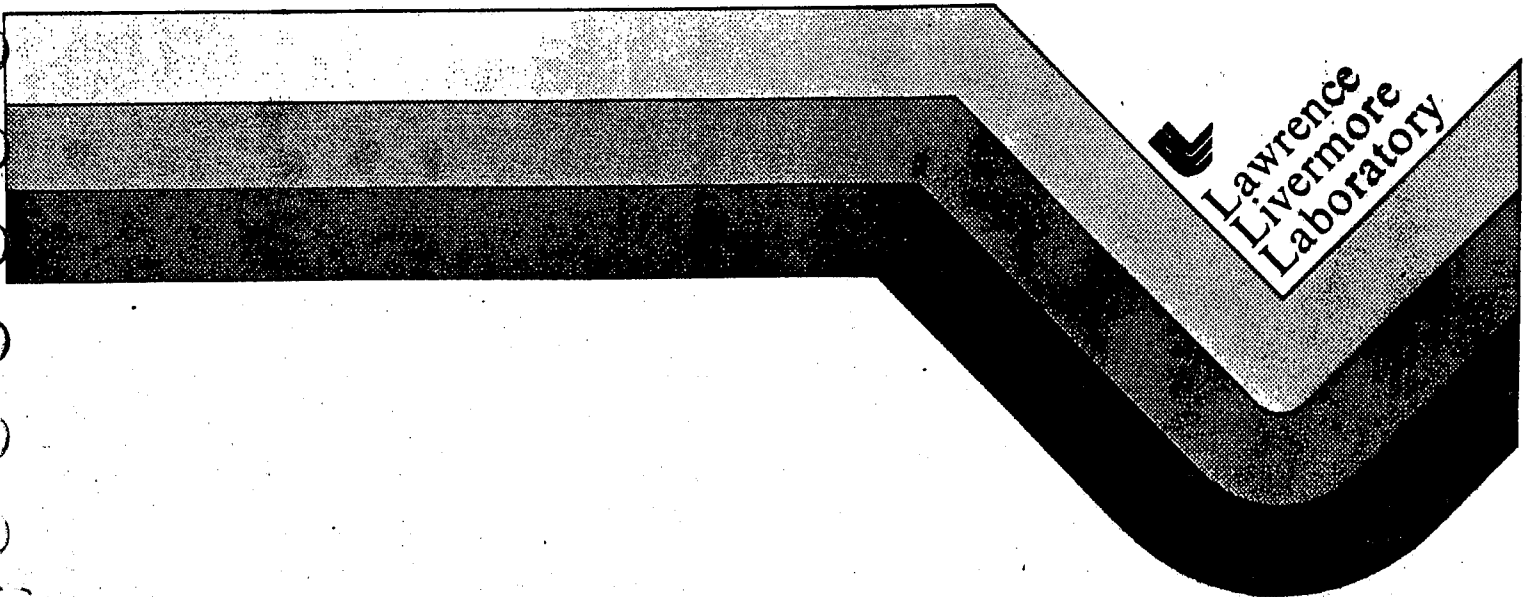


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THE ART OF HAND SCRAPING

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THE ART OF HAND SCRAPING*

INTRODUCTION

Hand scraping is generally considered in two categories: tooling and machine tool bearing surfaces or ways. There are other reasons for scraping, but these two categories should cover most other applications.

The objective in hand scraping is to remove material from a part to alter its geometry so two surfaces will match each other. We use such tools as a straightedge, surface plate, or other master gage, to match to another surface. We also match any other two mating surfaces by hand scraping.

The purpose of tooling scraping is to generate tools to be used in scraping other components. Straightedges, surface plates, and angle plates must be scraped to a known master. To generate this master flat plane, the system of "symmetrical distribution of errors" is employed. A flat plane will be attained by cross matching three surface plates that are square.

The major purpose for scraping is for machine tool bearing surfaces. Way bearings become worn and scratched and must be reconditioned in the final form by scraping and flaking.

Truing a bearing surface is also accomplished by scraping, usually progressing with the reconditioning process. Truing the ways involves straightness, angularity, and parallelism, with attention being paid to alignment of such items as gear trains, shafts, and T slots.

While in the process of reconditioning and truing, the geometric configuration of the components must be obtained by scraping the ways of the components.

Matching two surfaces of machine components must be achieved by scraping. A slide being matched to its ways must be scraped for fit and alignment.

The tapered gib used to facilitate assembly of a machine must be scraped to match the tapers while allowing the proper clearance for freedom of

*This is the second in a series of refresher courses prepared by the Machine Tool Services of the Materials Fabrication Division of the Mechanical Engineering Department.

movement of the slides. Finally, machine tool ways must be flaked for functional and aesthetic purposes.

In summation, hand scraping is a physical, tedious job requiring a high degree of precision and should be attempted by only those that are trained for the work.

HAND SCRAPING TOOLS

HANDLES (ARM, HIP, PULL)

The most common handle for scraping is the Anderson Brothers Scraper. This scraper has a clip-attached scraper blade for quick removal for sharpening. Scraper blades, which are made of high-speed steel or are carbide tipped, are available in three sizes, 3/4 in. for small parts and fine bearing scraping, 1 in. for general purpose scraping and 1-1/4 in. for rough scraping. The wood handle supplied with the Anderson Scraper will suffice for general scraping, but for long-term hard scraping a more ball-shaped handle is easier on your hands.

Hip scrapers are generally homemade. Cold rolled steel 3/16 in. by 1 in. by 24 in. is a practical size. Use the Anderson blade clip or weld a piece of carbide to the tip. A large handle (5 in. in diameter) is used to fit your hip. Padding on the handle is recommended.

The Anderson Scraper can be used as a pull scraper by heating and bending a high-speed steel blade to about 45°. The blade must be short-coupled in the clip to prevent chatter. The high-speed steel blade is used for hand sharpening on a stone.

POWER SCRAPERS

Power scrapers are hand-held electric scrapers with carbide-tipped blades. Power scrapers are used mostly for heavy material removal, although a rough bearing can be picked with the power scraper.

POWER FLAKERS

The power flaker is an electric hand-held flaking machine and has some advantages over hand flaking. The power flaker also has a carbide-tipped blade.

STONES

Stones used in scraping fall into two categories: stones for sharpening tools and stones for deburring and polishing the scraped surface (Fig. 1).

Honing stones for sharpening are generally silicon-carbide combination stones 1 in. by 2 in. by 8 in. and are coarse on one side and fine on the other. Deburring stones are used after a surface has been scraped. Slip stones are generally used. A slip stone is tapered and comes in coarse, medium, and fine grades. The most commonly used stone for scraping is the medium grade India stone. This is a semi-hard, medium-grit stone and will not load up and scratch the scraped surface.

For large surfaces and rough scraping, a cutter grinder wheel makes a useful stone. A practical size is the 1/4-by-6-in. aluminum oxide wheel.

For very fine finishing the Arkansas stone is used. This is a very hard, close-grained stone and is used for polishing fine surfaces. This stone should also be used for deburring tooling such as straightedges and surface plates, and also very fine scraped bearings as on measuring machine, precision grinders, and precision computer numerical control (CNC) machine tools.

As the stones are used, they will get dirty. A simple and quick way to clean them is to immerse the two stones in a solvent and rub them together. Dry them with a towel or air and they are ready for use again. It is recommended that the stones be used dry. This will prevent contaminating the scraped surface with oil or solvent, thereby causing smears.

CARBIDE SHARPENING

A diamond wheel grinder is the heart of carbide scraper blade sharpening. Because diamond wheels are difficult to dress, they should be used for scrapers only to produce the smooth finish on the scraper blade necessary to prevent scratches in the work. Two diamond wheels are most convenient, one 280-grit wheel for roughing and shaping a new blade, and one 400-grit wheel for

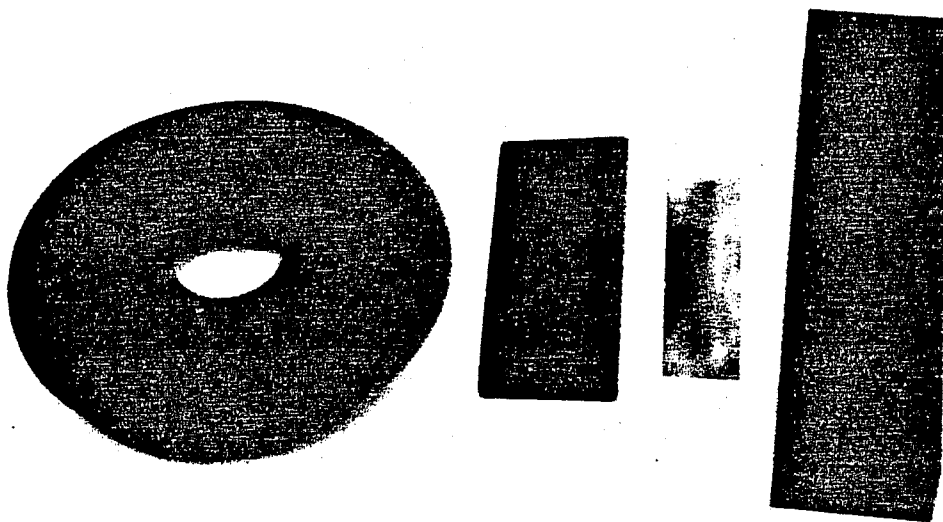


FIG. 1. Various stones.

finishing and sharpening the blade. The grinder should be a substantial machine with a heavy tilt table, coolant system, and a light. The spindle should be ridged and precise. It is very important to keep the wheel wet when sharpening. Use a mixture of 80% kerosene and 20% light machine oil. A gravity system is satisfactory, but let it run freely as you grind on the wheel.

Two methods are used to sharpen the scraper blade, by free-hand or by using the grinder table. To sharpen the blade in the free-hand method, the scraper blade and handle are left intact. Place your left hand index finger below the scraper blade about 1/2 in. from the wheel, with your thumb holding the top of the blade. Rest your hand lightly on the table. With your right hand, hold the handle of the scraper at about a 6° angle to the wheel. Your right hand on the handle will determine the curve of the blade. Therefore, the closer to the end of the handle the less of a curve you will grind. You now move your left hand in a side-to-side sweeping motion across the face of the diamond wheel, holding your right hand still so as to act as the pivot point for the arc. Use a moderate pressure on the wheel and one or two passes will sharpen the blade. Do both sides. It is important to sweep across the whole face of the wheel so the wheel will wear evenly and stay flat (Fig. 2).

To use the grinder table as a guide, you adjust the tilt table to a 6° angle. Detach the scraper blade from the handle and place the blade on the table. With the index finger of each hand, hold the blade flat on the table and with your thumb hold the rear of the blade to apply moderate pressure on the wheel. Again sweep the entire face of the wheel following the curve of the blade. Be sure to keep the coolant flowing while grinding (Fig. 3).

MARKERS

Markers for scraping bearing surfaces are used to transfer the geometrical relationship of one surface to another, whether for a master gage or mating surfaces. Red lead and bearing blue are the most popular markers.

Powdered red lead is mixed with kerosene as a vehicle; a little machine oil is used to prevent drying. When first mixed to a paste consistency, the red lead is wet and difficult to use. It is preferable to wait about a week to allow the red lead to dry to a caked condition; it is then easy to use. When it is being used, a small amount of kerosene or a quick drying solvent such as trichlorethane is added to keep the surface wet and easy to

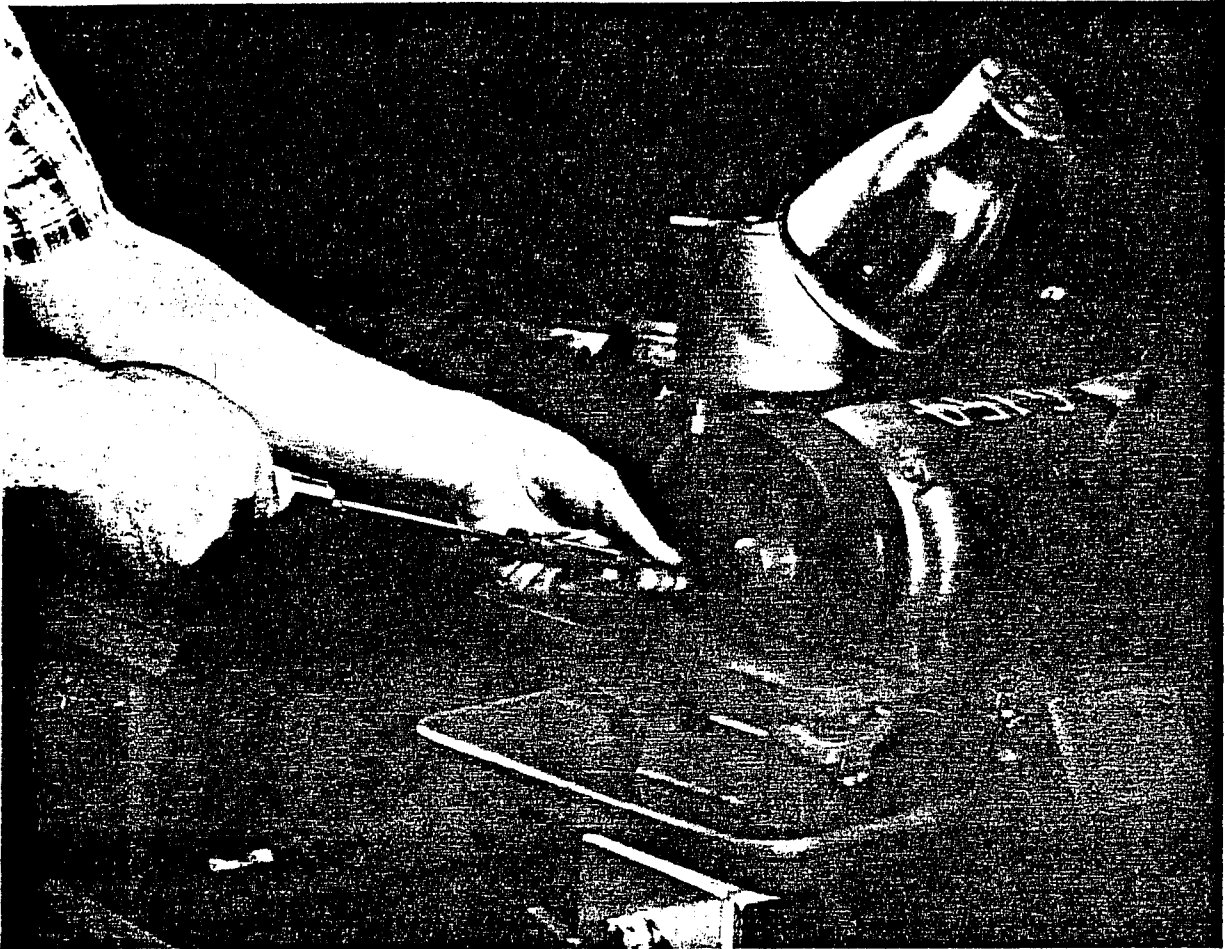


FIG. 2. Free-hand sharpening.



FIG. 3. Blade sharpening on the table.

spread (Fig. 4). The red lead is spread out on the scraped surface with a towel, then wiped dry and thin. It is important to have the red lead surface dry to prevent smears and false readings. A dry, dull red background enhances the blue marks making interpretation of the marks more accurate.

The bearing blue marking medium used for scraping is the commercially available Dykem Bearing Blue. The bearing blue is very oily when purchased so it should be partially dried before use; a simple method for drying is to put two or three tubes of the bearing blue in a flat, round container which has a lid. Level and smooth out the bearing blue and then place a tissue, such as a coffee filter, over it. Then fold an absorbent tissue and place it over the coffee filter. Replace the lid and let this set for a week. Replace the tissue as it becomes saturated with oil. The bearing blue should be dry and firm (Fig. 5).

With the bearing blue dry and ready for use, spread a thin layer evenly on the master gage or the larger of two mating surfaces. The bearing blue will then transfer to the red lead part to be scraped. It is advisable to use a darker or thicker layer of bearing blue when rough scraping and then allow it to thin out as the scraping becomes more precise.

MEASURING AND INDICATING

To attempt to name all types of measuring or indicating accessories used in hand scraping would be difficult, because this equipment varies from no tools necessary to exotic one-of-a-kind fixtures.

In scraping, 90% of measuring is a reference measurement which makes repeatability of the utmost importance. Repeatability depends directly on rigidity and quality of tools.

Some basic measuring tools used in various scraping procedures are finger-type indicator (Last Word), or the like, surface gage with a dovetail attachment, adjustable level, blade type square, round ground pins (dowel pins) various size parallels, indicator rods, micrometers, electronic indicators, and an indicating block (Fig. 6).



FIG. 4. Mixing red lead.

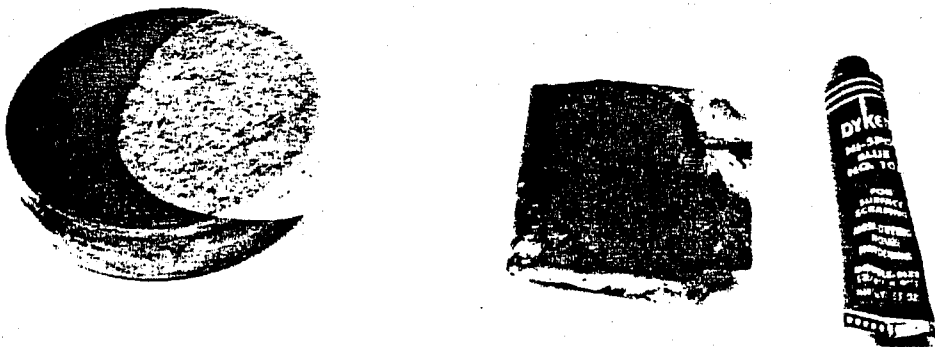


FIG. 5. Drying the bearing blue.

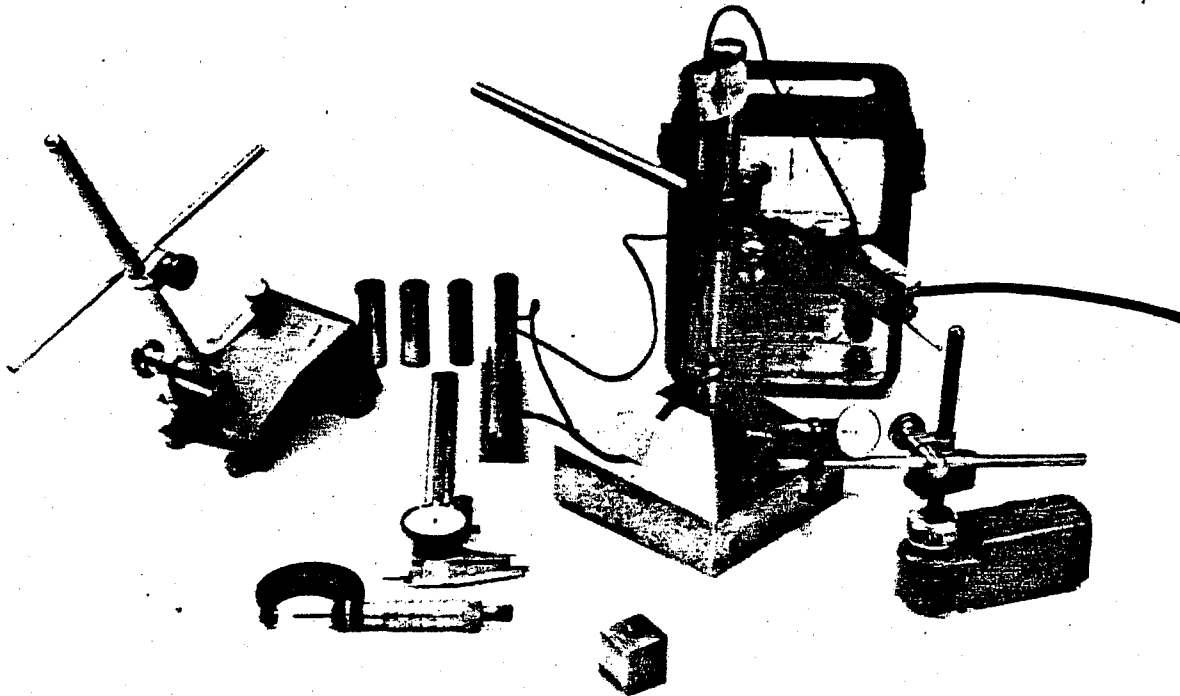


FIG. 6. Measuring tools.