VISUAL LESSON SHEETS FOR TEACHING SELECTED CRAFT UNITS

by

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CHAPTER I

INTRODUCTION

Visual aids, whether or not thought of under such terminology, have long been used in the teaching profession. It is through one of the many types of visual aids that the writer has attacked the problem of producing a set of visual lesson sheets that will assist in the teaching of craft work. The sheets serve as a teaching outline -- one that can be used by pupil and teacher alike and at a saving of both time and effort for each.

There are available many excellent books on woodwork, sheet metal, and other phases of the shop program, some of which texts touch on the fields selected. However, since texts must of necessity be general in nature, they do not lay sufficient stress on certain primary skills necessary to the completion of specific jobs. Then, too, an attempt has been made, through the use of these visual lesson sheets, to correlate more closely the informational and the manipulative side of the work by so placing the pertinent points that they are easily obtained when needed.

It is hoped that a contribution has been made which will lend some assistance to those who wish to engage in craft teaching. Through the efforts of many it may be possible to arrive at a more practical, efficient, and educationally sound procedure for the teaching of work in the craft field.

Statement of the Problem

The problem was selected in an attempt to:

1. Show the manipulative processes of certain basic operations in step form, in order to provide simplicity and accuracy of comprehension for the student.

2. Give a more adequate concept of the technical methods used by a practical craftsman, or one employed in a commercial shop.

3. Provide an opportunity for "consumer education", important in the training of a generation of "shoppers". Craft work, with its many sidedness, provides a sound basis for intelligent shopping in several fields.

With the proper use of visual aids, much time can be saved for both teacher and pupil. Getting across detailed points in a demonstration is often quite difficult, but the use of a visual aid in

conjunction with the demonstration simplifies the problem for both parties and is frequently a great saver of time and temper. The use of the flat picture advocated in this study might be compared with the use of a library. In the library the student can study a book (print and illustrations) as long as necessary. If he wishes to correlate this visual learning with verbal learning, he can do so easily. Hence the use of the flat picture, in conjunction with printed instructions and the demonstration, lends itself admirably to shop instruction and puts particular emphasis on that major problem of individual differences.

It is not always possible, nor practical, to take students into a commercial shop or into a great manufacturing plant, even though such shop or plant may be located at a convenient point. Methods vary in different shops, and even in the same shop from time to time, dependent upon contingent circumstances. Economic conditions in the particular field concerned, experience with the methods used by the person in charge of production, and other factors of like nature exert much influence. With this in mind, the visual lesson sheets used herein will, it is hoped, give a student some concept of the workings of a commercial shop. He may thus

establish a criterion in relation to his own school shop. This criterion is not for the purpose of comparing quantity of production but rather for comparing quality in relation to parallel constructional steps. Above all, it shall aid the pupil to realize that, to the best of its ability, the school situation, though necessarily limited in scope, parallels that of industry. In addition, the writer believes that this procedure offers an excellent opportunity for consumer education. After access to much information and illustrations on articles of high standard the pupil should have a better foundation for judging the standards of workmanship and quality.

Reich and Siegler (30:345) remark as follows:

> In judging goods our real guarantee is the integrity and intelligence behind the manufacture of the article but we can think of the following in making a purchase:
>
> 1. The workmanship factor. Does the article show signs of care and intelligence in the construction?
>
> 2. The safety factor. Is there danger of cutting oneself, of breaking something, or of tearing something in the use of the article? Is one's health involved?

3. The durability factor. Is the article heavy, properly joined, and rustproof?

4. The cleanliness factor. Is it easy to clean?

5. The use factor. Is it a valuable addition to the household?

Purpose of the Study

Pupils differ not only in interests and ability but also in their capacity to understand quickly and to comprehend fully an explanation or demonstration in its entirety. The purpose of this study is to propose a method whereby a teacher may, in some measure, allow for these individual differences on the part of his students and yet afford them an opportunity for further study at their own comprehension rate. The plan allows repetition and review of the important points set forth both in the demonstration and in the explanation which must accompany it.

Limitation of the Study

This study was planned for the elementary level, seventh and eighth grades. Much of the material might also be used by pupils in upper grade levels. The writer tried the plan on a group of seventh and eighth grade pupils for two years. In addition, an opportunity

was presented to try the visual lesson sheets on a group of ninth to twelfth grade pupils and on an adult night school group for one year. Reaction from these groups led to the belief that the instruction sheets were workable and valuable for each group.

No attempt is being made to present the sheets as the ultimate in perfection; on the contrary, it was found that what was originally thought to be very workable material needed to be rewritten and re-illustrated to conform to the needs and interests of other groups.

A further limitation to the study is the difficulty of obtaining access to commercial procedure. The writer feels he was most fortunate in being admitted, with his photographic paraphenalia, to a number of commercial shops, for there are many processes that the average visitor is not permitted to see. In one plant visited, even the workmen, other than those actively engaged in the job concerned, were not permitted to view certain work in progress. In this instance, the work was of such nature that the general dissemination of knowledge regarding its constructional steps would be definitely and quickly detrimental from a business standpoint. Hence the study is somewhat limited by commercial jealousy and business practice.

Procedure in Making the Study

The procedure was to attempt to make available to the student a set of sheets listing the basic steps necessary for certain jobs, and illustrating the more difficult points by means of photographs. It is hoped these will aid in the comprehension of the procedure necessary for the successful completion of the particular job at hand.

The projects to be used were selected first. After selection, they were broken down into their major operations, points to be illustrated were singled out, the photographs were made and finally the sheets were assembled and turned over first to pupils for practical test and then to craftsmen for rating in light of their experience. Those chosen were craftsmen who had had at least fifteen years experience and who were rated as experts by other workers in their field and by employers. While fifteen years was set up as an arbitrary minimum, the trade experience of the eight men rating the metalcraft sheets ranged from eighteen to forty-three years. Of this group, three had actively engaged in the teaching profession.

In respect to the Lapidary section of the visual sheets (appendix #2) difficulty was experienced

in reaching individuals qualified by light of practical experience, to rate the material. The two individuals who checked the sheets were at the time actively engaged in teaching the craft and had been active in lapidary work for some years. It is perhaps significant that until the past year, there were but two classes in lapidary in California; hence the difficulty in obtaining individuals with teaching experience, for checking purposes.

CHAPTER II

HISTORICAL BACKGROUND

Visual Aids

The origin of visual aids is as antiquated as the history of man. The ancient Egyptians decorated the tombs of their Pharaohs with charts and drawings of events and activities in the lives of the ruler and his people. The American Indian used a like procedure in recording events of his life; some of such visual aids of the cliff dwellers are still entirely clear and visible. Present-day civilization, if it may be termed such, makes elaborate use of visual aids to preserve for posterity the events of our time; as witness the cylinder sunk at a recent World's Fair, or the crypt at Oglethorpe University in Georgia of material sealed for the edification of future generations, or by movies of scientific and mechanical work, or the work of photographers, artists, and numberless other craftsmen.

In education, visual aids have not always enjoyed the popularity they do today, although doubtless some such aids have been used by schools since the time the first one was established. Though these aids were perhaps not thought of nor spoken of as such, they do fall in this category, for they appealed not alone

to the mental and the auditory but to the visual senses as well. In recent years, emphasis in the use of teaching aids has increased, and rightly, for all possible aids to the imparting of knowledge are welcomed by any one, whether he holds credentials supposedly qualifying him to teach, or is merely an individual attempting to get across a bit of information to someone else. Mr. J. D. Williams, (37:68) director of the University of Kentucky Laboratory Schools, says:

> Visual instruction is one phase of teaching that means different things to different people. The materials considered in the term Visual Aids means slides to one and all the devices used in teaching by means of vision to another. Any materials that are used to give visual expression that will build in the learning processes of a pupil an accurate conception of the thing being taught are called visual aids.

Basis of the Study

The interest and curiosity, as well as the resentment, of the writer was aroused some years ago when his schedule contained two very overcrowded classes. The efforts to handle such large groups and at the same time help all those needing assistance, undoubtedly started the writer's interest. It was several years, however, before the problem began to take definite form. After enrollment in several classes in visual aids and

becoming somewhat familiar with the field, it was realized that here, perhaps, was a clue to the solution of the difficulty.

The writer feels that the problem of aiding the pupil in understanding is a large and vital one. Since concrete or practical experience --"learning by doing" if you please -- is a valuable part of the learning process, visual aids will be found of great help in clarifying comprehension, and hence will be essential and valuable teaching devices.

Illustrations are a definite "whip" to student interest. The reader will probably be able, from his own experience, to recall instances in which he has observed someone pick up printed material, glance through it hastily, and discard it because there are no illustrations. On the other hand, almost any one can recall the rapt expression of the person who has found something that combines print and pictures. The writer, whenever able, wishes to aid his pupils to place themselves in this latter category. It provides a genuine learning help.

Of all the aids, flat pictures are doubtless most widely used. They are convenient, economical, and effective, and they present a relatively simple filing problem. In addition, the flat picture field presents

an almost unlimited source of supply. The individual who expects to make his own visual lesson sheets and his own pictures is limited mainly by his own ability and initiative.

Equipment can be an almost minor factor. Contrary to popular belief, no elaborate laboratory or equipment is needed for work of this type. True, it is undoubtedly pleasant to have the best to work with, but this is often beyond the means of a teacher. Perhaps this fact is a blessing in disguise, for without elaborate equipment the teacher will exercise his ingenuity more and his pocketbook less. Often a better product results than when one has all the "advantages" to work with.

In the case of this study, a picture having a format of approximately 1-1/4" x 1-3/4" was selected as being best suited to the job. There being at hand no camera taking a picture of such size, the writer set to work to remedy the situation.

The camera available used film in the standard 3-1/4" x 4-1/4" size. It was found that by the development of two suitable masks, pictures of the desired size could be made with this larger equipment, and there were such added advantages as reduced cost,

greater versatility, better image size and freedom from parallax troubles. Further details of the equipment used by the writer will be given in Chapter four.

CHAPTER III

THE STUDY

Projects Selected

In instruction, visual aids are valuable to the degree that they approach reality of experience. Conversely, the farther they are removed from reality of experience, the more ineffective they become. Reality is a subjective rather than an objective thing; the experience must be real to the student. Obviously, then, the visual aids used in class must be made (to seem) real to the learner, for reality depends upon how real a thing seems to an individual. The writer feels that the visual material set forth in this study is such that it has for the pupil an air of reality.

To be most effective visual aids are not to be over-emphasized but should be subordinated to the thing being taught. In the shop situation, there is sometimes little student preparation, and it becomes the problem of the instructor to get across to the student certain information by means of demonstration and explanation. There is ample opportunity for follow-up, and with a set of visual lesson sheets of the sort set up in this study, the preparation, the demonstration, the explanation and the follow-up can be accomplished readily. Probably one of the best criteria for checking on stu-

dent comprehension and the value of visual lesson sheets is the type of work turned out by the student as a result of having used the sheets in his actual class work.

The scientific selection of projects to be set up as examples and used in a set of sheets of this type would be in itself sufficient material for a thesis. Even though it is an empirical method of arriving at conclusions, we can, in Industrial Arts work, recognize certain results - the quality of the work produced - and from this can determine procedure. The writer used the foregoing method of selection since his interest was in finding a usable aid for the teaching of craft work.

Projects selected as examples in this study are those found to be consistently chosen by the author's students from year to year (appendix #3, #4, #5). Doubtless students are influenced in their selections in large measure by such pertinent factors as the type of work previously turned out in the shop, the equipment available, the type of individual, and contact with boys who have taken the work.

Dorris (9:374) makes the following statement:

> Life is rich and full only to the degree that we understand and appreciate the environment in which we live.

Paralleling this, if, through the use of visual lesson sheets or other visual aids, we teachers can lead the student towards a better understanding of his work, we shall have helped him to attain a fuller enjoyment of life and a more thorough satisfaction in his work. He will thereby more nearly approach the ideals of good citizenship. The assumption that pupils are automatically educated by exposing them to the viewing of a large number of pictures, is obviously as fallacious as that which assumes the same result by exposure to print alone. The writer's attempt to find a favorable method of presentation to the student led to the use of a combination of pictures and print.

For this study three projects have been selected in three different phases of craft work; a project in hand formed metalcraft, one in metal spinning or machine work, and one in lapidary (appendix #1 and #2). Selection was made on the basis of ten years teaching experience in the craft field, which gave at least some knowledge of the type of thing a student frequently wishes to make and of the points he often finds difficult to comprehend or master. It is the writer's feeling that these various projects give fair examples of the uses for visual lesson sheets in the craft field.

Analysis of Selected Projects

After determining the projects to be included

in the study, an analysis was made of each, and the basic manipulative steps were listed. A sample visual lesson sheet was then made up according to the writer's ideas, rewritten several times, given the students for trial, and finally checked by craftsmen. The sheets were tried on the students before being rated by the craftsmen so that the writer would have some basis for comparing the types of reactions. After criticism by the craftsmen, and in light of the reactions of the students, the sheets were again rewritten and tried on the classes. There is no end to the possible revisions, for changing conditions obviously continue to modify both school and industrial situations, and the teacher who wishes to do his best work must, of necessity, keep his visual lesson sheets alive by constant attention to possible revision. A change of schools would also, in many cases, necessitate a revision to accord with the interest, intelligence and ability of individuals in the particular community.

The writer feels that it is possible to break the projects into such small units that the main objective of the visual lesson sheets, the clarification of troublesome points, is lost in the mass of small detail. The teacher attempting to formulate sheets of

this type for his own use would, therefore, do well to accept a word of caution on this point.

Uses of Visual Lesson Sheets in a Learning Situation

Shop teachers who examined the plan were of the opinion that two of the most valuable uses for the visual lesson sheets were for individual instruction and for review. Frequently, a student would look at an article and, on the strength of the glance, assume that the job was quite simple. Study of some of the visual lesson sheets listing various phases in the constructional steps often showed the pupil that the project, rather than being of elementary constructional nature, presented several phases of comparative difficulty. Some individuals would have gone ahead on such a job assuming that they were familiar with the processes involved. As a result they would have experienced difficulty - the job might have turned out to be too difficult, or it might have ended up as a poorly executed piece of workmanship. One teaching objective of the writer is to see, as far as possible, that the boys in his charge bring their jobs to a successful completion. Arousing student interest through the use of visual lesson sheets helps in setting up this "success atmosphere". A boy's interest is greatly in-

fluenced by the extent to which he derives satisfaction from his work; interest being an ally of success, it is essential that it be found. This attitude of "work satisfaction" is one of the most valuable outcomes to be derived from school life. The experts who examined the material expressed the belief that the visual lesson sheets would definitely help in bringing about this desirable student attitude.

Frequently, the method employed in using the sheets would be as follows: assume a boy wished to spin a set of candlestick holders. Usually he decides what he wishes to make, then the material to be used for the job. After reaching a decision regarding the project and the material, he could, if he and the instructor agreed that he needed review, go over the sheets containing information concerning the material to be used. Often the student has the design in mind and a working sketch made. If not, there is an opportunity to go through a scrapbook containing illustrations of objects of the type he wished to make. When the design is sketched and approved, and the difficult points studied out and discussed, it often proved helpful to look up on the proper visual lesson sheet certain points in relation to spinning procedure. In this way the pupil would be less likely to experience

difficulty when he reached a difficult point in the job. Whenever possible, the procedure followed in a commercial job would be brought to the attention of the student and, if practical for him to do so, he would be encouraged to parallel industrial practice so far as possible. Specimens of work -- finished, unfinished, and ruined -- were found of value in bringing out various points in the procedure. It was found that telling a boy, "If such and such a practice is followed, the job will end in ruin", made little or no impression, but if he could be shown samples of cause and effect, the desired outcome was more likely to follow. It holds that, "the boy has to be shown;" merely telling him is not sufficient; he wants to know why and why not, and what will happen if he does follow his own ideas. Of such material our best inventors, mechanics, and artists are formed. Apropos to this thought is the following quotation from the magazine Time (34:69):

> It is interesting to note that the two inventions which most aided the industrial revolution, the telegraph and steamship, were perfected by two artists, Morse and Fulton. Thus the artists led off the industrial revolution and now that the revolution has reached the saturation point, industry is leading the trend back to art. Conditions for the perfectly functioning machine are precisely the same needed for perfect art. Americans (workers as well as designers) are expressing artistic genius through beautiful machines. They don't know that they are artists any more than the old Mexican pottery workers know that they are.

Evaluation of Material Used

In selecting the type of visual aid to be used, the writer was guided in part by a set of standards set forth by Worrell (38:323) as follows:

> Our use of any particular visual aid is determined somewhat by:
> 1. The degree of reality needed in a given situation.
> 2. The outcomes to be realized.
> 3. The methods to be used in presentation.
> 4. The cost, safety and time factors.

The degree of reality is determined, to a large extent, by the age of the pupil and his previous experience. It has been found that the younger the pupil, the more real his visual experience must seem to him if the most good is to come from using the aid. Certainly, the dull pupil is better able to understand facts presented realistically. Even the more intelligent pupil needs the impression of realism, especially when he is approaching a new subject.

Factual information may often be presented more efficiently through the use of static types which may be studied in detail at one's own rate of comprehension. Certain types, such as the flat picture, lend themselves to individual study; while the film, the film slide, and the field trip, are more commonly used for group work. The expense factor enters also and is definitely in favor of the flat picture.

Evaluation of the photographs used in this study was made on the following basis:

1. Are they relevant or significant?
2. Are they clear and definite photographically?
3. Are they of proper size? Size is often determined by the use to which the photograph is to be put.

Since the visual lesson sheets were of standard letter paper size, 8-1/2 x 11 inches, a picture was needed that could be mounted on the sheet together with the typed material. Experience showed the size used to be most satisfactory for this purpose.

Development of the visual lesson sheets will be more fully considered in the following chapter.

CHAPTER IV

MAKING VISUAL LESSON SHEETS

Photographic Equipment

The writer hesitates to make recommendations as to the type of equipment to be used by the individual wishing to make his own visual lesson sheets. Rather than setting up a list of equipment which will vary according to personal preference and experience, as well as according to personal preferences and experience, as well as according to developments in the photographic field, the writer will list the equipment he used. The reader can draw from available equipment and from his experience to fit his particular situation. The equipment used by the writer included:

1. Eastman 3-1/4" x 4-1/4" Plate Camera with 5-1/4" Anastigmat f/4.5 lens and self-timer.

2. A set of special metal masks developed by the writer for the purpose of making four exposures, of a size listed earlier in the study, on one negative. One important point to be kept in mind is that a lens of this focal length, used with a format of this size, will give a comparatively large image, which is of primary consideration for contact prints. A miniature camera having a focal length of two inches, for example, will give an image too small to be of practical value in work of this type, unless enlarged, which involves added expense, equipment, and time.

3. Tripod and tilting top attachment.

4. For negative material, cut film was used. Although this is a professional type film, the amateur worker will find such a variety of emulsions and other advantages that he will, if doing any quantity of serious work, eventually come to this type of film.

5. A developing tank.

6. Two Victor #2 photoflood reflectors and stands. The person planning the purchase of lights would be wise to carefully investigate the various products offered. It is well known to experienced photographers that certain types of reflectors will give as much as 50% more effective light on a given area than will other types. For the amateur who has to watch his budget, it pays to purchase well and wisely.

7. Weston Universal Exposure Meter.

8. Contact printing box.

9. Enlarger

With equivalent equipment, one is armed for almost any contingency that may arise in the photographic field, and will find it possible to handle an extremely large variety of work.

Photographic Technique

The making of pictures is something that almost anyone, with a period of practice, can engage in successfully. It is, however, a field that may rapidly carry the over-confident or the under-prepared individual into difficulty. It is foreign to the purpose of this thesis to list practices that are adequately

treated in any of several dozen photographic texts. In fact, the writer hesitates to list his own practices and habits in this line, for experience has proved that such information is of no help to the beginner and serves merely as a point for argument with the experienced photographic worker who has developed his own individual practices and habits.

Development of Sheets

In making visual lesson sheets it will be well for the instructor to give considerable thought to the type of individual he has to work with. In the writer's case a definitely varied type of personnel has provided one of the problems confronting him. Students have been from many social classes, and the range of mentality has been wide. There were boys enrolled in the shop who had had no previous experience with this type of work; there were others who had had one or two years experience; and still others who exhibited not the slightest ambition or enthusiasm; there were those who liked to work; and others who seemingly delighted in the accomplishment of doing nothing. Some boys liked to work along on their own ability and under the drive of their own imagination and reasoning; others seemingly were helpless unless the teacher were constantly by their side, figuratively leading them.

One school in which the writer taught furnished a wealth of "teacher-experience" material. In this school it seemed an administrative custom that the shop serve as a convenient "dumping ground." Students failing in other classes, students involved in teacher-pupil friction, transient pupils -- all were shop material according to this custom. Boys were scheduled for shop irrespective of their ability and their previous experience or lack of it. There was neither respect nor consideration for the safety factor involved. In a situation of this kind, a teacher has at least an opportunity to become familiar with types. It is interesting to the writer that several notably "hard cases" not only used the lesson sheets successfully but also gave constructive suggestions that proved helpful in adapting the sheets to the use of others in the group.

Various methods in presentation have been tried over the period of years the writer has been working with visual lesson sheets. Varied attempts have also been made to find a suitable method for using the sheets, for binding them, and for assembling them.

One trial followed the plan of setting up sheets to cover jobs for a definite period, the length

of time depending upon the work to be done. In this case jobs were classified according to time required for completion. It was found that such a system would necessitate too much detail work on the part of both pupil and teacher, leaving too little time for work or for teaching. The plan was discarded after a short period.

Another type of sheet was tried that carried a statement of the job to be done, and listed an allotment of approximate time for the completion of the work. Objectives were listed; likewise references, information needed before doing the job, and procedure. A short test was included at the end of the sheet. In fact, it seems that everything was included with the exception of a suggestion as to how the student might wade through the mass of material and yet find time to do his job - which, after all, was the thing of most interest to him. That plan was also discarded.

Another plan used sheets for various grade levels. For example, a set of sheets for the seventh grade listed jobs practical for that level. Another set was used for the eighth grade, and so on. This plan laid out the field in which the student in a particular grade should work. This also was unsatis-

factory since boys are often found who can hold their own in respect to quality and quantity of work with individuals on a higher grade level. This plan went into the waste basket with the others.

Various methods of visual lesson sheet arrangement were tried. On one set of sheets the pictures were arranged across the top of the page and numbered to correspond to the typed information given below. A period of use indicated that this was a poor method, as the relationship between the picture and the typed information proved inadequate. Since there was some distance between the illustration and the definite information, many boys did not bother to associate the two. They either looked at the photographs and failed to read the procedure steps, or vice versa.

Selvidge (32:34) comments:

> "each part (of the page) should be set off as a distinct division."

Thinking that Selvidge's statement might be a clue to the solution of the problem, an attempt was made to collect jobs involving similar operations and to list them under one heading on one sheet. In spinning, jobs that would require use of the spinner's pliers were to be listed as a distinct division. This too literal interpretation of Selvidge's advice led to

confusion, bulkiness of material and troubles in filing, all of which resulted in a lack of student interest.

After helpful assistance at an Oregon State summer session, a further attempt was made to produce a more workable set of sheets. Another suggestion of Selvidge's was considered as follows (32:34):

> The page should be so arranged that it presents an interesting and attractive appearance. Avoid long sentences. Long sentences tend to become involved and long paragraphs are not inviting even to those accustomed to much reading.

A new set of sheets was made up and handed to the students. This time there was a more favorable response. Going still further along this line, the writer decided to reduce the sheets to what he considered, at the time, the barest essentials. A trial indicated that a propitious approach had at last been found. Subsequent efforts have been directed towards reducing the amount of material on the sheets; the writer has tried to exercise care in concisely listing pertinent procedures and pictures.

An attempt was also made to include student activity at various points on the sheets, but not to such an extent that it would prove objectionable. The activity was brought out by means of suggestive or leading questions or statements. A certain element of re-

view also enters here as the student must either think back or make a definite effort to find the answer. In some cases this will take the form of asking another student, but more frequently the instructor will be consulted. Lack of familiarity with the points would not necessarily mean complete failure of the job at hand; rather that there was pertinent information to aid the student in doing a better job had he bothered to find it.

An example of this is shown on page 61 of this study. On the visual lesson sheet entitled "SPINNING A SET OF CANDLESTICK HOLDERS," is a picture of the two spinning tools needed for the job. This does not preclude the use of additional tools. The student using the sheet understands that the two tools shown are essential to the successful completion of the job. The question is asked, "Can you name them?". Experience has led the writer to believe that a boy can and often does forget the names of tools. Vacations are excellent forgetting times. This short question serves as a constant reminder. While tool names are not essential to the successful completion of a spinning job, they are, from a teaching standpoint, a matter of desirable information.

Although pertinent in the school situation, the naming of tools is less important in a commercial shop; many spinners have no names for a number of their tools. The majority of commercial spinners contacted had no particular names for the tools they used and didn't know whether such names existed. The reader must bear in mind that most of the commercial tools are made by the men who use them; a spinner often makes a new tool for some particular job that has come into the shop. There were certain basic tools, however, that were found in each shop and for which the spinner always had a name. It was observed that there was sometimes a slight variation in names, from shop to shop, although the general terminology remained constant. To these men names are unimportant; time and work produced are the primary considerations. In school work, however, good teaching requires the use of specific names and terms.

Another question listed under the illustration of "Tools used" is "Before using, always check these tools for _____ and _____." The obvious answer is to check the "diamond point" (trimming) tool for sharpness and the "point tool" for particles of metal that might be adhering to it.

Under item number 13 on the same sheet is:

Trim to size
a. Eyes _____?
b. Fingers _____?
c. Tool angle _____?

No boy is allowed to handle the trimming tool on any metal until he is familiar with trimming procedure. Even so, boys will forget and will take short cuts. Item number 13 serves as a constant reminder that eyes should be protected during the trimming of metal, fingers should be safe and out of the way, and the proper tool angle should be used. From the standpoint of a boy using the sheet, the points might be interpreted as:

Trim to size
a. Eyes protected?
b. Fingers safe?
c. Tool angle correct?

The student activity questions deal with the reasons why things are done in a particular way or why certain things are true. Students were often called upon later to explain the reasons for these directions. This might happen in a discussion period when some other student needed help, or when the instructor had called a conference.

Another side of the problem considered had to do with related information. A set of information

sheets was made up to be used as required. The information was boiled down into concise form, and only material definitely related to the class type of work was included. A sheet on copper would list a short history of the metal, a few remarks about refining, details of costs, examples of standard sheet sizes and weights, and some of the uses for the metal. This is the same type of material that a student would find in a text but it is assembled more concisely. The attitude of the student toward this type of lesson sheet caused a decision to give such information by group discussion rather than by information sheets.

One side of the problem that has not yet been satisfactorily solved by the writer is the binding of the visual lesson sheets. Several methods have been tried, but none has proved entirely satisfactory.

At first the sheets were glued to a backing of corrugated cardboard, such as paper cartons are frequently made of, and the faces lacquered for protection. Later the sheets were glued to a plywood backing and the faces lacquered. But strangely, the sheets mounted on cardboard outlasted those mounted on the plywood. There was some degree of resilence

to the cardboard when laid on a tool or on the work-bench, but the plywood was harder and heavier, and the sheet wore out more quickly.

Again, sheets were glued on chipboard and the faces covered with transparent material of various types. After the removal of the emulsion, x-ray film makes a favorable facing for this purpose. Two major drawbacks to this material were the difficulty of obtaining the film and its inflammability. The latter condition naturally eliminated it from shop use.

A number of coverings have been tried, such as cellophane, glass, and plio-film, a rubber product of recent development, but the writer is satisfied that the most suitable method is yet to be found.

It is felt that the present visual lesson sheets have advantages over those that have preceded. Students are used to handling standard notebook pages (8-1/2" x 11"). The title on the present sheet merely states necessary information regarding the job out-lined on the sheet; there is nothing to produce a feeling that an assignment is being handed out. Since the questions included are at a minimum and are of the student activity type rather than straight

question-and-answer type, the student quickly realizes that the points listed have a definite relation to the job he is doing and the skill he is trying to master.

References are entirely omitted. Students seemed to take a defensive attitude towards sheets carrying reference listings.

Sketches and line drawings are also eliminated. Students expressed definite preference for photographic illustrations, seemingly because they lent an air of reality.

In the current sheets, the writer has been attempting to reach the goal set forth by Selvidge (32:79):

> Ultimately we shall get away from the sheet that contains a lot of extraneous and confusing matter, and those that relieve the student of all responsibility for thinking, and get to a type that recognizes that a difference in method is required in training for skill from that required in training for thought. They will give the student the information and instructions he is entitled to and place upon him the burden of solving his problem.

Craftsmen contacted seemed, as a group, to be very favorable towards the visual lesson sheet plan. The superintendent of the largest hand-wrought copper shop on the Coast said in effect that the visual lesson sheets would be a great help to him. This man

trains a number of new workers each year and his observation was that such training took a great portion of his time - which means that his normal work allotment is increased. Sheets such as set up in this study would, according to him, be exceedingly valuable in his situation as well as in a school shop.

Typical questions asked craftsmen were along the line of the following:

1. In your opinion, as a practical tradesman, has a plan of this type any value in teaching a boy the rudiments of the craft?

2. Do you think such a plan would have made it easier for you to learn your job had you had access to such sheets?

3. Have you ever had any experience in formal teaching, or in teaching in any manner? (It was the writer's intention here to reach those individuals who have taught their craft to an apprentice but who would hesitate to claim they had had teaching experience.)

4. How did you go about getting across to your pupil the principles of the craft?

5. Would you like to have a set of these sheets for use in training an apprentice? Why?

The craftsman having the reputation among the spinners of San Francisco as being the best man in that city gave very freely of his time and shop facilities to assist the writer in his work. Several "trade secrets" were disclosed that proved of value when tried in the school shop, as well as demonstrations of why certain steps in procedure should be added or eliminated from the sheets.

The point was brought out by several craftsmen that procedure steps would need revision according to the type of teaching being attempted. If the sheets were to be used in teaching in a school shop, then they were satisfactory as written, but for teaching an apprentice who would go directly into the trade, several steps would be eliminated. These steps would be dropped merely because the tradesman's time means money, and he omits everything he can and takes all manner of shortcuts. A school shop is concerned with many points other than speed of accomplishment. The opinion of the craftsmen, as a group, was that the visual lesson sheets were decidedly valuable.

It has always been the writer's contention that students in his shop should use practical projects when-

ever possible. Several tradesmen who inquired as to what type of work was being done in the school shop made statements to the effect that such practical jobs were good. Two of the commercial workers went so far as to state that had the jobs been of the type they termed "play," they would have refused to talk about their craft to the writer. As it was, these particular gentlemen gave considerable assistance after their personal prejudices had been satisfied.

Along this line, Selvidge (32:81) makes the following comment:

> It is important that as large a proportion of the jobs as possible be of a practical or productive character. There are two reasons for practical jobs. One is economy and the other factor is the interest of the student.

CHAPTER V

SUMMARY AND RECOMMENDATIONS

Visual lesson sheets offer a method that will, in at least some degree, help make allowance for individual differences in comprehension rate and for other relative teaching points. The medium consists of a set of sheets listing manipulative procedure of basic operations in step form, with photographic illustrations paralleling the written material at the key, or most troublesome, points.

These visual lesson sheets are intended as a supplement to, rather than as a substitute for, the textbook, as well as the oral, the written, or the demonstration method of presenting information. They will be of value only to the degree that they help students in gaining additional knowledge, and so help them to learn happily and to live happily.

Visual lesson sheets aid greatly in developing the individual's possibilities, give basis for reflective thought before and during a job, and tend to direct him through a job in an orderly, progressive manner. They thus help establish efficient and worthwhile work habits. They offer a basis for intelligent

shopping, since the student is gaining information about materials at the same time that he is given manipulative instruction.

No attempt is made in this study to cover all projects in craft work; the field is too large. The writer believes that the aid given him by the visual lesson sheets in respect to time saved on repetitive demonstrations and explanations alone, sufficiently justifies the use of the lesson sheets in his shop. Considering the advantages of: (1) students progressing at their own rate, (2) the opportunity to reread and recheck information and operations, and (3) teaching by the use of basic steps which may be used on a number of different jobs, it would seem logical that visual lesson sheets have pedagogical merit.

Craftsmen familiar with the sheets were of the opinion that they would be valuable. Naturally, there was divergence of opinion regarding the procedure arrangement. Most of the craftsmen experienced difficulty in getting their line of reasoning away from the commercial angle. They realized this, however, and made the point that there was usually a difference of opinion among commercial workers regarding the proper way to break down a job. This

difference was attributed to the result of variety in experience, skill and equipment, and in the quality of work desired. All seemed to think, however, that the visual lesson sheet plan definitely would be of value in a school shop.

The sheets may be used with group demonstrations. Their greatest value, however, lies in the fact that, after the teacher has given a group demonstration, an individual puzzled over some phase of the job or who, because of absence or other reason, needs time equal to that given the entire group, may be helped with his problem at a saving of time to the instructor, the individual student, and the entire class. Thus the best interests of all concerned are served.

The writer, of course, does not maintain that the method used would be applicable to all types of shop work. Experience indicates, however, that for the field selected, it is particularly well suited.

The supreme function of the school is teaching, and the writer believes that with the aid of visual lesson sheets he has been better able to fulfill that function.

Recommendations

It is sincerely hoped that others interested

in the same field will lend their efforts towards the further solution of the teaching problems involved. This study is naturally not the final work; there is much yet to be done.

It is therefore recommended that further studies be made to determine:

1. Proper procedure in the matter of visual aids for other phases of the craft field.
2. Means of producing closer coordination of the school shop and the commercial shop.
3. A more satisfactory method of binding visual lesson sheets.
4. A more practical method of filing visual lesson sheets.
5. More effective means of using the visual lesson sheets.

Although these five recommendations do not exhaust the possibilities for future investigation, the writer believes that they are of great importance and that the results of such further studies will give added proof of the value of visual aids in the teaching of craft work.

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APPENDIX

APPENDIX

1. Lapidary

As student interest was found to be decidedly unfavorable towards information sheets they have not been included. It is the writer's belief, however, that some information should be given in this study regarding points neither commonly known nor accessible. Since there is little information available concerning lapidary work, the following section has been added with the hope that it will prove of value to the person seeking assistance in this field.

The cutting and polishing of "rocks" from the raw is a most interesting craft, and one which has practically no limit. It has become increasingly popular and will undoubtedly be more so in the near future as more individuals become better acquainted with this fascinating work. As in other arts, success depends upon a love for the craft and a devotion to the work; practice tends toward perfection in this field as well as in others.

Facet cutting of stones, either precious or semi-precious, is not a task to be taken lightly. Gem cut stones, or stones that have been faceted, are

entirely within the range of ability of the amateur lapidary worker but most certainly not until he has gained experience. The amateur worker will concern himself with stones cut cabachon, which includes curved and flat surface styles applied to the less precious stones, and with the working of flats. After the worker gains experience and feels sufficiently grounded in the peculiarities of various stones, his interest may lead him to attempt the cutting of a sphere. Facet cutting, however, is something to be looked forward to as a goal; certainly it is not to be tried until the worker has mastered the technique of cabachon cutting and polishing.

When a person becomes interested in rocks, he begins to collect specimens which catch his attention because of color, shape, or other peculiar characteristics. As soon as he learns to hunt along stream beds, beaches, and the lower slopes of hills, he will be surprised at the wealth of material he finds, material which probably escaped his view before the growth of his interest in earth science.

The minerals available will, of course, depend upon the section of the country in which one lives. In some sections, much of the material is a

form of quartz, the most commonly found mineral and one which occurs in many different forms and colors.

A list of stones found in California counties is given by Thomson (35:18) as follows:

ANADOR
- diamond

BUTTE
- diamond
- garnet
- gold quartz
- zircon

CALAVERAS
- garnet
- gold quartz
- jasper
- opal
- rock crystal

DEL NORTE
- chalcedony
- diamond

ELDORADO
- diamond
- garnett
- gold quartz
- rock crystal

FRESNO
- californite
- chalcedony
- garnet
- turquoise

HUMBOLDT
- jet

INYO
- chrysocolla
- garnet
- moonstone

KERN
- chalcedony
- chrysocolla
- garnet

LAKE
- opal

LOS ANGELES
- chalcedony
- sapphire

MARIN
- garnet
- moonstone

MARIPOSA
- garnet
- gold quartz

MONO
- lapis lazuli

MONTEREY
- garnet

NEVADA
- diamond
- gold quartz

PLUMAS
- chrysocolla
- diamond
- garnet
- jasper

RIVERSIDE
- beryl
- garnet
- kunzite
- moonstone
- moss agate
- rock crystal
- rose quartz

SAN BERNARDINO
- chrysocolla
- garnet
- moonstone
- opal
- turquoise

SANTA CLARA
- chalcedony
- garnet

SAN DIEGO
- beryl
- californite
- chrysocolla
- garnet
- kunzite
- moonstone
- opal
- rock crystal

SAN DIEGO (contd.)
rose quartz
topaz
tourmaline

SHASTA
garnet

SISKIYOU
californite
opal

SONOMA
garnet

TRINITY
diamond
garnet

TULARE
californite
chrysocolla
chrysoprase
crystal
diamond
garnet
hyalite
opal
rock crystal

TULARE (contd.)
rose quartz
topazolite

VENTURA
garnet

The tools needed for the amateur lapidary are simple, easy to make, and relatively inexpensive. Although there are some pieces of equipment now available on the market, it is safe to say that the major portion of the lapidary equipment in use today, from the amateur standpoint particularly, is of the so-called homemade type.

It has been stated that as soon as one has cut one's second stone, he is an expert. To the person unfamiliar with lapidary work, this seems preposterous. It is interesting, and often amusing, to observe the speed at which some "rock hounds" pick up the knack of handling material and equipment, and how quickly they talk and act like old hands at the work.

Raw gem material is surprisingly cheap, that of the semi-precious type being especially so. The interested worker will have no difficulty in ob-

taining material to work on -- rather, he will discover he has too much. Volcanic glass or obsidian, quartz, agate, moonstone, petrified wood, and flint are a few of the commonly found stones that afford excellent material for both the beginner and the more advanced worker.

Patience and practice are needed before the beginner can turn out a perfect specimen, but there will be nothing imperfect about his enthusiasm as he contemplates his first completed and polished specimen, however crude it may be.

The hardness of the material furnishes, to a great extent, the foundation for the finish. Generally speaking, the harder a specimen, the better the polish it will take. For the amateur lapidary worker who wishes to test his material, a sample scale of hardness is given below. The materials listed are accepted as standards. Material is said to be of hardness three, for instance, if it is scratched by fluorite but scratches selenite (21:2):

1. Talc - easily scratched by the finger nail
2. Selenite - just scratched by the finger nail

3. Iceland Spar - scratches and is scratched by a penny.
4. Fluorite - not scratched by copper, but does scratch glass
5. Apatite - just scratches glass; easily scratched by a knife
6. Orthoclase - scratches glass easily; just scratched by a file
7. Quartz - not scratched by a knife
8. Topaz - scratches quartz but scratched by corundum
9. Corundum - scratches everything but diamond
10. Diamond - very much harder than any other mineral.

According to some authorities, Moh's scale of hardness, commonly used as a standard, fails to indicate properly the actual differences between the various gems. To illustrate, sapphire is listed on Moh's scale as nine and diamond as ten; yet the hardness of the diamond is actually at least ten times that of the sapphire.

An idea of the scale may be obtained from Baxter's listing (2:185):

Stone	Moh's Scale
Diamond	10
Sapphire	9
Topaz	8
Quartz	7
Opal	6

"Thunder Eggs" always seem to arouse interest and curiosity and give rise to questions regarding the composition of such oddities. Dr. E. S. Larsen, professor of petrography at Harvard, has this to say regarding thunder-egg genesis (5:248):

> Thunder eggs are without doubt spherulites originating in a rhyolite. They were originally hollow, and later chalcedony was deposited in the open spaces within them. The general process of formation probably took place in the following manner. Liquid lava (rhyolite) was poured out from below and spread out on the surface of the earth in the form of a lava flow. A small percentage of water is often contained in molten lava in chemical combination, and it is well known that a portion of this water is released upon the cooling of the mass. Accompanying the cooling of the lava, crystallization of silica and feldspar began about local centers to form large spherulites. The spherulites are not large single crystals, but aggregrates of submicroscopic crystals of more than one kind, including probably cristobalite and feldspar.

As crystallization proceeded in the lava the crystalline portion could no longer carry water, thus permitting the moisture to escape with more or less violence to form cavities in the spherulites.

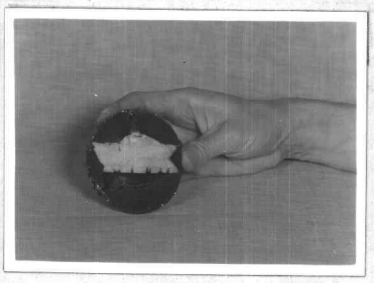
In some spherulites, several layers of gas cavities will be noted, giving them an onion-like structure. Often the cavities formed in this manner arennot filled with mineral matter, but remain empty or only partially filled.

In some Oregon specimens examined, the spherulites did not remain empty, but some later process deposited a chalcedonic silica in the cavities to form the very interesting "thunder eggs". In localities where large spherulites occur, they are found embedded in a volcanic glass, and this is true of many of the Oregon localities. This volcanic glass (a rhyolite) represents a portion of the lava flow that failed to crystalize.

SAMPLE

VISUAL LESSON

SHEETS



WORKING "THUNDER EGGS"

PROCEDURE:-

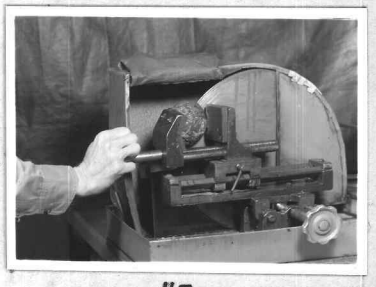
1. Wash specimen and examine for best cutting angle.

2. Clamp in saw vise. Be certain the specimen is TIGHT.
   a. A loose specimen will ruin the saw.

3. Check level of cutting fluid in drip pan.
   a. Saw should dip 1/4" to 1/2".

4. Check with instructor. If O.K. turn on power and:

5. Saw your specimen.
   a. Use only enough pressure for a steady cut.
   b. Too much pressure makes the blade crooked and wears out the saw.
   c. Continue the cut evenly until sawed through.



#5

6. Draw saw carriage back away from the blade, shut off power, and remove specimen.

7. Relieve rough edges on grinder.
   a. If coarse, rough material, use coarse wheel (#100).
   b. If finer, smoother material use fine wheel (#220).
   c. Be sure wheel is used wet. Dry wheels cut too fast and too hot.
   d. Grinding wheels will grind finger nails.

#7

--ALWAYS WASH YOUR HANDS AND SPECIMEN BEFORE MOVING ON--

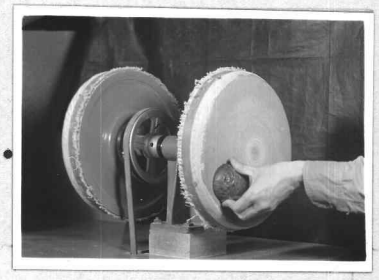
8. Lap the face on the coarse lap (#100) until saw marks are removed.
   a. Lap is slowest at _____; fastest at _____.

#8

9. Wash specimen and your hands <u>thoroughly</u> and move to next lap. Continue working specimen through successive laps (coarse to fine) until face is smooth.

10. Check with instructor, if O.K.

11. Sand on dry sander (#240 grit).
   a. Test speciman on _____ for heating.
   b. Sanders merely _____ fine marks, they don't cut.



#11

12. Wash up and go on to:

13. Buffing wheel
   a. _____ on all buffs.
   b. Use buff slightly wet.
   c. Large buff for flats only.

#13

14. Wash specimen thoroughly and examine for finish.

FLUTED DISH

PROCEDURE:-

1. Obtain metal from instructor.

2. Trim metal to circular form and file smooth.

3. Hammer mark metal.
   a. Are you a silversmith or a blacksmith?

4. Check circular form. True up if out of round.

5. Select forming mallet and block.

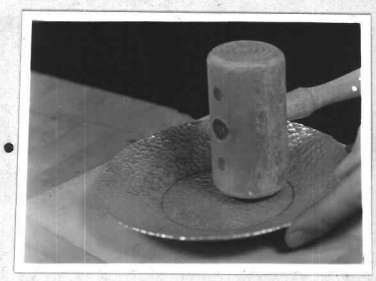
6. With mallet and form block raise metal to dish shape by striking concentric blows.
   a. Strike directly in front or metal becomes oval shaped.

#6

7. Bring metal to full shape and round it carefully.

8. Lay out base with pencil compass.

9. Set base down with rawhide mallet.



#9

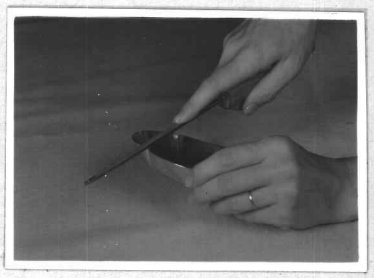
10. Divide dish into required number of sections for fluting. See the instructor.

11. Obtain fluting blocks and shape to angle of dish's side. Get a helper to aid in the fluting operation.

12. Carefully bring all flutes to the same depth and shape.
    a. Taper the flutes from nothing at the base, to full depth at the rim.
    b. Be sure to slide fluting block while tapping it.
    c. Helper must keep dish snug against the fluting base-block to prevent flats.

#12

13. Slot flutes at the rim with a triangular file.
    a. Keep file cut in center of flute.
    b. File all flutes to same depth.



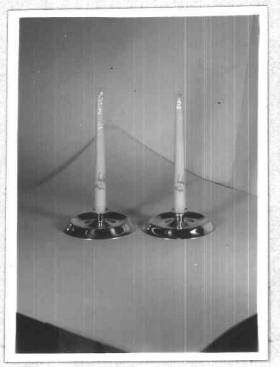
#13

14. Round-over top corners of the cuts.

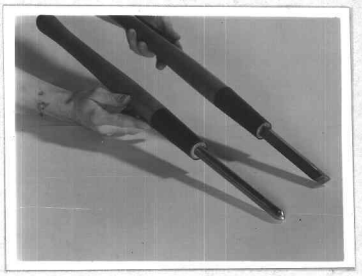
15. Smooth cuts with small piece of old emery cloth.

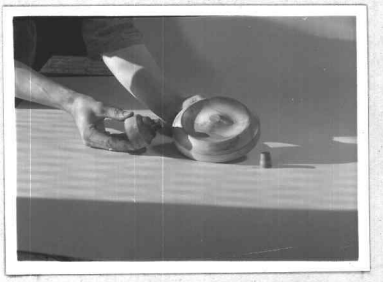
16. Check with instructor, if O.K.

17. Prepare for finish.



SPINNING A SET OF CANDLESTICK HOLDERS





1. The tools used:
   a. Can you name them?
   b. Before using, always check these tools for ___ and _____.

2. Select chucks and follow block from bin.
   a. What is a good wood for chucks?
   b. Why glaze a new chuck? How?

PROCEDURE: -

1. Obtain metal from instructor.

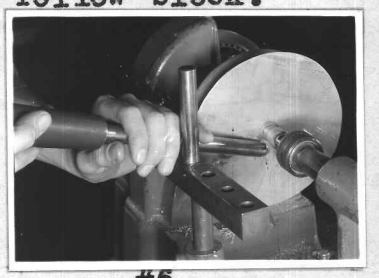
2. Set up machine.
   a. Before inserting the spinning center _____.

3. Center the disk between chuck and follow block.

4. Adjust tool rest and fulcrum pin.

5. Lubricate the disk.
   a. Too much will _____.

6. Place nose of point tool just below the center of the follow block.

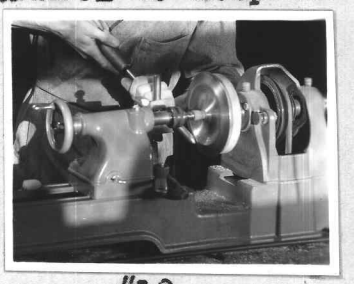


#6

7. Apply steady, even pressure with the tool, and seat the metal against the chuck.

8. Check the seating carefully.
   a. Careless checking may cause bumps, overlapping, or reversing of metal flow.

9. Continue to spin the shell. Be CAREFUL to keep the metal flowing and the same thickness.



#10

10. Turn the edge. Be sure to spin the metal down snugly <u>as you go</u>.

11. Planish the shell.

12. Check with instructor, then:

#13

13. Trim to size
   a. Eyes _____?
   b. Fingers _____?
   c. Tool angle _____?

14. Wipe off lubricant, and:

15. Go over shell lightly with emery cloth to remove pits and imperfections.

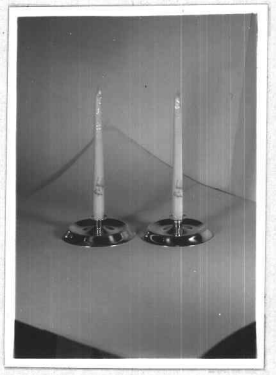
#15

CAUTIONS

1. Keep the metal flowing. DON'T sweep it out.

2. Keep your hands away from that rotating disk of metal; it is a buzz saw in disguise.

#9 & 10



#11 & 12

SPINNING

THE CANDLE CUP

Operations #1 - 2 - 3 - 4 - 5 - 6 - 7 - 8 - 9

are identical with those on Sheet #4.

10. In forming the shoulder on the cup, use only ehough pressure to set the metal into position. Do it LIGHTLY and QUICKLY or the metal may be torn.

11. Set the lip of the cup into position.

12. Planish the shell.

13. Check with instructor, then:

14. Trim to size.
    a. Eyes ____?
    b. Fingers _____?
    c. Tool angle _____?

15. Wipe off lubricant, and:

16. Go over shell lightly with emery cloth to remove pits and imperfections.

CAUTIONS

1. Keep the metal flowing. DON'T sweep it out.

2. Keep your hands away from that rotating disk of metal; it is a buzz saw in disguise.