

**Scraping of Plane Surfaces – Course: Technique for Manual Working  
of Materials. Methodical Guide for Instructors**



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# Scraping of Plane Surfaces – Course: Technique for Manual Working of Materials. Methodical Guide for Instructors

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## 1. Objectives and contents of practical vocational training in the working technique of “Scraping of Plane Surfaces”

By concluding their training, the trainees shall have a good command of the working technique of “Scraping of Plane Surfaces”. Therefore, the following objectives must be achieved:

### Objectives

- Knowledge of purpose and application of scraping and checking against master plates.
- Good command of the various working techniques of scraping and surfacing as well as capability of planing workpieces.
- Capability of selecting the appropriate tools and accessories and of using them properly.
- Capability of making decisions on quality independently.

Therefore, the following contents have to be imparted to the trainees:

### Contents:

- Purpose of scraping
- Scraping tools
- Purpose of checking against master plates
- Testing tools and accessories for checking against master plates
- Action of scraping
- Technological process of planing flat surfaces.

## 2. Organizational preparations

In order to guarantee a trouble-free development of the instructions, exercises and practical work it is necessary to prepare this training appropriately.

### 2.1. Preparations for instructions on labour safety

Prior to the exercise a brief instruction in the proper use of working tools has to be given. This comprises also

hints for accident-free work. The main emphasis is to be laid on:

- Flawless scrapers must be used only
- The scraper handles roust not show any cracks
- Workpieces roust be clamped in such a way that they do not become distorted by the clamping forces
- Scraped surfaces must be protected from damage – they must be covered
- Surfaces of tools for checking against master plates must be protected from damage – to be oiled after use!

Familiarity with these hints has to be confirmed by the trainees' signatures in a control book.

## 2.2. Provision of teaching aids

- For the purpose of demonstrations during the instructions a small surface plate has to be installed at a workbench, and a vice should also be at the site.
- The "Trainees' Handbook of Lessons – Scraping of Plane Surfaces" is to be handed out to the trainees in sufficient numbers.
- When using the transparencies series of "Scraping of Plane Surfaces", check whether they are complete (transparencies nos. 6.1. – 6.3.) and whether the overhead projector is functional. (Check the operation conditions at the place of work and make sure of the proper mains supply I)
- Surveys etc. which are to be written on the blackboard have to be completed prior to instruction.
- All the tools and accessories mentioned in section 3 should be kept ready for illustration purposes.

## 2.3. Provision of working tools and materials

- Sufficient copies of the "Instruction Examples for Practical Vocational Training – Scraping of Plane Surfaces" must be handed out to the trainees to provide them with the theoretical foundations of the exercises to be carried out.
- The initial materials necessary for the exercises have to be prepared and laid out in sufficient numbers according to the materials mentioned in the "Instruction Examples...".
- Each trainee is to be provided with a workbench at which the respective clamping devices and surface plates are firmly fixed and which is sufficiently lit.
- The trainees' workbenches have to be fully equipped with tools and accessories according to the envisaged exercises.

Recommended basic equipment:

- steel rule, bevelled steel straight-edge, vernier caliper
- bastard and smooth files 200 – 300 mm (flat)
- hand hacksaw
- locksmith's hammer, aluminium hammer
- flat scraper, pull-type scraper

- checking ink, inking block, levelling straight–edges
- bench–type or column–type drilling machines with the appropriate clamping devices (machine vice, holding clamps, C clamps) for necessary preparations (drilling) in certain exercises.
- Before the exercises are carried out, the drilling machines’ compliance with the requirements of labour safety has to be checked.

#### 2.4. Time schedule

Time planning is recommended for the following training stages:

- introduction to the working techniques in the form of instructions
- necessary demonstrations
- job–related instructions for preparing the exercises
- carrying–out the exercises
- recapitulations and tests.

The necessary time share depends on the respective training conditions. Most of the time is to be allocated to the exercises.

### **3. Recommendations for practical training in the working technique of “Scraping of Plane Surfaces”**

The following paragraphs comprise proposals on conducting trainee instruction, the demonstration of working techniques as well as the exercises and tests. The following sequence of stages is recommended:

- Introductory instruction with demonstrations from the “Trainees’ Handbook of Lessons”.
- Exercises in scraping according to the “Instruction Examples 6.1. – 6.5.”.
- Final test of theory knowledge based on the contents of “Examples for Recapitulation and Tests”.

Practical skills should be evaluated immediately after handing over the finished workpieces. Knowledge of theory should be constantly checked. However, it is recommended that a final test paper should be written after concluding the exercises.

#### 3.1. Introductory instruction

If possible, this instruction should be conducted in a classroom, Make sure that the trainees put down necessary and supplementary notes or answers to questions in their “Trainees’ Handbook of Lessons”.

Instruction can be carried out on the basis of the main points contained in the “Trainees’ Handbook of Lessons”.

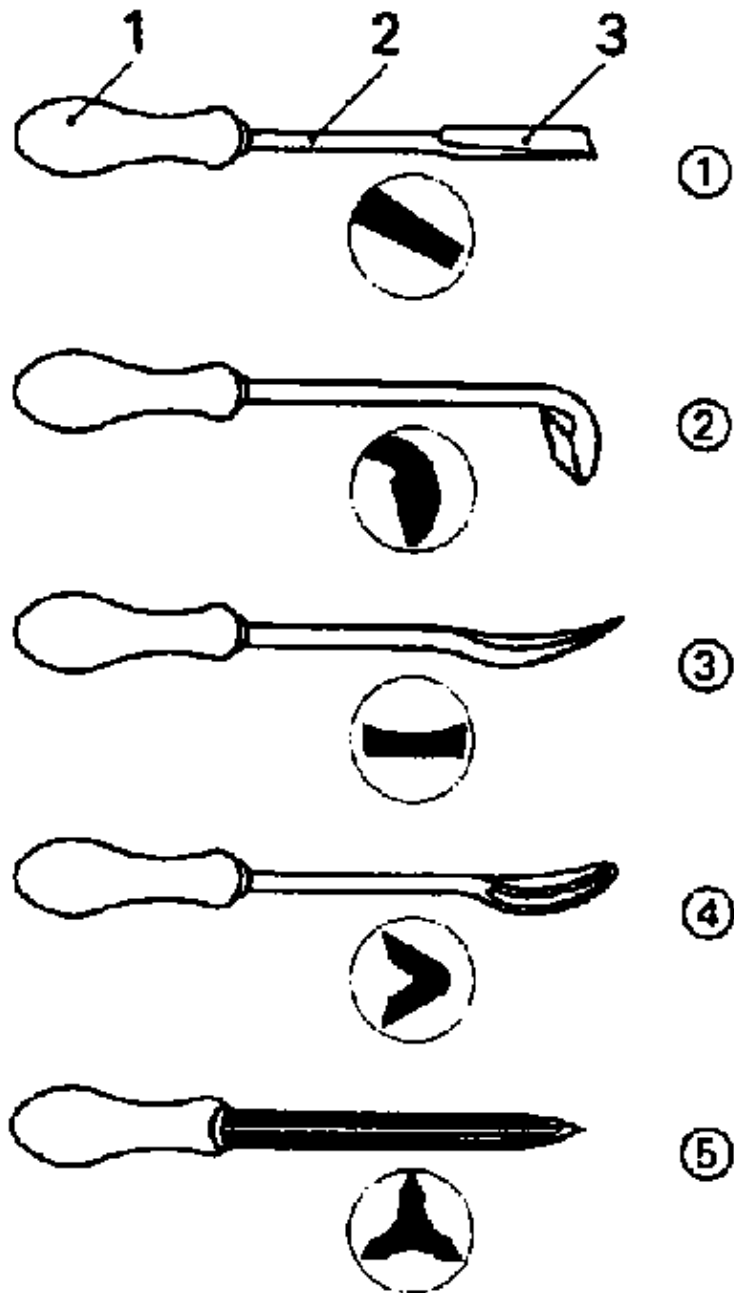
#### Purpose of scraping

This subject can be explained to the trainees by way of a short lecture. The instructor has to emphasise that manual scraping ranks among the high–grade manual techniques and that this working technique is mostly replaced by machine processes in modern industry. However, the trainees have to understand that machine processes cannot be employed everywhere and that they are not always worth while.

#### Scraping tools

The following tools and their use should be introduced by showing some original tools and illustrations contained in transparency no. 6.1.

- flat scraper (push-type scraper)
- pull-type scraper
- curved bearing scraper (half-round scraper)
- three-square scraper.

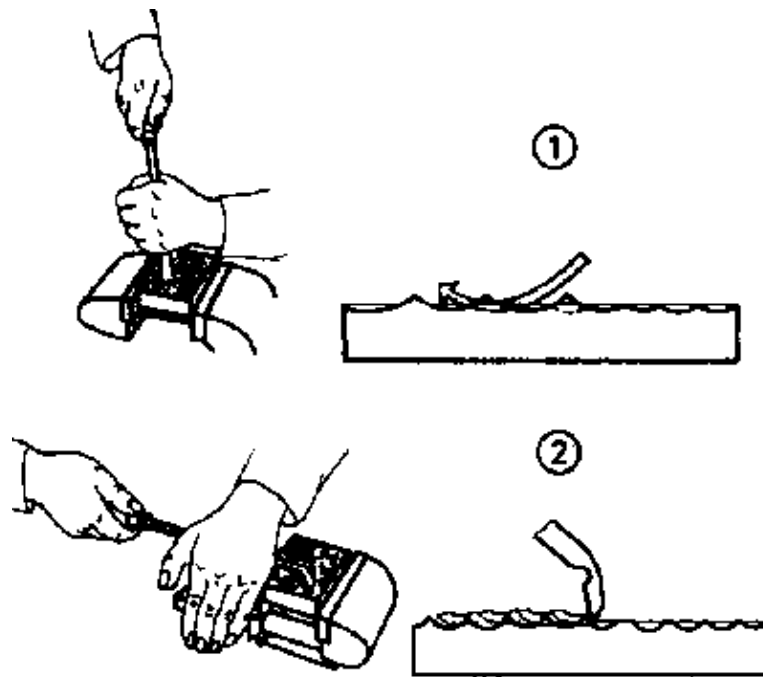


Transparency 6.1

Transparency no. 6.2.

can illustrate the use of flat and pull-type scrapers. Subsequently, it has to be stressed that these tools have to be ground absolutely sharp and whetted clean. The whetting has to be demonstrated, because it is rather difficult to give a clear-cut description of the motions involved.





Transparency 6.2

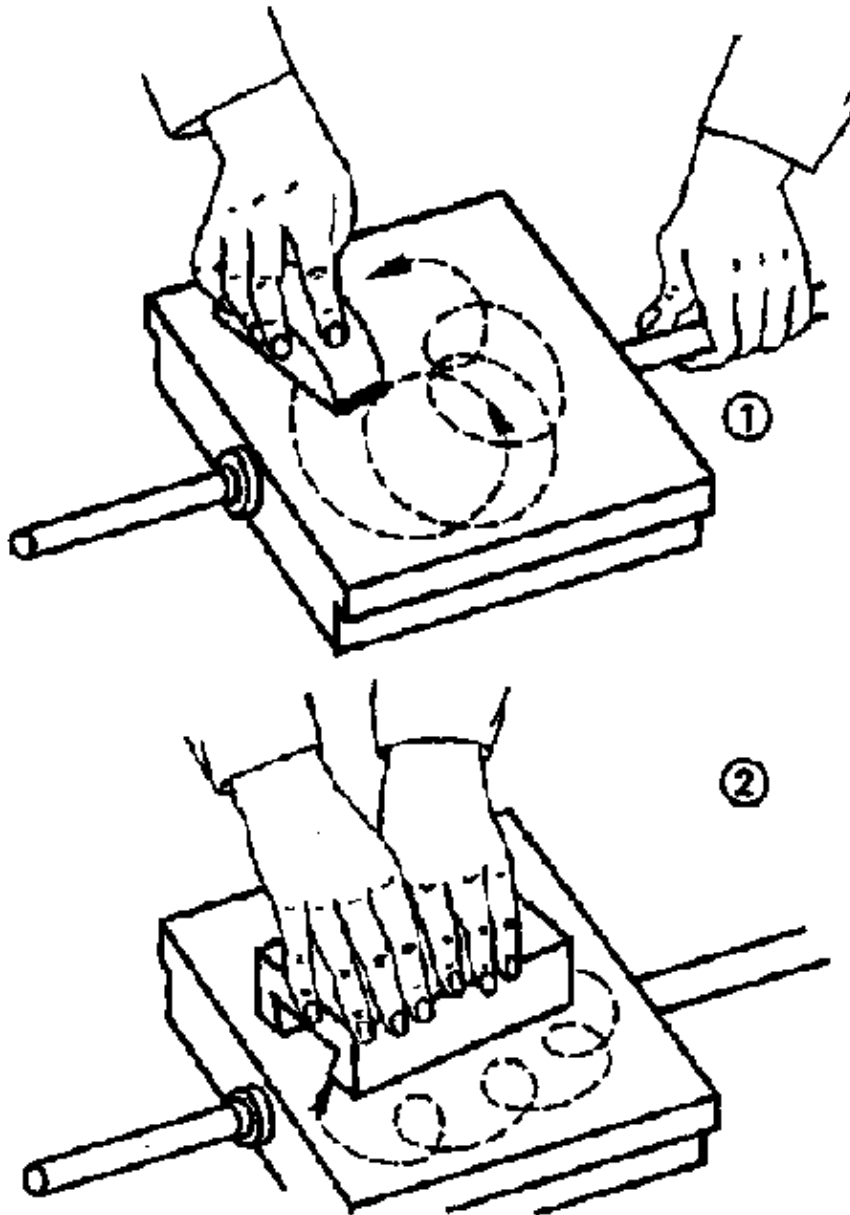
Purpose of checking against roaster plates

It is necessary to explain this quality checking technique to the trainees.

The instructor clearly points out that scraping and checking against master plates are two interactive processes.

Transparency no. 6.3.

will illustrate this working method.



Transparency 6.3

Testing tools and accessories for checking against master plates

- surface plate
- levelling straight-edge
- planing straight-edge
- planing tool for slide guides.

The following accessories are to be mentioned:

- checking ink
- inking block.

If the original tools are not available, the illustrations contained in the "Trainees' Handbook of Lessons" can support and supplement the instruction.

Action of scraping

Transparency no. 6.2. and the illustration contained in the "Trainees' Handbook of Lessons" supplement the instruction of this major topic. This includes a demonstration of the proper angle of inclination (45 degrees) as well as the characteristic movements of the hand when working with the scraper.

Technological process of planing flat surfaces

First, the individual steps of the process must be described and – if possible – they will be followed by demonstrations then.

This demonstration includes the following steps:

1. rough–scraping (pre–scraping)
2. checking
3. spot–scraping
4. finish–scraping and pattern–scraping

The “Trainees’ Handbook of Lessons” contains a detailed description of these steps. The trainees must avail of a good theoretical knowledge of these processes before they can begin their practical work. Therefore, it is advisable that the trainees should answer the questions contained in the “Trainees’ Handbook of Lessons”.

### 3.2. Exercises

If it has not been possible to include the individual demonstrations in the instructions yet, this shall be done prior to the beginning of the exercises.

Subsequently, it will be possible to commence with the first exercises contained in the “Instruction Examples for Practical Vocational Training”. However, it is necessary to prepare every individual exercise by a brief “job–related instruction” during which the trainees are shown a finished workpiece in order to demonstrate the objectives and purpose of this exercise.

The instructor must have finished such a workpiece by himself in order to be familiar with all the problems which might arise in producing such a workpiece.

Thus the instructor can mention the main points of evaluation as well as all the problems involved in manufacturing such a workpiece. During these instructions the Sequences of operations and the working drawings should be placed on the desks so that the trainees can make some notes therein.

All the trainees can carry out these exercises simultaneously, if the necessary material is available (availability of a sufficient number of working tools etc.). This being the case, all the individual exercises should be carried out by the individual trainees without being pushed by time limits.

If there are not enough tools available, the trainees have to be grouped in teams depending on the application of the various tools:

- team no. 1 – single–piece work according to the working drawings
- team no. 2 – scraping exercises according to the “Instruction Examples 6.1 – 6.4.”
- team no. 3 – planing of the lathe bed – Instruction Example 6.5. (maximum: 3 trainees).

If there are still trainees who cannot participate in the exercises, they shall be given a task to consolidate their skills in previously learned working techniques.

### 3.3. Examples for recapitulation and tests

This section comprises questions which are to consolidate and test the acquired skills and knowledge. Each question is provided with the respective answer. Questions which are also contained in the “Trainees’ Handbook of Lessons” are marked with the letter “A”.

1. What is the purpose of scraping?

(To perform a smooth finishing of pre–worked surfaces: they have to be smoothed, deviations of form have to be removed or patterns have to be created.)

2. What kinds of workpieces are mainly worked by scraping?

“A” (Sliding machine components – tool carriages, slide bearings.)

3. When is it useful to employ scrapers?

“A” (When fine finishing cannot be done by machines.)

4. Which are the scraping tools?

(Flat scraper, pull-type scraper, curved bearing scraper, three-square scraper.)

5. When is it useful to employ flat scrapers?

“A” (They are used for pre- and spot-scraping of plane surfaces, for removing bigger amounts of chips.)

6. When is it useful to employ a pull-type scraper?

“A” (It is used for finishing and pattern scraping of plane surfaces and for removing minimum amounts of chips.)

7. What is to be done after having ground a scraper?

“A” (Whetting of the cutting edge for removing burrs.)

8. What happens, if you omit this process?

“A” (The burrs will break off during the scraping action and this will result in notches on the cutting edge which, in turn, will make the cutting edge useless quickly.)

9. How is whetting to be performed?

(Both sides of the cutting edge of the scraper have to be alternately pulled over the whetstone in inclined position until the burrs are removed.)

10. What is the purpose of checking against master plates?

(It is a technique for checking the quality of scraped surfaces optically.)

11. What does “planing of a surface” mean?

“A” (Planing means a permanent alternation of scraping and checking against master plates until the surface is finished.)

12. Which testing tools and accessories do we need for checking against master plates?

(Surface plate, levelling straight-edge, planing straightedge, planing tool for slide guides, checking ink, inking block.)

13. How does the use of surface plates and levelling straightedges differ?

“A” (Surface plate: used for small- and medium-sized workpieces which are moved over the plate

levelling straight-edge: used for long and narrow surfaces of workpieces; the straight-edge is moved over the workpiece.)

14. What is the purpose of using checking paste?

“A” (Checking paste will make visible irregularities on the worked surface.)

15. How are the chips removed when scraping?

(This is a squeezing process during which the material will be removed at a cutting angle of more than 90°.)

16. Which are the characteristic stages of planing a flat surface?

“A” (Pre-scraping, checking, spot-scraping, checking, finish-scraping.)

17. What is typical of pre-scraping processes?

“A” (Long and powerful pushes with a flat scraper over the whole surface and diagonal to the tool marks are typical of the pre-scraping processes.)

18. What is typical of spot-scraping processes?

“A” (short and curved pushes with a flat scraper over the peaks of the surface with frequent changes of directions are typical of spot-scraping processes.)

19. What is typical of the finish-scraping processes?

“A” (Gentle pulling of the pull-type scraper over the peaks of the surface is typical of finish-scraping processes.)

#### **4. Application of the working technique of “Scraping of Plane Surfaces”**

The sequence of exercises can follow the order of the 5 exercises mentioned in the “Instruction Examples for Practical Vocational Training – Scraping of Plane Surfaces”.

These “Instruction Examples...” also comprise a list of materials (initial material, hand tools, measuring and testing tools, accessories) and a sequence of operations as well as an illustrative working drawing.

Thus, the trainees avail of the necessary information to begin their exercise-related work.

Should the quality of the produced workpieces be considered insufficient, the trainee has to carry out comprehensive preliminary exercises. To do so, any waste parts will do. If the respective skill has been practised sufficiently, the envisaged workpiece can be produced.

The following hint should be taken into consideration:

Scraping can be practised on pre-worked parts. The production of component parts and their assembly can be done by other trainees earlier.

Should the proposed “Instruction Examples...” not be used in the exercises, then it is also possible to select other work-pieces.

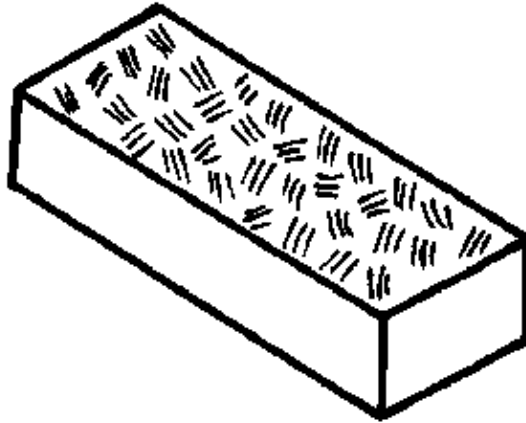
In this case all the working techniques described earlier should be also practised when working these parts.

#### 4.1. Instruction Examples

What follows is a brief description of the individual instruction examples in order to give a survey of those workpieces on which the previously acquired knowledge can be verified:

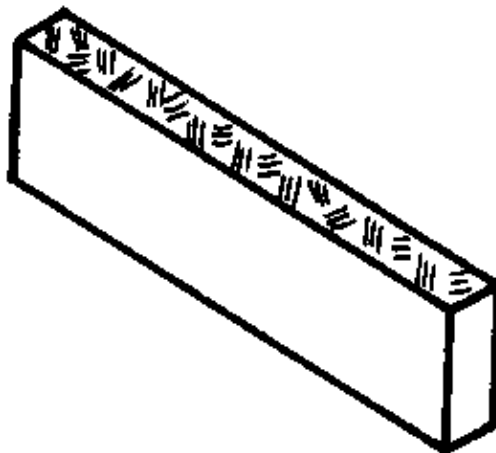
##### Instruction Example 6.1. V-block

The trainees will practise the flat-scraping process on a flat steel surface (without given dimensions). Flat scrapers will be employed only.



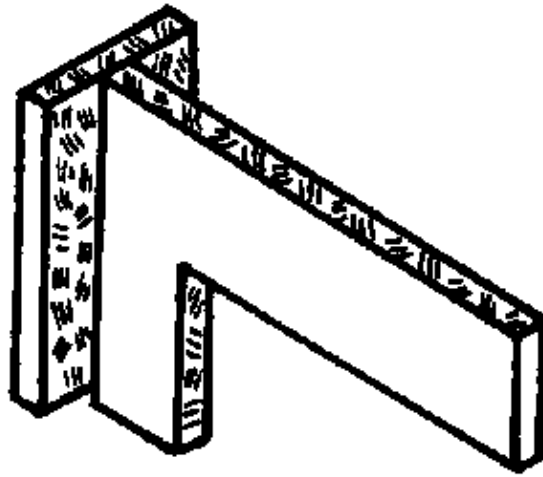
##### Instruction Example 6.2. Steel straight-edge

Two parallel, narrow surfaces of flat steel are worked with the flat scraper first and with the pull-type scraper then. After hardening the surface, the straight-edge can be used in the workshop.



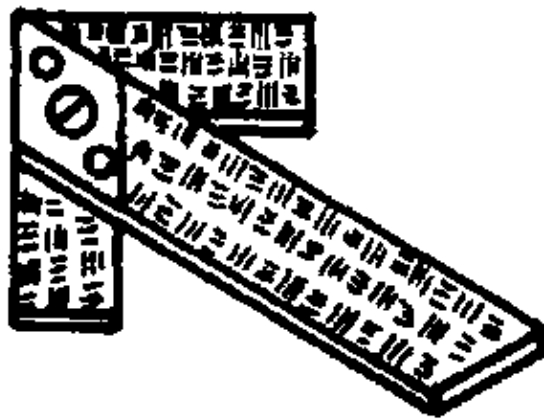
##### Instruction Example 6.3. Try Square

Two or, resp., three narrow surfaces of flat steel are worked in such a way that they are parallel to each other – in accordance with given dimensions. Parallelism will be checked by using dial gauges. After hardening the surfaces, the try square can be used in the workshop.



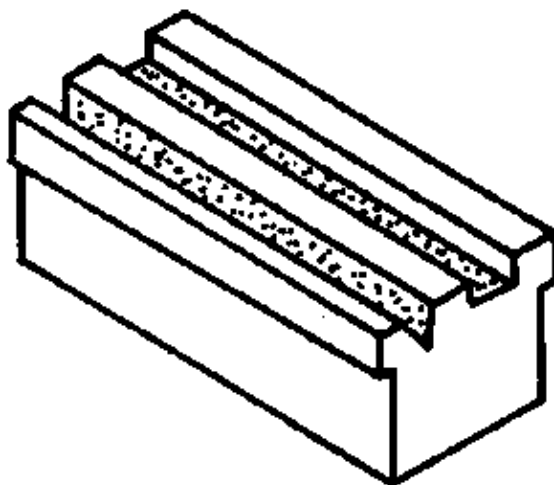
Instruction Example 6.4. Centre Square

After the production of the components, this device can be used to practise pattern scraping of braiding patterns on steel sheets, After hardening the surfaces this centre square can be used in the workshop.



Instruction Example 6.5. Lathe bed

Planing will be practised at an available lathe bed employing all the necessary techniques of scraping and checking against master plates.



4.2. Criteria for practical training

It is recommended to determine some major points of observation and evaluation of the work to be performed.

The following criteria can serve as a guideline:

#### Pre-scraping process

- Does the trainee employ long and powerful pushes which run diagonal to the working marks?
- Does the trainee apply the scraper with varying scraper positions?
- Does the trainee exert an increasing pressure?

#### Checking against master plates

- Does the trainee apply very thin films of the checking ink?
- Does he spread the checking ink evenly over the whole surface?
- Does the trainee recognise the surface appearance, and is he in a position to interpret it?

#### Spot-scraping

- Does the trainee apply the flat scraper in short, clearly defined curves?
- Does the trainee persistently work the peaks?
- Does he check regularly?
- Does he achieve the ratio of three peaks to one valley?

#### Finish-scraping and pattern scraping

- Does the trainee apply the pull-type scraper correctly?
- Is the trainee in a position to produce a regular pattern?

## **5. Captions and legends of the “Scraping of Plane Surfaces” transparencies series**

Transparency no. 6.1. Kinds of scrapers

(1) Flat scraper

1 – handle

2 – shank

3 – blade

(2) Pull-type  
scraper

(3) Half-round  
scraper (solid)

(4) Half-round  
scraper (hollow)

(5) Three-square  
scraper (hollow)

Transparency no. 6.2. Kinds of  
finish-scraping

(1) Scraping with  
pushing actions

(2) Scraping with  
pulling actions



Transparency no. 6.3. Checking against master plates

(1) Spreading the checking ink over the surface plate using an inking block

(2) Rubbing of the workpiece on the surface plate

