

I saw an unusual sight on television recently in a programme about industry. A man was scraping a machine slide. In these days of mass production and ground slides it was a rare sight and it took me back 40 odd years to when I was fairly well on with my apprenticeship. A few of us older apprentices were put into the toolroom, one at a time, to learn to scrape. We were taught by a man who had scraped for a living at Archdales, the machine tool makers.

The task was to scrape a small surface plate about 12 in. by 10 in. on the working surface, with a smaller base, which made a recess at each end for fingers to get in and lift it. The plate was 2½ in. thick and quite heavy; when finished, it was ours to use. It had to be machined flat, parallel and square first and it was done on the Butler shaper, which normally did the bolsters. A shaped finish is ideal to scrape, it gives something to get hold of - that's what we were told by the toolmakers and they smiled a quiet smile while they said it...

There was no nonsense about drawing a scraper from the stores. Charlie, the ex-Archdales expert, found an old 10 in. hand file and we took it to the blacksmith, who forged it to shape and hardened and tempered it. It was then roughly ground to shape and the teeth ground off the edges; this was important because the sharp edges can hurt. Charlie then showed me how to sharpen the scraper - more about that later because there is a special way of holding it.

Charlie started me off on the bottom surface first and almost stood over me for the first couple of days making sure that I was going about it the right way. It was hard work and for the first few days my right arm ached from finger tips to shoulder and my hands became ingrained with a cocktail of red lead, cast-iron dust and engineer's blue. The red lead was used to smear on the plate before blueing, to

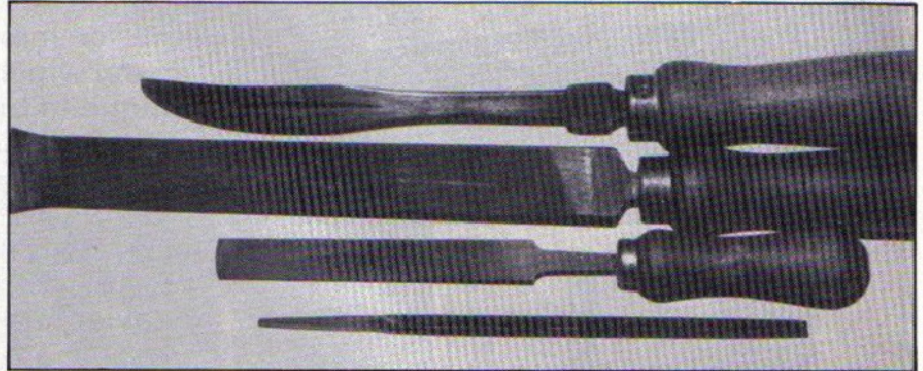
make the blue spots show better. When I began to get the hang of it, I was allowed to start on the working surface and, after a lot of hard work, the plate was finished to a standard of 20 spots per square inch. Square inches were ritually marked out at random on the plate and the spots counted to make sure. The toolmakers were only too happy to test for me. As a few days of my month were left, I scraped one of the toolmaker's plates, a larger one, 18 in. by 12 in. or thereabouts; toolmakers always work on the principle

that you don't keep a dog and do your own barking.

That was my introduction to what is a very good method of getting a surface flat. It isn't a skill which I've used frequently and if I want to do some scraping I have to practice first, but I soon get the touch back and can still get a surface quite flat.

### Reasons for scraping

Surfaces are scraped mostly for accuracy. Especially where filing isn't good enough for finish or flatness. Gib strips,



Scrapers: from top to bottom, half round, medium flat, small flat and three square - all made from old files.

# SCRAPERS

Scraping is an art which was essential in engineering at one time and which all apprentices were required to become proficient in. It still has its uses in the home workshop and if one has to scrape work then it should be done correctly and efficiently. R. J. Loader describes, in a light-hearted way, how he learned, and passes his expertise on to readers

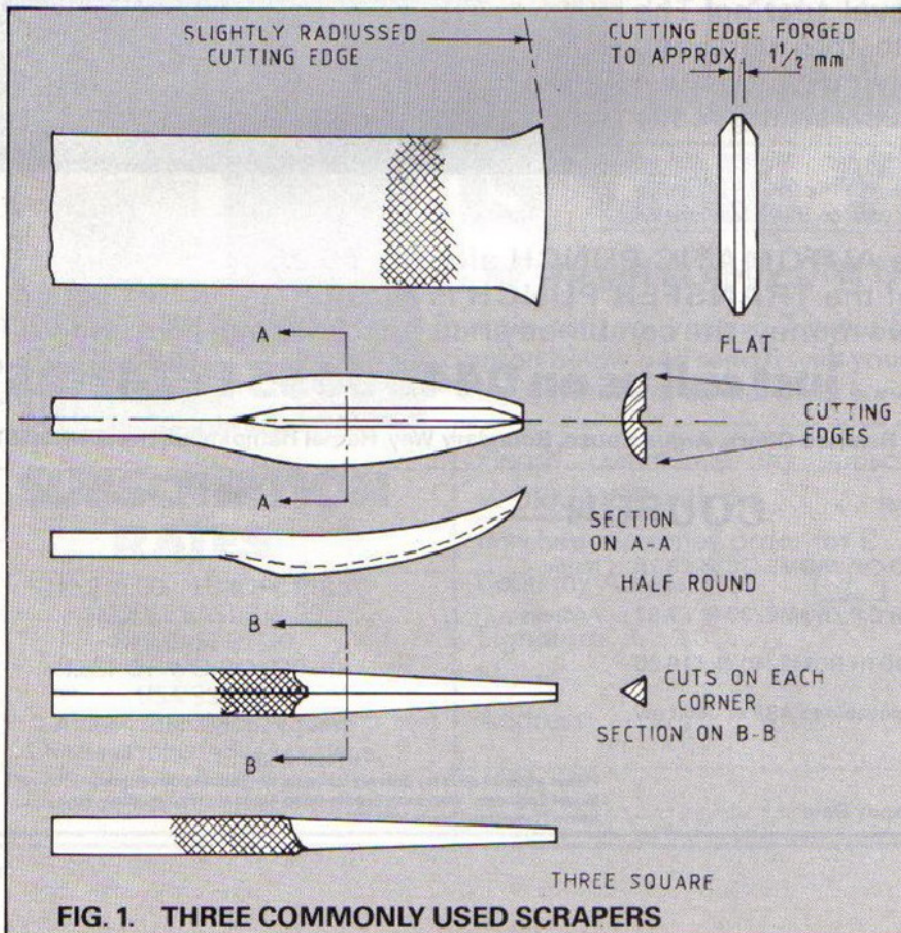
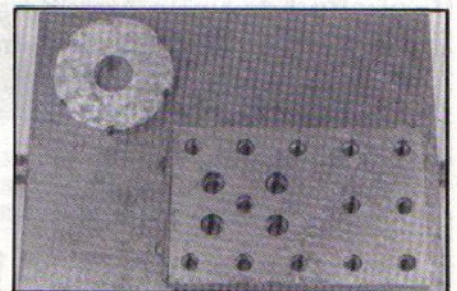


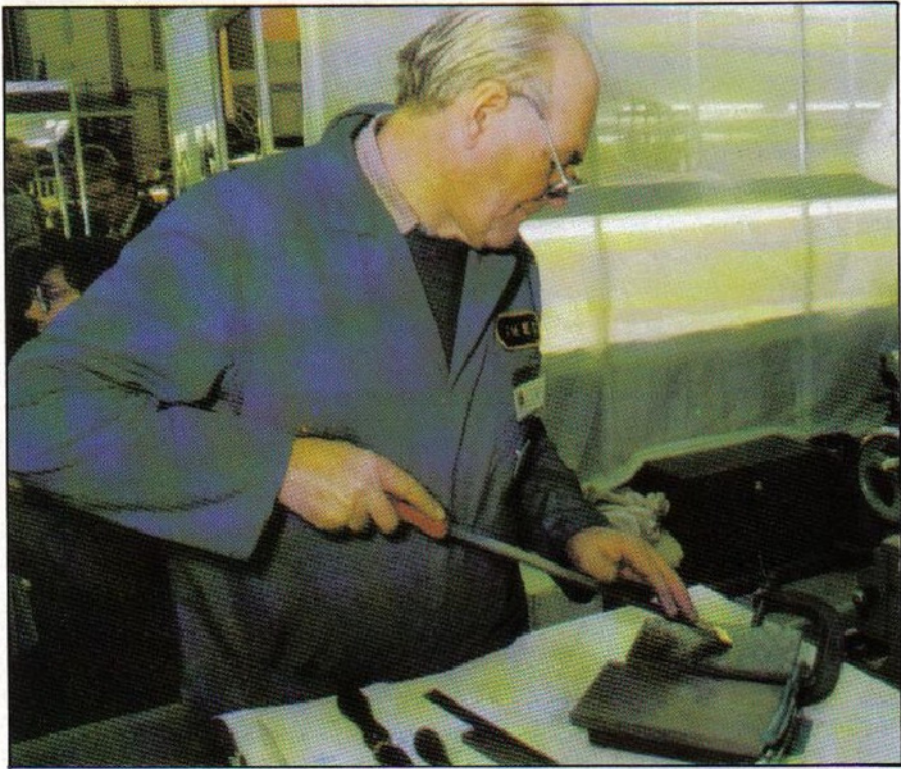
FIG. 1. THREE COMMONLY USED SCRAPERS



A surface plate scraped by the author, with a small lathe milling table and a disc, the latter chequered.

machine slides and flat bearing surfaces can all be scraped and high spots or patches picked off without touching the rest of the surface. It also breaks up a surface which would otherwise be 'sticky' because it is too flat, like a ground one. The very small depressions made also create oil pockets. Scraping can be decorative and improve the appearance of a finished part no end by scraping a pattern. The two usual patterns are feathering, which is a series of crescents, and chequer, which is a chessboard pattern. Of the two, chequer is the easiest to do. I could feather once but would need a great deal of practice these days.

The process is most effective on the more brittle metals and the best of the lot is cast-iron.



Scraping demonstrated at the 1990/91 ME Exhibition.

**The tools**

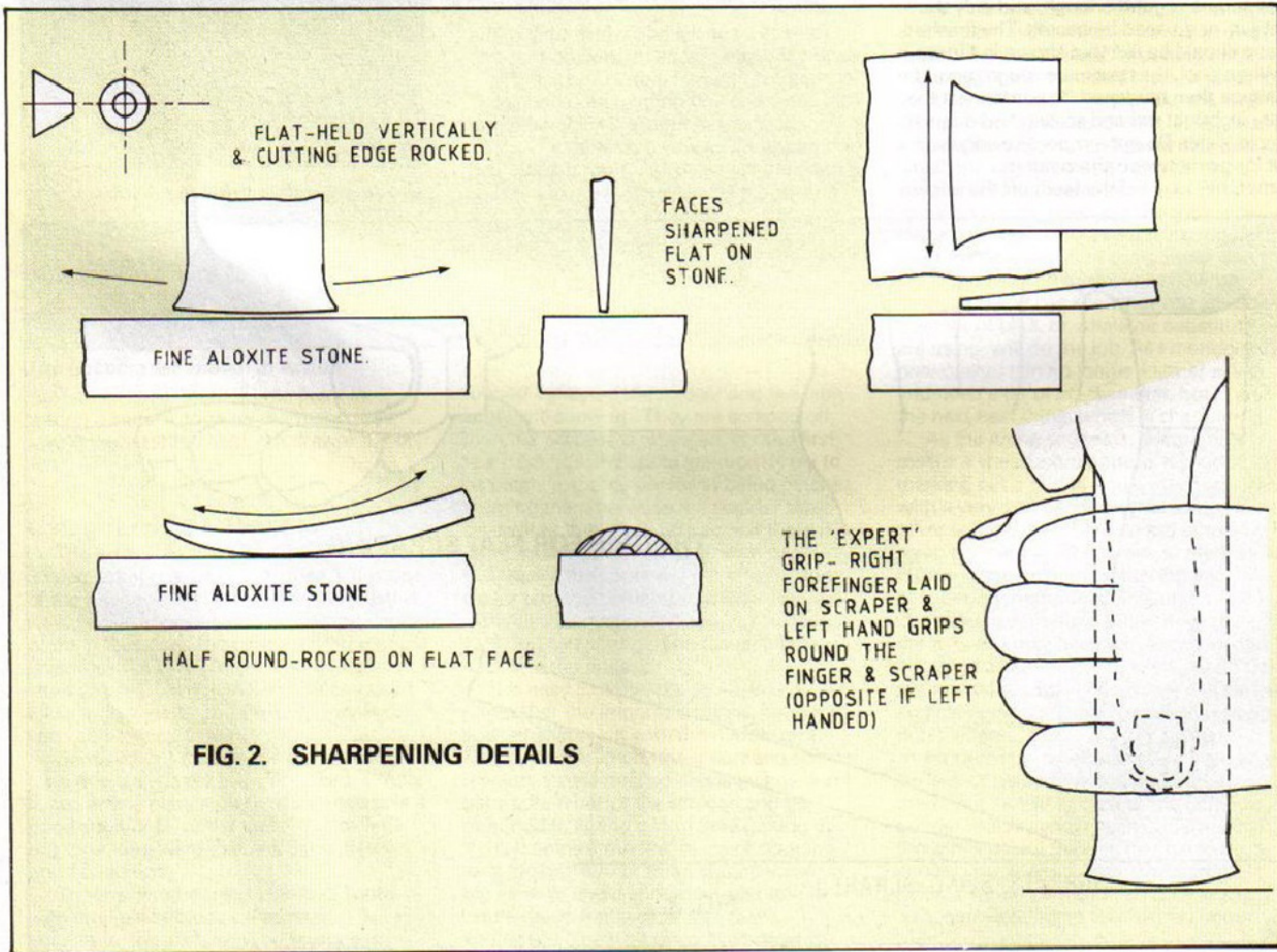
Scrapers can be bought but the steel they are made from is of the same type as files are made from, so it is an ideal use for worn out files.

A three-square is the easiest to make. Just select a three-square file which is past its best, grind the teeth off the first inch or so, then stone to a fine finish. As well as being the easiest to make, it is the easiest to use because it is a deburring tool, used for holes and curves. I use two sizes, one made from a double-ended saw file, which has sides of about 1/4 in. The other one is a miniature one for very small holes, made from a broken three-square Swiss file.

The half-round involves a bit more work; an old 6 in. or 8 in. half-round file will be suitable. First soften the file by heating to bright red and leaving it to cool in the hearth where it was heated, so that it cools as slowly as possible. When cold, it can be filed to get rid of the teeth and shaped with a recess in the flat face. To bend it to the radius it will need heating to a bright red or orange and tapping round curve. The completed shape is shown in **Figure 1**.

Harden by heating to bright red, quenching in water vertically, then temper to the palest straw colour possible. Stone to a fine

# S & SCRAPING





**Sharpening the sides of a flat scraper.**

finish on a fine oilstone.

Half-round scrapers are used for picking off the high spots from large bearings or bores which shafts have to fit precisely, such as the arbor bushing of a horizontal milling machine or the spindle bearings of a lathe which has solid bearings. They can also be used for deburring large holes and curves, among other things.

Flat scrapers need a bit more work because they have to be forged to spread the cutting edge and thin it down. Forging temperature is at least orange, yellow if the heat source is good enough, and only the first  $\frac{1}{2}$  in. or so need be heated. The finished shape should be like that shown in **Figure 1**. When cool, the tip can be rough ground to shape then hardened. To harden, get the first  $\frac{1}{2}$  in. bright red and scaling and quench in cold water. Do not temper, the edge will last longer between sharpenings. Remember to grind the teeth off the edges,

especially where it will be held.

### Sharpening

The sharpening of any tool is important because the finish will only be as good as the finish on the tool. For flat scrapers, especially, it is critical – so this one comes first. It has to be stoned on the faces and the edge to as high a degree of sharpness as possible. Rough stoning can be done with a medium stone, but the finishing should be on an aloxite stone of *as fine a grit as possible*, using plenty of oil or paraffin.

There is a special grip which Charlie the expert showed me; he insisted on that grip for the best results. I didn't question it 40 odd years ago and nothing has changed my mind since, so **Figure 2** shows the grip and method. The way a scraper is sharpened varies slightly from person to person and it is unlikely that anyone could

scrape effectively with anyone else's scraper.

After sharpening, any oil or paraffin should be wiped off with a rag. Resist the temptation to try the edge with thumb or finger, it will dull it.

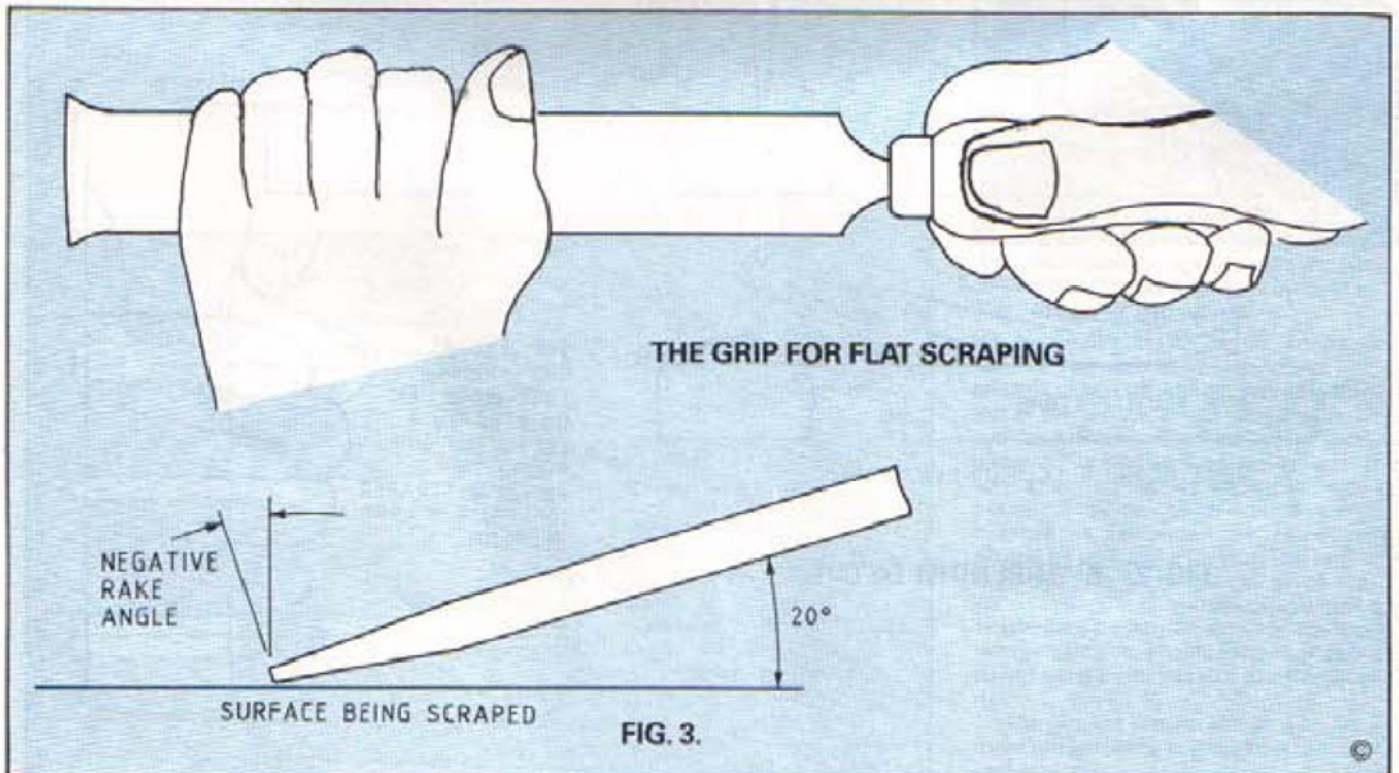
The half-round is sharpened by rocking it to and fro on the fine oilstone with oil or paraffin just the same as the flat except that there is no special grip. The curved side should need no treatment.

Once a three-square scraper has been finely stoned, it will only need an occasional rub on a fine stone to keep the edge in good condition.

Take care when handling scrapers, the cutting edges don't look very sharp but if handled the wrong way they can cut fingers very well. Try to keep them apart



**The small milling table in position.**



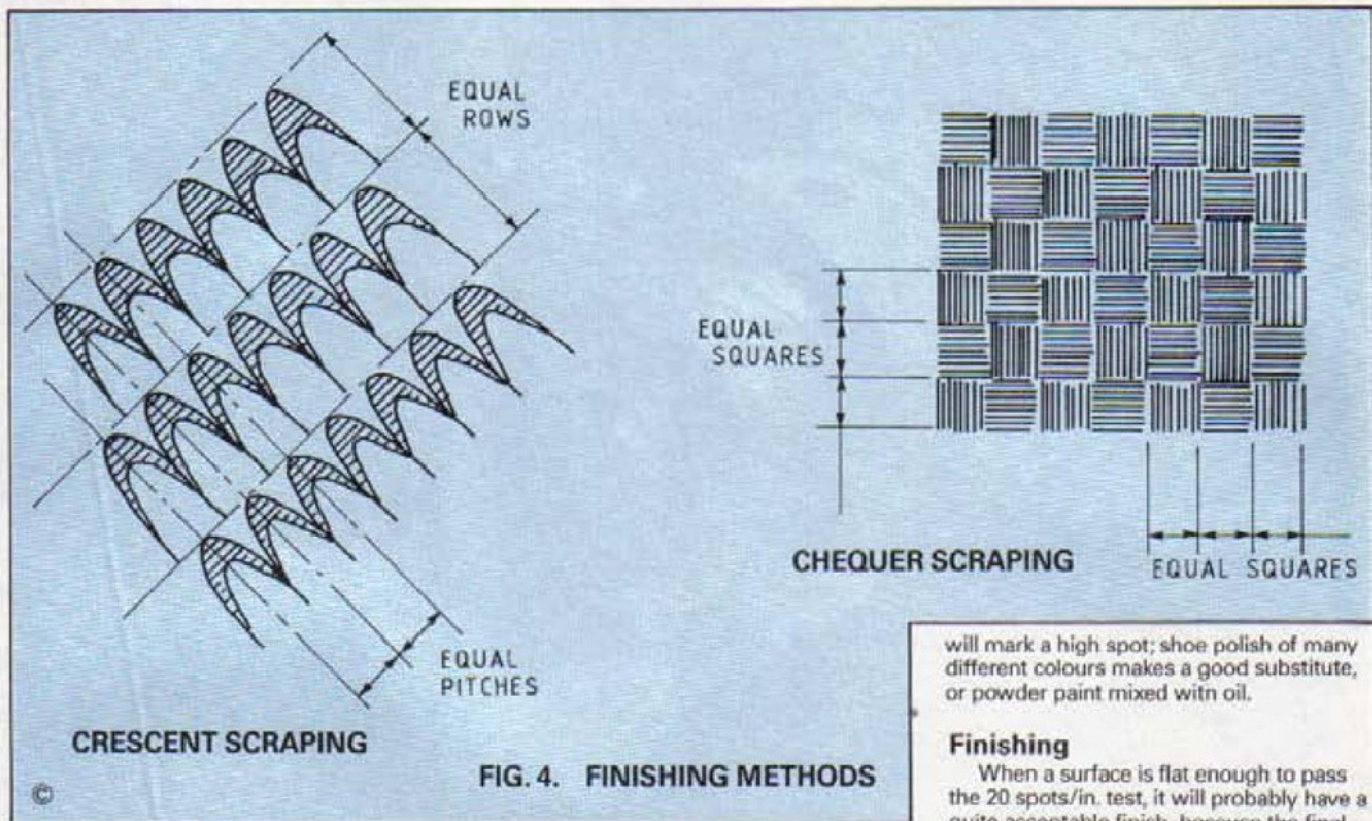


FIG. 4. FINISHING METHODS

will mark a high spot; shoe polish of many different colours makes a good substitute, or powder paint mixed with oil.

### Finishing

When a surface is flat enough to pass the 20 spots/in. test, it will probably have a quite acceptable finish, because the final strokes will have been very short and each time the surface is blued the scraping direction will be changed 90 degrees. It will, however, look even better if it is feathered or chequered.

Feathering is done by using one corner of the cutting edge of the scraper as a pivot and wobbling the scraper forwards over the work so that the radial cutting edge makes a crescent shaped mark. It gives the scraper a swooping motion like the flight of a small bird. If the movement is diagonally across the work, the crescents nice and small, the rows close and crossed by a second set at 90 degrees to the first, it looks very hand-finished. The trick is to make sure that the crescents are regular and that the corners of the scraper don't dig in. So that the marks will show up nicely and you can see what you are doing, a smear of blue, or whatever substitute you are using, will do the job. As I mentioned previously, I can no longer feather at will and need a bit of practice first, but I can do the next best thing, which is chequering.

As the name suggests, chequering makes a chessboard pattern. It is done by marking out a grid of equal-sized squares with a very soft pencil and scraping every other square, then filling in the others by scraping them at 90 degrees to the first set. Figure 4 shows both feathering and chequering methods of finishing. Chequering isn't quite the inferior one of the two, as I may have suggested. In fact, if it is done accurately, it is very easy on the eye and when the light catches it at certain angles, there is a 'now you see it, now you don't' effect.

Modern machine tools often have a surface or two with a scraped pattern on them, but looked at closely, the cutter or grinder marks can be seen underneath. It is, though, a useful thing to be able to do, and should you invest in your own surface plate, it would be nice to be able to say, 'yes, genuinely hand finished, by yours truly'.



The flat scraper shown in action.

from other tools, there is little point in putting a superb edge on them and then having them rattle about in a drawer full of files.

### Using the flat scraper

The scraper is held at an angle of about 20 deg. and gripped as in Figure 3. It is one of the few tools which cuts with a negative rake, so it is impossible to dig in. The centre of the radius does the cutting and the metal is removed in very small amounts with short strokes. Like most hand processes, it takes time to learn and the only way is to keep at it and be patient.

Some sort of master surface is needed for a reference, ideally a surface plate. If there is no surface plate a piece of plate glass is a good substitute, or the table of a milling machine, providing that it is flat and in good condition.

The master surface is smeared lightly with engineer's blue or a suitable substitute, the surface to be scraped is

rubbed lightly on the master and the high spots will show up. They are scraped off, then the process is repeated. For the first few rubbings, the spots are more likely to be patches, if they persist in being patches, try filing them because the scraper takes off so little that it will take ages if there is a bump of a thousandth of an inch or so. Eventually, the spots will get smaller and closer together. When any marked square inch has 20 or more spots in it, you have won and can start getting the circulation back into the fingers.

It is easy to write, not so easy to do, so remember the important things. Keep the scraper sharp, cut with the middle of the radius, start at the furthest part and scrape towards the nearest so that shavings don't get trapped under the scraper, and be prepared to spend a long time getting it right. It helps if the first piece of scraping isn't too big; two or three square inches is big enough and it should be cast-iron or brittle brass. Remember too, that engineer's blue isn't the only stuff which