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A Study of Transparencies and the Overhead Projector in the Industrial Arts Wood Shop Program

Eugene G. Bertino
Central Washington University

A STUDY OF TRANSPARENCIES AND THE OVERHEAD PROJECTOR IN THE INDUSTRIAL ARTS WOOD SHOP PROGRAM

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by

Eugene G. Bertino

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George L. Sogge FOR THE GRADUATE FACULTY

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CHAPTER I

INTRODUCTION

I. THE PROBLEM

The writer, having taught industrial arts classes in the high school for the past number of years, felt a need to find a method of instruction that could clarify some of the content taught in the wood shop industrial arts program.

Other problems were also considered. Could the method be used in the industrial arts classroom without waste of time or having to use special facilities? How much of the instructor's time was needed to prepare the instructional material? Would the students retain and use the information given? Finally, was the method and materials readily available?

After much research, the overhead projector and permanent transparencies seemed to answer all of the above questions.

Statement of the problem. It will be the purpose of this paper to discuss overhead projection and permanent transparencies using a set of transparencies to teach a unit in the industrial arts wood shop program.

Importance of the study. This unit using the overhead projector in the wood shop program will be of practical use to the classroom instructors, counselors, and to our administrators.

It has long been known by this writer that our public school program has been generally behind times in teaching methods and techniques as compared to other types of schools. Good teachers have long recognized the value of preparing materials to meet specific communication needs in their classes. Leaders in business, industry, government, and the military services often face similar needs (9:1).

It was a need for solving a specific problem that led this writer to develop a unit in a specific field of study using the best possible means to solve the problem; the overhead projector and the use of permanent transparencies.

Limitations. The unit using the transparencies in this paper has been limited in scope to the beginning wood shop classes either in junior or senior high school. This study is also limited to a unit on some of the characteristics of wood. It could also be used as refresher or review material for all classes being taught in conjunction with the wood shop program.

The transparencies used are of the permanent type and of the homemade variety using the Diazo process.

II. DEFINITIONS OF TERMS USED

A unit of instruction. A unit of instruction has been defined by Carter V. Good as:

> 1. A major subdivision of a course of study, a text book, or a subject field, particularly a subdivision in the social studies, practical arts, or science.
>
> 2. An organization of various activities, experiences, and types of learning around a central problem, or purpose, developed cooperatively by a group of pupils under teacher leadership; involves planning (5:587).

The overhead projector. The overhead projector is a transparent still projector capable of enlarging up to ten inches by ten inches transparencies with brilliant screen images suitable for use in a lighted room. Its optical arrangement permits transparent graphics to be placed over a lighted platform for quick reference and for over the shoulder projection. Its light pattern moves vertically through the transparency to an overhead mirror mounted at a forty-five degree angle above the objective lens. The overhead mirror turns the rays of light so that they strike the screen perpendicularly (7:27).

Transparencies. Transparencies are large slides for use with an overhead projector (10:102). Transparencies are positive drawings reproduced in color on heavy acetate

and vary in size from four inches by five inches to ten inches by ten inches. Often times the transparency is called a foil.

Tracing paper master. Tracing paper masters are pen and ink or typewritten carbon backed on translucent or transparent material (9:Ch. 3:14). With the use of these masters an unlimited number of transparencies can be made in various different colors.

Diazo process. Diazo films, sensitive to ultra-violet light, will produce brilliant, colored dye images on a clear, transparent, plastic base. In the presence of ammonia fumes, Diazo salts will combine with colorless compounds called "couplers" to form dyes, the color of which is determined by the choice of couplers (9:Ch. 3:12). Some of the colors available are black, red, orange, blue, green, purple, yellow, and brown. With the Diazo process only one color is available per foil.

Multi-color Diazo transparencies. Multi-color Diazo transparencies are made up of single color foils that are superimposed to form multi-color transparencies (9:Ch. 3:15).

Methods. Methods are the orderly procedures that direct learners in developing skill and habits and acquiring knowledge and attitudes. Methods for the practical arts

and vocational subjects include: demonstrations, lectures, discussions, directed research, visual presentations, individualized instruction sheets, student-directed activity, directed references, student planning, supervised performance at the work station, experimental work, field trips, speakers, panel discussions, conferences and testing (12:210).

Teaching aids or devices. Teaching aids or devices are specifically planned pieces of equipment to help students understand and learn; illustrative of these are films. They are material aids employed as an adjunct to training or teaching, and may be classified as devices for the improvement of instruction (12:25).

Teaching techniques. Teaching techniques constitute procedures used by the teacher in giving instruction through various teaching methods (4:148).

CHAPTER II

OVERHEAD PROJECTION

Visual materials are useful for giving foundation and reorientation material, correcting and intensifying impressions, and giving reality to the subject being studied. Properly organized instruction with visual materials being a supplemental, yet essential part of that instruction, will eliminate a great deal of wasted time and effort of both the industrial education instructor and the pupil, through intensifying the interest of the student and increasing the efficiency of the instruction (15:25-26).

Students cannot and do not think in terms of symbols such as words. Rather, their minds usually conceive thoughts in terms of pictures--visualizations (1:11).

All of the visual communication methods are valuable and each is especially suited to one or more specific communication situations. Among them is one method of visual presentation that offers outstanding versatility and opportunity; "overhead" projection (1:13).

I. HISTORY

The visual cast projector was developed by the Navy during World War II. Since its inception, it has found

favor as an excellent teaching medium in almost every walk of life (14:82-83). As usage of the projector increased, "overhead" replaced visual cast, due primarily to the fact that the projected image is behind and over the head of the speaker (1:15).

The price of the projector and the teaching materials associated with it were fairly expensive when the projector was brought on the open market. However, the projector now sells in the price range of two hundred dollars and the price of materials has decreased since their usage has increased. One plastic foil without processing costs in the vicinity of twenty cents.

II. AUDIO-VISUAL COMMUNICATION

Why this use of the overhead projector in the wood shop program? We already employ such time tested teaching techniques as the demonstration, chart, mock-up, model, and the actual three-dimensional objects we work with. One reason is that research tells us that audio-visual materials in teaching can provide as much as 300 per cent more effectiveness in student learning with a reduction of more than 13 per cent in teaching time (1:18).

Another reason for the use of audio-visual aids and materials is their usage to increase understanding, to explain a principle or abstract idea, to illustrate

relationships, to show order and sequence of procedure, to demonstrate standards of workmanship, and to show materials of construction.

An effective aid is one that is designed to help clarify a teacher's verbal explanation of a complicated principle or theory. It can then be said that the most useful and effective audio-visual teaching aids are those conceived and created for a teacher's particular needs (11:38-39).

III. ADVANTAGES OF OVERHEAD PROJECTION

There are many advantages to overhead projection and the materials that can be used to support the instructor in the classroom. These advantages will be discussed in a wood shop teaching situation.

Large image. Standard overhead projection transparencies are ten inches by ten inches in size and are much larger than a 35 mm. slide or a 16 mm. film. This means that the projector is much closer to the projection screen (1:17).

Face the audience. The overhead projector is used at the front of the room. The advantages of this are numerous. Since this is the normal position of communication, the students are not apt to be doing anything to deter from

their listening, thinking, and reasoning. Questions may be asked and discussed while the instructor is in direct visual contact with the students. Probably one of the most important issues is that discipline can be maintained (1:17).

Lighted room. The overhead projector can be used in a room with natural light. No shades need to be drawn in a daylight situation and lights can be used in an evening presentation.

Many industrial arts areas have no specific facilities to darken a room. This means if films or slides are to be shown, the complete class must be transferred to an area equipped for the film. Time is lost when a class has to be moved to a projection area and back again to the original classroom, not to mention the time lost in settling down a class after they have moved to a projection room situation (1:17).

Flexibility and versatility. The sequence of presentation need not be fixed in overhead projection. Units of teaching have sequence, but an important question by a student could be answered immediately and not be put off or left unanswered as in the showing of a film or film strip. If no answer were available in the unit, an explanation could be drawn on the clear acetate of the overhead

projector along with the verbal explanation of the instructor. New transparencies can be added or old ones removed to stress new points added to the unit (1:17).

Personalized presentation. The instructor controls the situation. He is communicating with the help of the projector instead of being a machine operator. A personal approach is possible because projection materials can be custom made for a particular teaching situation. If the instructor wants to emphasize a point, phrase, or key word, he can use a grease pencil and mark the transparency while he is lecturing. This method further tends to put a point across. The grease pencil mark can easily be removed with a soft cloth or tissue paper with no damage to the transparency.

Illustrated lecture. Students are more attentive when a talk is accompanied by illustrations. This will increase the interest in the materials presented and give a chance for impression through the various senses; sight, hearing, touch, and smell. An illustration can be shown on the projection screen while some manufactured product or by-product is shown to the students in the classroom (4:53).

Homemade materials. The overhead projector lends readily to the production of materials made by or for the user to meet his specific visual communication needs. Transparencies for overhead projection do not require complex photographic equipment or laboratory facilities to produce. Non-professionals can easily prepare simple but effective transparencies in a minimum of time and at very low cost (1:17).

Transparencies can be made as simple as using acetate and a grease pencil or as complex as a multi-color overlay.

Lecture notes. The instructor need not specifically remember the facts from year to year because a simple outline can be written on the transparency mount. While the instructor is showing the transparency, he can review the outline and elaborate upon the specific cell being shown (1:17).

Testing device. All or part of the material being shown on the projection screen may be covered or uncovered upon the discretion of the instructor. A transparency could first be used as a teaching device and later the nomenclature could be covered with just the letters or numbers showing. The students then could be asked to write down the answers on paper. This transparency could also be

used by students without the supervision of the instructor as a method of self-improvement (1:17).

IV. METHOD OF TRANSPARENCY PRESENTATION

Since the list of plates in the Appendix uses only three techniques in presenting the transparencies, only these will be discussed.

Overlay technique. Overlays seem to be the key to unlocking many difficult teaching-learning problems because they permit the introduction of numerous factors. The overlay transparency is one made up of a base transparency or "cell" with several additional cells mounted on top. The additional cells are positioned so that they may be removed or added to the total visual picture as desired by the user (1:46). In this manner the overlay may be used to build up or break down the components of a system or process (13:407).

An overlay transparency in this paper means that all the additional cells are mounted on the left side so as to open similar to a book. The order of sequence is predetermined in the overlay.

Modified overlay technique. This method uses a base cell and the addition of one overlay foil completes the visual. To create another visual the first overlay is

removed and one mounted from another side is substituted. This manner can produce eight different visuals with one base cell. Four are mounted on the top surface and four are mounted on the bottom surface. The purpose of the transparency being mounted in this manner eliminates the cost and time in making the base cell.

Animation technique. Writing, marking, drawing, or movement on the transparency provides a degree of animation during projection (7:35). An arrow may be moved across the transparency to point out specific items or areas to be emphasized. A rivet may be used, thereby allowing a disk to rotate. Plastic parts may be developed to show gearing, jointing, and fitting (7:45).

CHAPTER III

A UNIT IN WOOD SHOP

Time is often a factor that determines the methods and teaching aids that might be used when teaching a unit of instruction. A teacher might decide, for example, that it would be very effective to have a visual presentation of the first and introductory unit in the wood shop classes (12:331).

The instructional program and materials must be selected and designed to fulfill the aims established for the course (12:225). An introductory unit in wood shop could give general information as well as to relate experiences to other aspects of the school curriculum--social studies, science, mathematics, and English in particular. This introductory unit should also convey an appreciation of the processes and problems of industry (12:126).

I. FROM TREE TO CLAMP

This unit is designed to show and explain some of the characteristics of wood. The unit begins with a section of a tree and follows through until the tree has been cut and clamped into a large solid panel.

II. TREE SECTION

This is Plate 1 and is found in the Appendix. This plate shows and explains the basic composition of wood.

Pith. Pith is the small central core, darker in color, which represents primary growth formed when woody stems or branches elongate. Pith is not separated from the wood in rough lumber or timbers, but it is excluded from finished surfaces.

Most branches originate at the pith, and their bases are intergrown with the wood of the trunk as long as they are alive (16:3).

This is also the part of the tree which sometimes deteriorates and leaves the center of the tree hollow (3:10).

Heartwood. Heartwood consists of inactive cells formed by changes in the living cells of the inner sapwood rings, presumably after their use for sap conduction and other life processes of the tree have largely ceased. The cavities of heartwood also may contain deposits of various materials that frequently give much darker color to the heartwood. All heartwood, however, is not dark colored.

In some species, such as the ashes, hickories, and certain oaks, the pores become plugged by tyloses, as in

white oak which supplies lumber suitable for tight cooperage. The infiltrations or materials deposited in the cells of heartwood usually make lumber cut from it more durable when used in exposed situations than from sapwood (16:4).

Sapwood. Sapwood contains living cells and has an active part in the life process of the tree. It is located next to the cambium and functions in sap conduction and storage of food.

The sapwood layer may vary in thickness and in the number of growth rings contained in it. Sapwood commonly ranges from one and one-half to two inches in radial thickness. As a rule, the more vigorously growing trees of a species have wider sapwood layers. Many second-growth trees of merchantable size consist mostly of sapwood. Unless treated, all sapwood is nondurable when exposed to weather (16:4).

Annual rings. Annual rings or growth rings are often divided into springwood and summerwood. The inner part of the growth ring formed first in the growing season is called springwood or early wood, and the outer part formed later in the growing season, summerwood or late wood. Actual time of formation of these two parts of a ring may vary with environmental and weather conditions. Springwood is characterized by cells having relatively large cavities

and thin walls. The transition from springwood to summerwood may be gradual or abrupt, depending on the kind of wood and the growing conditions at the time it was formed.

When the growth rings are prominent, springwood differs markedly from summerwood in physical properties. Springwood is lighter in weight, softer, and weaker than summerwood; it shrinks less across and more lengthwise along the grain of the wood. Because of the greater density of summerwood, the proportion of summerwood is sometimes used to judge the quality or strength of the wood (16:3-4).

The age of a tree can be figured quite accurately by counting either all the springwood or summerwood rings. One ring of springwood and summerwood constitutes a year's growth.

Medullary rays. The medullary rays of a tree are bundles of fibers that pass from the center or pith to the bark and serve to bind the unit together (2:1).

When the wood is split lengthwise, it is along the medullary ray that it develops.

Cambium. Cambium is the most recent annual ring, in which all growth in thickness of bark and wood arises by cell division. No growth in either diameter or length takes place in wood already formed; new growth is purely the addition of new cells, not the further development of

old ones. New wood cells are formed on the inside and new bark cells are formed on the outside of the cambium (16:2).

Bark. Bark is divided into two kinds, the inner and outer. The outer bark is the corky, dead material that varies greatly in thickness with different species and with the age of the tree. The inner bark is the moist, soft, thin living portion of the tree.

III. COMMON SAWING OF LUMBER

This is Plate 2 and is found in the Appendix. This plate shows and explains the most common method of sawing lumber.

Plain sawing. Plain sawed lumber is cut tangent to the annual rings. One big advantage of plain sawed lumber is that it is cheaper, as a rule, because less time is required and less waste is involved in sawing it from the log (16:142).

Curvature after being sawed. An undesirable characteristic of plain sawed lumber is that of shrinkage and warping.

IV. SPECIAL SAWING OF LUMBER

This is Plate 3 and is found in the Appendix. This plate shows and explains other more desirable methods of cutting lumber. These methods are more expensive due to the additional time needed to cut the log and the added waste incurred.

Plain sawing after removal of pith. The pith is removed and the log is then plain sawed.

Plain sawing after two sides removed. Two sides are removed to be rid of the sapwood and then the log is plain sawed.

Plain sawing after removal of pith and squared. The pith is eliminated and then the log is squared to remove the sapwood. This method is the most costly method of a variation of plain sawing.

Quartersawing. Quartersawed lumber is cut radially to the annual rings or parallel to the medullary rays. Some of the advantages of quartersawed lumber are that it shrinks and swells less in width, twists and cups less, types of wood figure are brought out more conspicuously, and it does not allow liquid to pass into or through it so readily (16:42).

One major disadvantage is the cost is much greater than plain sawed lumber.

V. WOOD CHANGES

This is Plate 4 and is found in the Appendix. This plate shows and explains the shrinkage that occurs in wood which includes the pith.

Shrinkage, board which includes the pith. Shrinkage occurs on the outer edges of boards which include the pith.

Correct method of parallel edge joint. The pith should be removed and then the board could be butt joined in the same pattern as it was in previously.

VI. PARALLEL EDGE JOINT

This is Plate 5 and is found in the Appendix. This plate shows and explains the necessity of joining wood to equalize whatever changes may take place.

Matching external rings to equalize warpage. Whenever a parallel edge joint is used, the jointed edges should be so matched as to equalize whatever shrinkage or warpage takes place.

Incorrect method. The incorrect method shows an external edge jointed with an internal edge. A very bad joint may be the result.

VII. WARPAGE

This is Plate 6 and is found in the Appendix. This plate shows and explains that warped boards are round on one side and hollow on the other side (8:75).

Boards which include the pith. All planks after they are plain sawed turn away from the center of the tree. The annual rings seem to want to straighten out. The cutting of the plank from the log has released some stress and strains and "warpage" occurs.

VIII. JOINING FACES OF TWO BOARDS

This is Plate 7 and is found in the Appendix. This plate shows and explains the method of gluing which is used when a greater thickness in stock is required. An example of this is lathe faceplate material used to turn a bowl.

Joining convex sides. The joining of the convex surfaces could produce a weak joint because both edges are turning away from each other.

Joining concave sides. The joining of the concave sides is the correct method of gluing the two pieces of stock together. Each piece equalizes the other thus producing a flat piece of stock.

IX. PARALLEL EDGE JOINT IN A SOLID PANEL

This is Plate 8 and is found in the Appendix. This plate shows and explains the procedures in making an edge joint. This problem is the one which confronts the students in woodworking many times during the school year. Remembering this technique will save the student time and avoid many additional problems.

Incorrect alignment of the annual rings. Each of the three boards are so arranged that the annual rings are all facing the same direction, thus all boards warping the same direction. A series of boards glued in this manner compound the warpage of each individual board and the end result is a warped panel.

Correct alignment of annual rings, working face and grain design. When gluing a panel made up of more than one piece of stock, three facts should be checked. One of these is the alignment of the annual rings. Since solid stock has a tendency to warp each piece of stock should so

be glued as to have the annual rings alternated. In this manner each piece of stock will counteract the piece next to it.

Another fact is that the face of the large panel will be easier to work with if the face grain in each piece of stock is generally going in the same direction. This fact, however, is not as important as the alignment of the annual rings or the grain design.

The grain design of the large panel is important as this could add much beauty or be a detraction depending upon its make-up. Modern furniture is rarely ever painted, but finished to accentuate the natural beauty of the wood.

X. ABNORMAL GROWTH

This is Plate 9 and is found in the Appendix. This plate shows and explains the abnormal growth or defects in a log. This growth is natural in form and not caused by insects or other animals destroying part of the tree.

Hard knots. Knots are that portion of a branch or limb which has been surrounded by subsequent growth of the wood of the trunk or other portion of the tree. As a knot appears on the sawed surface, it is only a section of the entire knot; its shape depending upon the method that was used to make the cut (16:484).

Wind shake. This type of shake is caused by excessive bending. The defect occurs parallel to the annual rings. Stock with wind shake affect the appearance of the surface as well as permits entrance of moisture which further causes the opening to enlarge.

Heart shake. Heart shakes are defects running parallel to the medullary rays. These checks are usually not seen until the log has been cut into planks. This defect is caused by internal stresses and improper drying.

Star shake. Star shakes are caused by the drying of the outside extremities of a log. The split occurs as the stresses and strains are relieved.

XI. CORRECT METHOD OF CLAMPING

This is Plate 10 and is found in the Appendix. This plate shows and explains one correct method of gluing, using bar clamps and handscrews. Bar clamps are usually used in odd numbers. That is, every other clamp is either placed on the top of the panel or on the bottom of the panel. The bar of the clamp serves as a straight edge and helps keep the panel flat.

Handscrews are used on the end of the panel to help keep the faces of the pieces of stock as nearly flat as

possible. Good clamping techniques can save valuable work-bench time of each student.

CHAPTER IV

SUMMARY

Industrial arts teachers must continually evaluate their teaching program so that they can use the best and newest teaching methods possible. In view of new and better audio-visual aids and materials available, a study of overhead projection and permanent transparencies was made.

The use of the overhead projector with permanent transparencies can offer the industrial arts instructor a vast new field which he can use to improve the learning of his students.

Most industrial arts teachers have a background in graphics and mechanical drawing which is an advantage in making permanent transparencies.

Often times the material which the shop instructor wants to convey to the student is found only in an expensive reference book. The instructor can make a permanent transparency, alter it if he sees a need, and use it in his teaching program for as long as he sees fit to use it. The overhead projector and permanent teaching transparencies are valuable teaching tools in our area of the curriculum.

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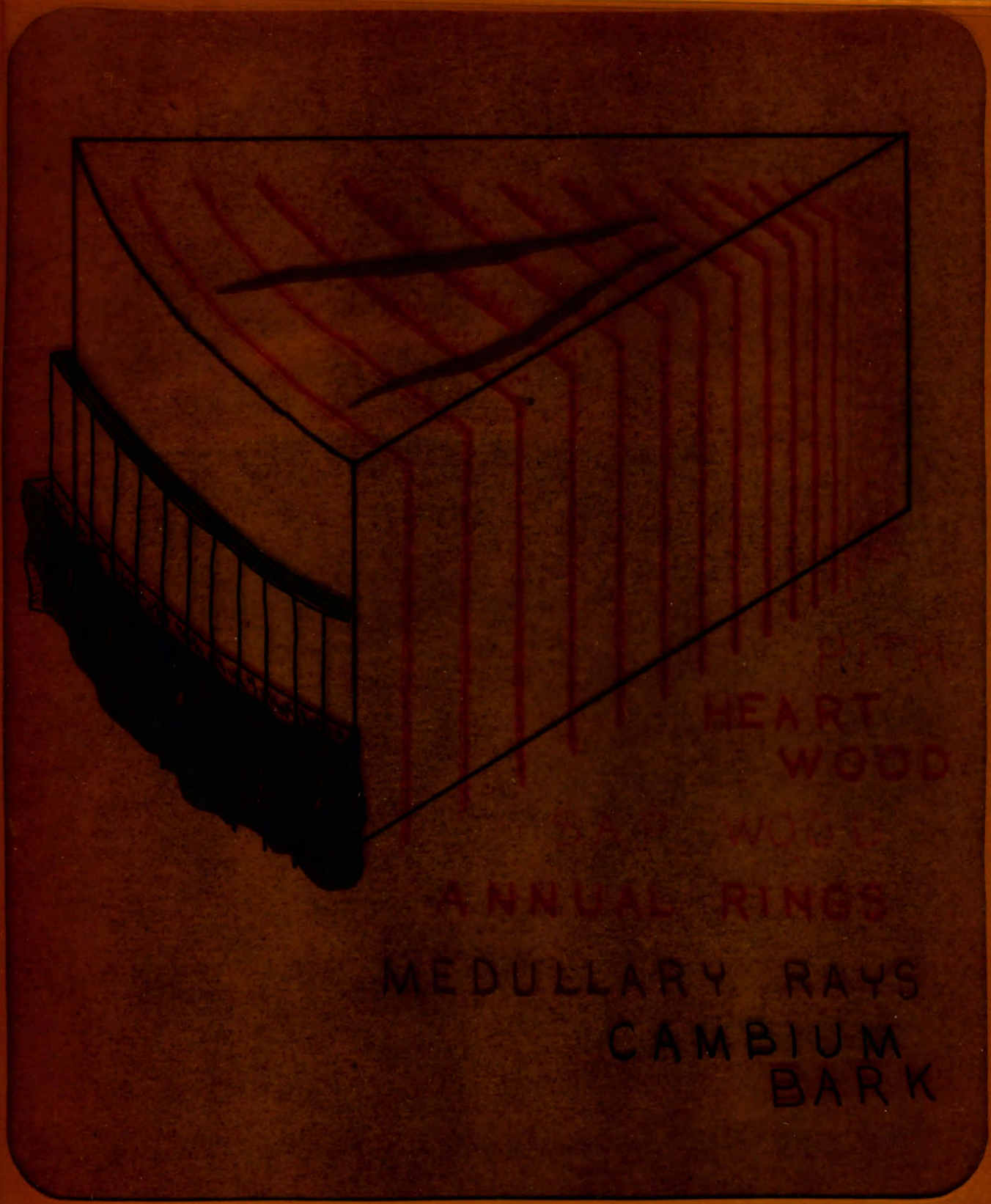
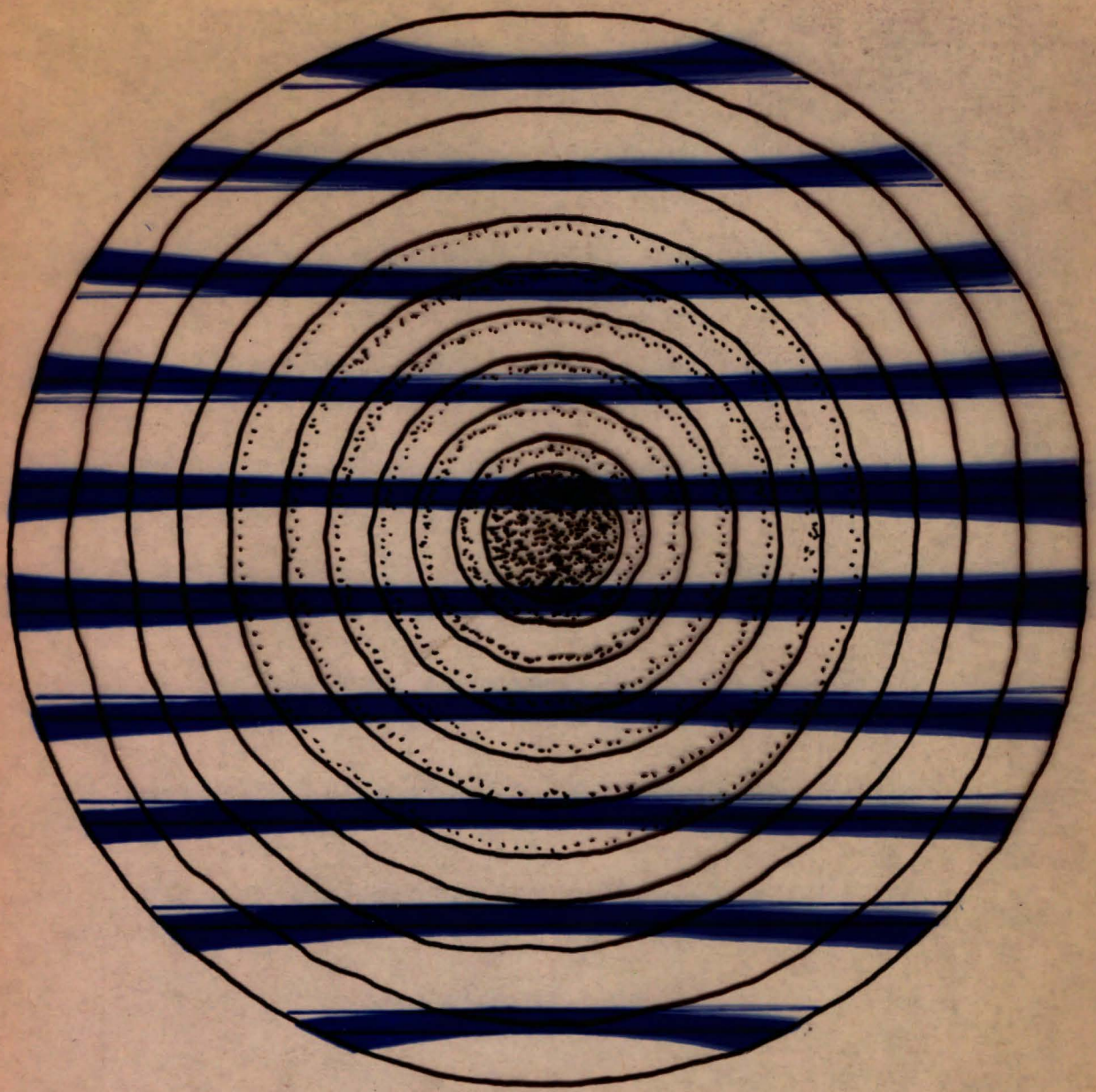
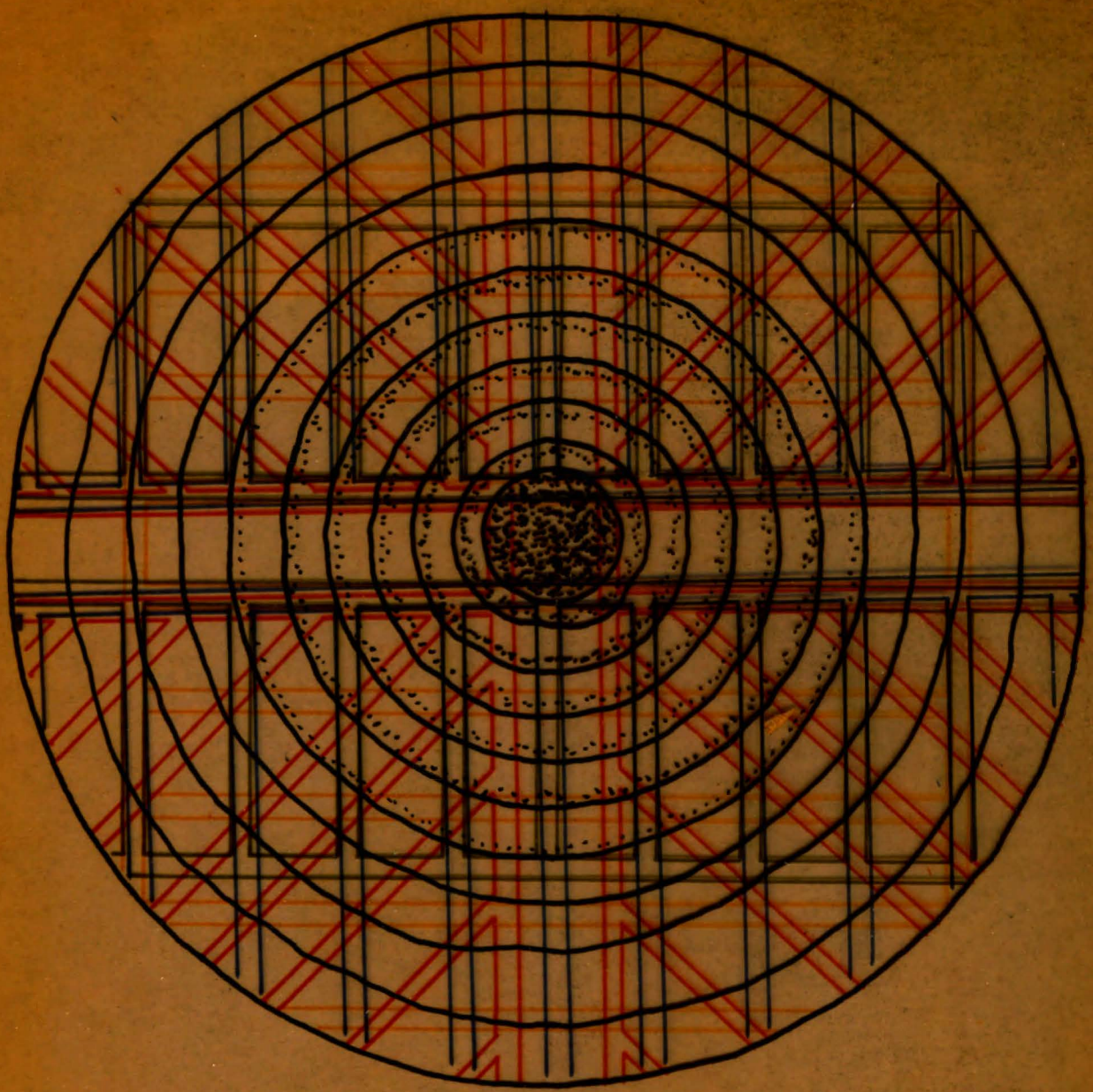
APPENDIX

PLATE 1





PLAIN SAWING
CURVATURE AFTER
BEING SAWED

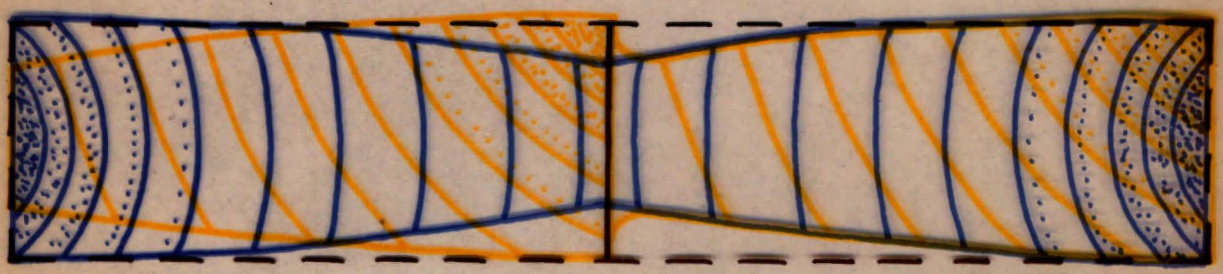


PLAIN SAWING AFTER
PREMOVAL OF PITH AND
SQUARED

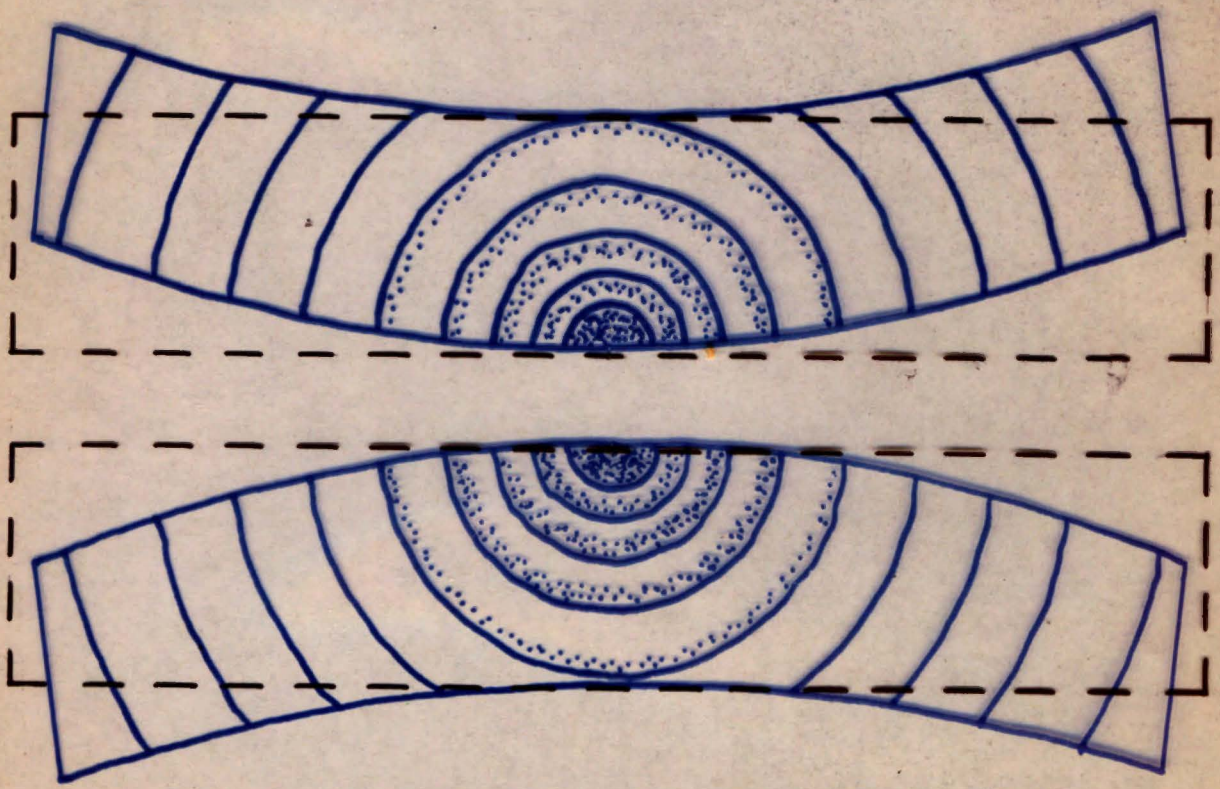
BOARDS CUT FROM THE CENTER OF A TREE ARE THE WEAKEST.

SHRINKAGE REMOVES PART OF THE PITH.

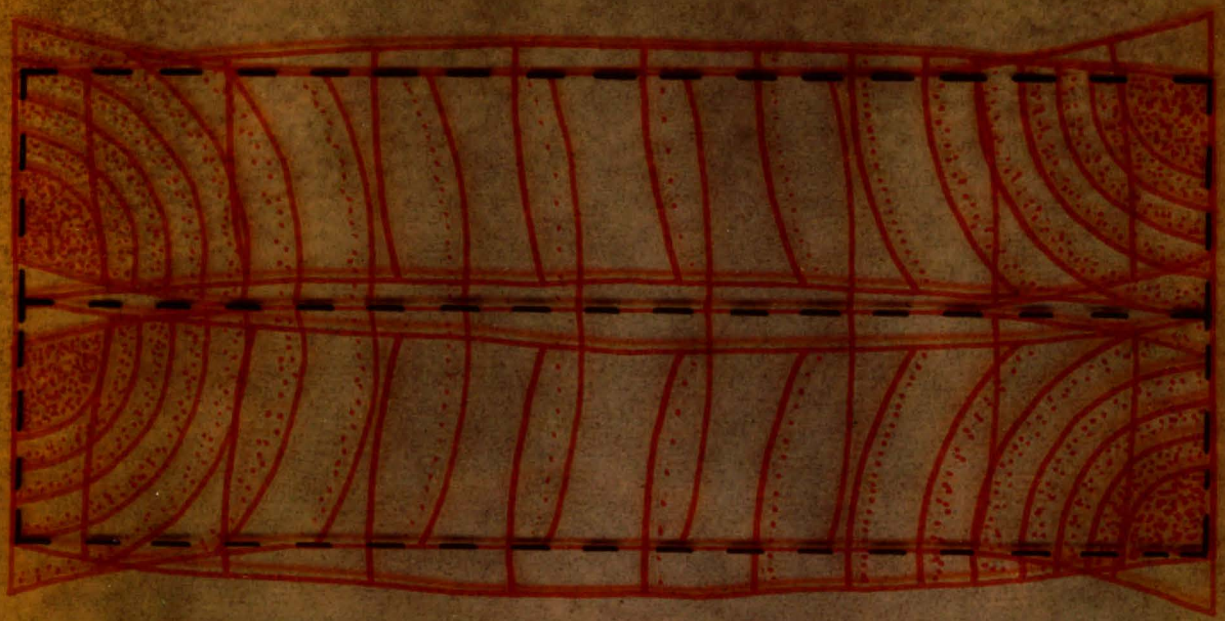
INCLUDES PITH



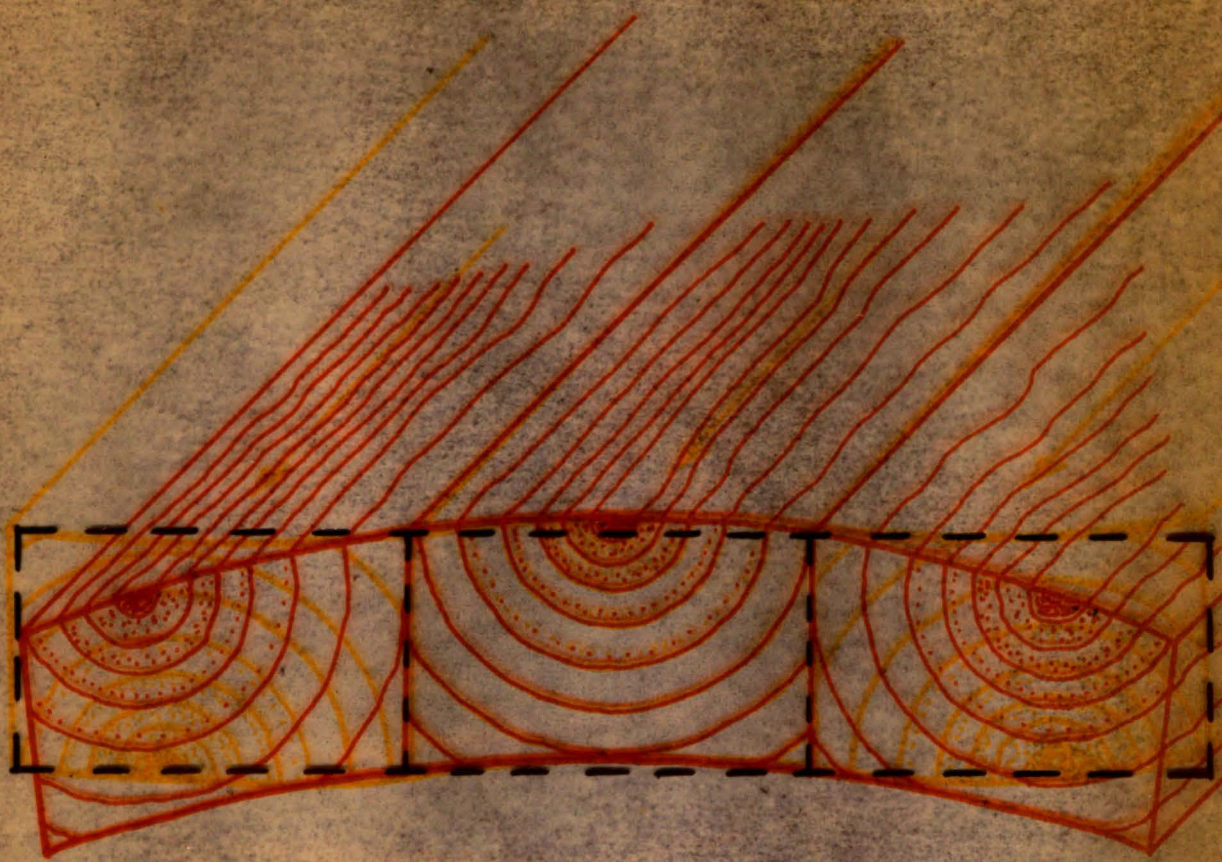
MATCH EXTERNAL RINGS IN ORDER TO EQUALIZE WHATEVER SHRINKAGE OR WARPAGE TAKES PLACE.



WARPAGE - BOARDS WHICH INCLUDE PITH

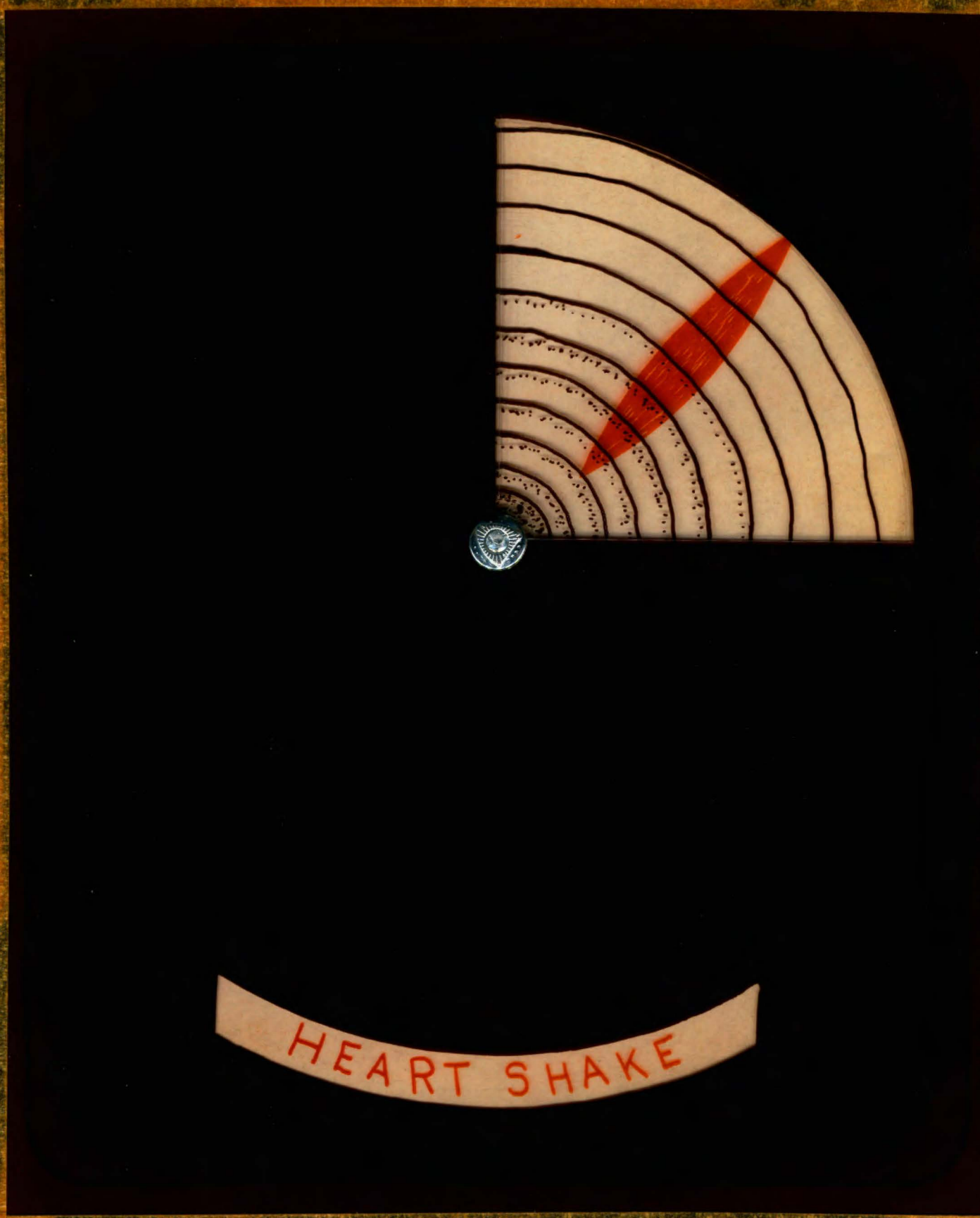


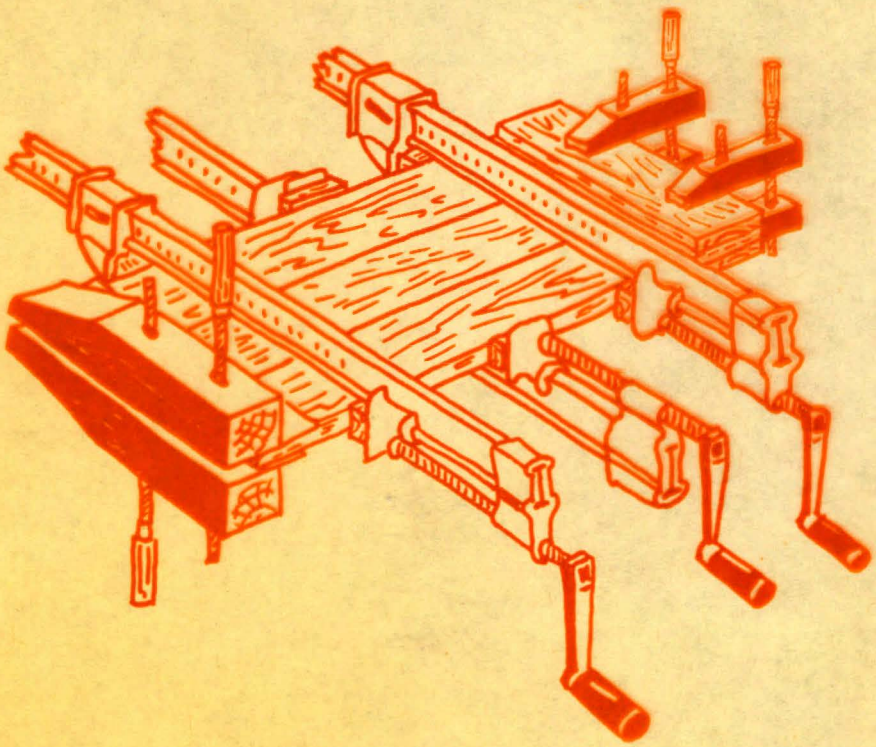
JOINING TWO BOARDS :
CONVEX SIDES WILL PRODUCE
A GOOD JOINT



INCORRECT ALIGNMENT OF
THE ANNUAL RINGS
THE WORKING FACE

PLATE 9





POSSIBLE ARRANGEMENT OF BAR CLAMPS AND HAND-SCREWS FOR EDGE GLUING