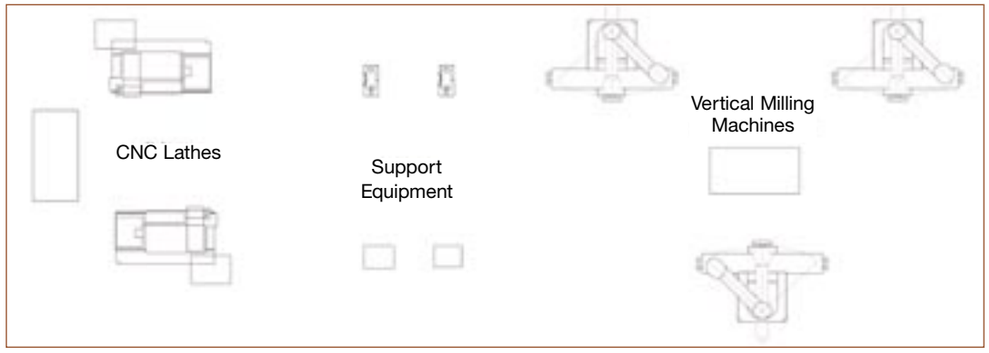
Redoing your tool storage and shop layout can pay big dividends.

Job shops typically buy advanced cutting tools and equipment to decrease cycle times and increase part quality. Although these investments can produce great improvements, a low-cost solution can provide similar benefits: reorganizing cutting tool storage and changing shop layout.

This is usually the last thing on an owner's mind unless he is moving the shop or running out of space. Changing the layout means physically moving equipment and tools to promote efficient use of resources. A traditional workplace layout focuses on raw materials coming into a shop, machines laid out in process order to produce parts and finished product then shipped. This layout is not effective for most manufacturers—especially job shops. Instead, shops should focus on organizing machine tools to be in easy reach and make sure setup tools are always with each operator.

Start Small

Reorganizing the shop floor doesn't require



A machine-type layout groups machines by their function.

rearranging all the equipment. Start small by organizing specific areas of the shop floor. Organize hand tools at a machine so the operator can easily find them. Create an area for cutting tools. Use a cabinet or shelving unit to organize inspection tools. The goal is always reducing setup times.

A shop can be organized in multiple ways, depending on how it functions. If each machine has just one operator, one toolbox can hold all the setup tools. If operators set up multiple machines, use movable carts containing the setup tools to avoid having operators walk back and forth between the machines and their toolboxes.

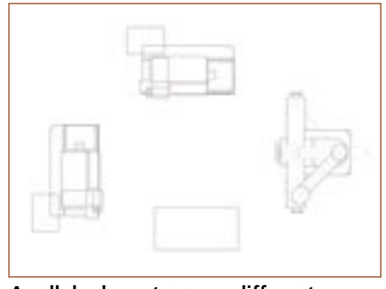
The Search is Over

Cutting tool organization is one of the most important small-layout improvements a shop can make. The most common method is by tool type, such as placing all drills in one cabinet. Within that cabinet, organize the drills by the type of workpiece materials they are suitable for machining and then by tool size. It's also important to organize them so specials can be located quickly.

When a shop organizes its cutting tools, it reduces time spent searching for tools and provides better knowledge of available tools. A great deal of setup time is wasted searching for cutting tools. Because small shops typically can't afford to staff a toolcrib, organization is key.

Good organization also allows operators and programmers to determine if the right tools are available for the job. Operators frequently spend precious time searching for a special tool. This time is never accounted for when quoting jobs.

Following the previous suggestions might only save 20 to 30 minutes per setup, but those savings can add up. If



A cellular layout groups different machines to produce a certain part or family of parts.

a shop averages 1,000 setups per year, the total setup reduction would result in annual savings of 333 to 500 hours, or about $25,000 to $37,500 per year at a $75 per hour shop rate. It also increases capacity by up to 500 hours.

Organizing Equipment

Rearranging equipment on the floor to increase productivity is the next step. This is much more involved than organizing cutting tools and creating setup carts. The planning process should involve everyone from the owner to the operators and should result in a detailed layout.

Unless a shop has its own maintenance crew, it will need an electrician to disconnect and reconnect all the equipment and a rigger to move heavy equipment.

To begin planning the new layout, measure the machines and the dedicated work area. The measurements should provide a box that encompasses the machine's footprint. If a CAD system is available, footprints can be drawn up and manipulated on the computer to get the desired layout. If a CAD system is not available, scaled templates are the best way to get a visual layout. Using templates is easier than drawing the layout by hand because it offers more flexibility.

After measuring the machines, determine if you will use a cellular or machine-type layout. A cellular layout groups different machines to produce a certain part or family of parts. A machine-type layout groups machines by their function, such as turning centers or OD grinding.

The type of layout a shop selects depends on what it manufactures. For example, if 90 percent of the parts are shafts that need keyways, a cellular layout is probably best. The cell might consist of two lathes and a machining center. The two lathes would turn each side of the piece and the machining center would mill the keyways.

If the shop produces highly variable orders, a machine-type layout is more appropriate. In this layout, the turning centers are grouped in one area, the machining centers in another and support equipment—such as drill presses and bench grinders—in between.

The purpose of changing a shop's layout is to have a single operator running multiple machines. Although this is not a new concept, it is harder to implement than one might think.

Pros and Cons

A shop owner's dream is to have a single operator running every machine in the shop—the ultimate efficiency. But many factors work against this system.

Let's assume the shop is laid out in a machine-type configuration. The objective is to have an operator run two machines at once. The plan is to have the operator run two separate jobs on two machines. The part-to-part cycle times are 5 minutes on Machine A and 1 minute on Machine B. The cycle times listed should be considered the time it takes to complete one part and load another.

Cutting tool organization is one of the most important small-layout improvements a shop can make.

At first glance, it appears the operator could produce five parts on Machine B in the time it takes to complete one part on Machine A, but consider the following. There are 15 workpieces to run on Machine A and 1,000 workpieces to run on Machine B. When the operator completes the parts on Machine A, he needs to set up that machine for the next job and he will not be able to run Machine B during setup. Now, instead of one machine being down because of setup, there are two.

However, Machine B would never have been running at the same time as Machine A before the new layout, so the shop still increased its production. Production, of course, didn't double, but it still increased.

On the other hand, consider as an example machines laid out in a cellular configuration. The part being made is a shaft turned on both ends and then milled. The shop quoted a price based on machining the part complete in the cell. However, the shop also has a separate milling job that must be run on the mill within this particular cell. The choices are not good: Be late on the milling job or lose money on the shaft job.

These are but two typical problems associated with changing a shop's layout. However, solutions are available. In the cell example, because the shop runs the shaft in the cell, it has spread labor across the three machines in the cell. Now that the shop has reduced the cost to the customer, it could work with that customer to increase the lead times required for those shafts.

In the machine-type example, better scheduling improves the efficiency of the system even more by reducing the number of setups and the time to perform each one. The Achilles' heel of the machine-type configuration is machine setup, because the arrangement prevents the operator from running other machines during setup. To improve scheduling and reduce setup time, group parts by the tools and workholders needed to produce them. And, to reduce changeover time for jobs requiring bar feeders, group workpiece material by size.

Although the new layout is not 100 percent efficient, the shop, as a whole, is more efficient than before. With a bit of planning, the new layout will allow a shop to ship more parts with the resources it already has. △

About the Author

Tim Simmermon is a manufacturing engineer at a job shop in Chicago.