

Date: July 12, 1954

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Title of Study: A Suggested Course of Study for Industrial Drawing in Oklahoma High Schools

Number of Pages in Study: 56 Candidate for What Degree: Master of Science

Under Direction of What Department: Industrial Arts Education

Scope of Study: This course of study for two years of industrial drawing in Oklahoma high schools was formulated with the purposes of aiding drawing teachers in organizing and adding to their own course of study. Included are such aids as objectives, teaching methods, equipment list, textbooks, a suggested course outline for one year of general drawing with brief introductions to special fields of drawing. The last year includes work in mechanical drawing and further work in special fields of drawing, and one semester's work in architectural drawing and house planning.

Many helpful aids and hints to the drawing teacher may be found in the appendices, along with sources of testing material, recommended textbooks and periodicals, drawings for use in producing drawing room furniture, and a plan which is suggested for a drawing room arrangement.

Conclusions: The writer believes this suggested course of study will be helpful in aiding drawing teachers to formulate their own course of study that will meet the needs of their particular students. This course of study has been designed with the thought in mind that it will serve only as a suggested aid to the teacher in planning his own course in drawing.

ADVISOR'S APPROVAL

C. L. Hill

A SUGGESTED COURSE OF STUDY FOR  
INDUSTRIAL DRAWING IN OKLAHOMA HIGH SCHOOLS

A SUGGESTED COURSE OF STUDY  
FOR INDUSTRIAL DRAWING IN OKLAHOMA HIGH SCHOOLS

By

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Bachelor of Science

Oklahoma A. and M. College

1951

Submitted to the School of  
Industrial Arts Education and Engineering Shopwork  
Oklahoma Agricultural and Mechanical College  
in Partial Fulfillment of the Requirements  
for the Degree of  
MASTER OF SCIENCE  
August 1954

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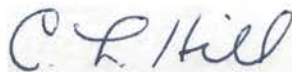
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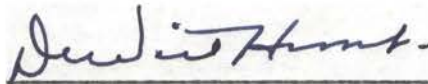
MASTER OF SCIENCE

1954

REPORT APPROVED:



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## ACKNOWLEDGMENTS

I am greatly indebted to Cary L. Hill, Associate Professor of Industrial Arts Education, Oklahoma A. and M. College, for the suggestion of this report, for his patient counsel, guidance and constructive criticism in the preparation of this report.

I am also greatly indebted to DeWitt Hunt, Head of the School of Industrial Arts Education and Engineering Shopwork, Oklahoma A. and M. College, for his counsel and guidance while pursuing my graduate work and fulfilling the requirements for the Master of Science degree.

R.L.L.

## FOREWORD

This is the sixth in a series of courses of study to be issued by the State Department of Education for the use of industrial arts teachers in Oklahoma. The production of the material in this series of bulletins is a responsibility of the State Advisory Committee for Industrial Arts in Oklahoma Schools. This committee consists of twenty members representing classroom teachers of industrial arts, city supervisors, teacher education groups and two persons from the staff of the State Department of Education. The full membership of the advisory committee for 1953 was as follows:

C. R. Moon, Midwest City, Oklahoma  
Millard England, Cordell, Oklahoma  
Loren Smith, Ponca City, Oklahoma  
W. R. Swartz, Midwest City, Oklahoma  
M. J. Ruley, Tulsa, Oklahoma  
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Jake Smart, State Department of Education, Oklahoma City  
Cary L. Hill, Oklahoma A. and M. College, Stillwater, Oklahoma  
L. V. Ballard, Oklahoma City, Oklahoma

This advisory committee, which has been organized since 1937, meets annually at the time of the Oklahoma Education Association convention. All members are appointed by the Executive Board of the Oklahoma Industrial Arts Association with the exception of those who by their office or

position are ex-officio members. Other publications published under this committee are: Accident Prevention in School Shops, 1940 and revised in 1947; A Course of Study in Hand Woodworking la and lb; A Course of Study in Electrical Work la and lb, 1942; A Course of Study in Machine Woodworking la and lb, 1942; A Course of Study in Sheet Metal Work la, 1943; and Industrial Arts in Oklahoma, Bulletin No. 105, 1951. All of these publications were distributed through the curriculum division of the State Department of Education, Capitol Building, Oklahoma City.

Preliminary work was started on this course of study during the summer of 1941 under the direction of C. L. Hill, visiting professor at Oklahoma A. and M. College. There was little progress made during the war years. In 1946 the material was organized and validated for printing. Before it could be printed there were changes made in the textbooks recommended. During the spring of 1954 a graduate student, Rudolph Lack, under the direction of C. L. Hill, was given the assignment of reorganizing and rewriting this material as a part of his requirements for the Master's Degree.

The writer wishes to acknowledge all of the persons who have ever worked on this course of study. Special acknowledgment is given to the following persons whose original drawings were reproduced for inclusion in this report: The drawing stool and table by DeWitt Hunt; plan for a drafting room by Fred R. Hoy; the drawing sheet layout by John B. Tate; and the drawing board cabinet by Kenneth McGlammary.



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## INTRODUCTION

In developing this course of study the writer has realized the many different theories of how the subject should be taught. An investigation of several courses of study has shown the many different ways in which each has been written, the many ways in which the material has been presented and the order of presentation. Likewise, an investigation of the many textbooks written on drawing has revealed the many different theories of the authors. There are many differences of opinion as to how much sketching should be taught, when it should be taught, development of skill in sketching and how soon should instrument drawing be introduced. While there is some difficulty in satisfying these many different theories it may be stated that there is general agreement as to the purposes of Industrial Drawing. Nearly all authors will agree that the aim is to develop some technical skill in the student and to develop his ability to visualize and convey his ideas to others on paper in the form of drawings.

The material in this course of study has been organized to aid the teacher in presenting a plan of study developed to provide maximum educational value and more effective and efficient teaching.

Industrial Arts, as defined by the State Advisory Committee for Industrial Arts in Oklahoma Schools, includes Industrial Drawing as well as shop work. Drawing, either freehand or mechanical, is a graphical language by means of which ideas are conveyed to others. Any ideas concerning the alteration, assembly, or conversion of raw materials into more useable forms are usually conveyed by drawings. Those who plan changes

on any raw material must make drawings and those who make the changes which others have planned must be able to interpret or to read the drawings.

Mechanical Drawing may be defined as a method of graphical representation through drawings produced with the aid of mechanical instruments. The term Industrial Drawing, as used here, seems more appropriate than mechanical drawing or drafting, because of the close relationship between drawing and industry.

## OBJECTIVES OF INDUSTRIAL DRAWING

Objectives may be thought of as aims or goals to be achieved by bringing about desired changes in student behavior as a result of his experiences under the direction of the school. Those experiences provided by the school are the facts, skill and tools which the individual will need if he is to become a happy, useful and successful citizen.

Guiding objectives are necessary to any instructional unit of work if it is to be purposeful. Guiding goals or objectives have been designed to fit this particular course of study in Industrial Drawing based upon a survey of textbooks of drawing and other courses of study. Every teacher needs to develop his own course objectives designed to fit the needs of the group of students in that particular course. Any teacher using the following objectives as a guide will therefore need to modify them to fit the needs of his students.

The specific objectives for Industrial Drawing should be to:

- D.G. 1. Develop the power of visualization and strengthen the constructive imagination.
2. Form habits of careful observation and perception.
- <sup>T</sup><sub>11</sub> 3. Form habits of accuracy and exactness.
- <sup>T</sup><sub>11</sub> 4. Develop some degree of skill.
- <sup>T</sup><sub>11</sub> 5. Develop an understanding and appreciation of the language of industry.
- <sup>T</sup><sub>11</sub> 6. Develop correct techniques of drawing.
- <sup>T</sup><sub>11</sub> 7. Develop the ability to convey ideas to others through

- drawing.
- 7.8. 8. Develop the ability to read blueprints and working drawings.
  9. Develop a safety consciousness.
  10. Present occupational information of the drafting industry.

#### Grade Placement

In large city school systems the student may be introduced to drawing as early as the seventh grade. Needs of the individual at this grade level call for a wide variety of experiences in exploration, guidance and knowledge. When the individual enters high school the exploratory and guidance activities need to be continued as his interests center upon a chosen goal. The high school will be the last formal education for many individuals therefore it must have prepared them for a means of earning a livelihood. Two other groups of people must be considered, (1) those preparing for college, and (2) those who do not expect to make practical use of it. Industrial drawing courses should be planned to give the greatest practical value to individuals represented by each of these groups.

Many schools are small and offer industrial drawing only in the high school, if at all. The possibility of offerings at the junior high level in these schools is very remote. With this in mind it may of necessity permit industrial drawing in the curriculum only at the high school level.

Industrial Drawing Ia has been designed for the beginning classes. Industrial Drawing Ib is a continuation of Ia with that type of projection

peculiar to sheet metal drawing. Industrial Drawing IIA introduces the student to many types of drawing with emphasis on machine drawing. Industrial Drawing IIB emphasizes architectural drawing.

Industrial Drawing Ia and Ib should be offered as early as possible in the high school program. In the four-year high school, the course should be open to ninth grade students and to all others who have received no high school credit in Industrial Drawing. It is recommended that all students have one semester of drawing before participating in shop activities. If a student has been unable to take a course in drawing before taking shop work, he should be required to enroll in a drawing course concurrently with the shop course. Industrial drawing should be a separate course, however, and should not be a part of shop work.

Industrial Drawing IIA and IIB may be taken as the student finds an opportunity to enroll. Either course may be taken as the student's schedule permits and one should not be considered a prerequisite to the other.

#### Prerequisites

There are no prerequisites to this course other than that the student must be a regularly enrolled high school student. In those schools organized and administered under the 8-4 plan this will include the ninth grade. It is recommended that, in cases where it is possible, students should take one semester of industrial drawing before enrolling in industrial arts shop courses. In some cases where students have transferred from other schools or have had previous shop experience, the teacher will need to make special consideration of this so that there will be no loss of interest on the part of the student. This course of study is flexible

and may be adjusted by the teacher to meet the needs and interests of the individual student.

### Social Effects

Industrial drawing, as a school subject, affords an excellent opportunity for the student to understand the many changes in our rapidly changing industrial world. Never before has the need for industrial drawing been realized as it is today. In the last few years the consumer has been able to buy products which he may install, assemble or finish. Along with these products are complete instructions and assembly drawings on how to install, assemble or finish. Without a basic understanding of drawing or blueprint reading, many persons are unable to do even these relatively simple operations.

The progressive teacher should point out the many uses of drawing in all forms of industrial life so that the student will realize that drawing is, truly, the language of industry. This philosophy of teaching should prepare the student of industrial arts in accordance with his interests and within the limits of his capability to find the vocation for which he is best suited.

The academic subjects of mathematics, science, history, art and language all have important correlations with drawing. The student must make calculations previous to expressing his ideas by the conventions of drawing. Experiments in science may be easily demonstrated by carefully made drawings. In the study of history and art the development of the homes of man and a comparative study of the architecture of different lands may be best handled by a series of plates worked out by the students themselves. Thus the student will observe a daily use of language in

describing his drawings and must understand its use in order to illustrate a written idea in the form of a drawing.

This is only a suggestive list of possible correlations as the student learns the applications of drawing to his everyday life and the industrial world about him. Naturally he develops a greater appreciation of drawing as, truly, the universal language.

During World War II, the National Defense program provided an excellent opportunity for drawing to prove its genuine worth to all industrial pursuits. The burden of providing the government with trained men for defense industries was delegated largely to the schools. In view of this fact, industrial drawing has been highly specialized in order that it may contribute significantly to the future progress of our democracy.

#### Teaching Methods

Industrial drawing need not be a cut and dried series of lectures, demonstrations, and senseless lettering sheets and drawing plates. To disseminate information to the students, the lecture method must be used at times. One fault of poor teaching technique is attempting to present too much information at one time. This may be prevented by limiting the lecture to fifteen or twenty per cent of the class period, supplemented by demonstrations, illustrations, or other audio-visual teaching aids. Much learning is accomplished through the eyes. If lectures are supplemented with teaching aids which the students can visualize, much more learning will take place.

The student and teacher should plan and work together. Students will be more interested if they have a part in planning. Encourage student participation in planning, class discussion, reporting, and working



in groups.

Problems should be assigned in accordance with student aptitude and ability. Students should be encouraged to work as rapidly as possible. Problems of more difficulty should be assigned to the more capable while less difficult problems should be assigned to the less able students.

Tests for evaluation of progress should be given at times throughout the course, covering development of manipulative skills and knowledge of drawing and guidance information.

Teaching aids, such as charts, informational bulletins, lesson plans, models and specimens, and other concrete objects which the student may use and examine freely should be made available. Motion pictures, both sound and silent, filmstrips, slides, and other forms of projected pictures should be utilized to stimulate and motivate pupil interest, learning, and participation in group discussions. They are excellent for holding attention, aiding retention of information, forming correct mental images and understanding proper relationships of component parts.

T.O. This writer believes that students should be introduced to drawing  
 FRE. by first learning to sketch problems. It seems reasonable to assume that a student starting in a course which is entirely new to him, and of which he knows little or nothing about, will have all he can do to master the principles and techniques of drawing without having at the same time to learn how to use drawing instruments. It is recommended that students learn the theory of drawing, the placement of views, and so forth, through the process of freehand sketching before learning the techniques of instrument or mechanical drawing. The student will find the ability to sketch will aid him in visualizing problems and solving them on the drawing board.

A textbook should be used by the teacher and students in the course. There should be copies of the best books and magazines in the field of industrial drawing to be used as references. The three state adopted textbooks for drawing are listed among the following recommended textbooks.

1. Ericson, Emanuel E., and Soules, Roy L., Planning Your Home, Charles A. Bennett Co., Inc., Peoria, Illinois, 1938, 131 pages, \$3.60.
2. Farnham, Walter E., and McCabe, Francis T., Mechanical Drafting Essentials, Prentice-Hall, Inc., New York, 1948, 196 pages, \$3.40.
3. French, Thomas E., and Svensen, Carl L., Mechanical Drawing, McGraw-Hill Book Co., Inc., New York, 1948, 437 pages, \$3.48.
4. Frykland, Verne C., and Kepler, Frank Roy, General Drafting, McKnight and McKnight Publishing Co., Bloomington, Illinois, 1949, 166 pages.
5. Hale, E. M., McGinnis, Harry, and Hill, Cary L., Introduction to Applied Drawing, McKnight and McKnight Publishing Co., Bloomington, Illinois, 1952, 80 pages, paper, \$0.80.
6. Waffle, Harvey W., Architectural Drawing, Bruce Publishing Co., Milwaukee, Wisconsin, 1943, 334 pages, \$3.96.

#### Summary of Suggested Course Outline

The following four pages of this course of study consist of suggested outlines with selected problems and reference readings for Industrial Drawing Ia, Ib, IIa and IIb. Each outline is divided into five vertical columns. One column is arranged under the title Learning Units. These are the major informational topics and work experiences which the student should do. They have been arranged in a logical sequence to provide continuity and additional knowledge and skills as the student progresses in the course.

The other four vertical columns have been arranged under the authors of recommended textbooks selected for use in this course of study. Each

COURSE OF STUDY IN INDUSTRIAL DRAWING 1a

Learning Units	Fryklund and Kepler			French and Svensen			Hale-McGinnis-Hill			Farnham and McCabe		
	Ref. Page	Problem		Ref. Page	Problem		Ref. Page	Problem		Ref. Page	Problem	
		Number	Page		Number	Page		Number	Page		Number	Page
Language of Drawing	9-12			1-2						1		
Sketching - Isometric to Orthographic	20-23			51-55	Fig. 5.7	56	9-12	A-2	12	2-13	All	7-9,12-13
				"	" 5.8	57	"	A-3	13	14-21	All	17-19
				"	" 5.9	58	"	A-7	15	2-16	All	20-21
				"	" 5.10	59				22-23	All	30-31
Orthographic to Isometric							17-18	B-2	19			
							"	B-3	20			
							"	B-8	22			
Use and Care of Drawing Instruments, Supplies, Scale and Other Measuring Devices	13-14			3-19			45			114-124		
	36-37											
Lettering and Lines Vertical	26-36			20-31	44-47	282				190-193	All	193
	"			"	48-51	"				"	Lower Half	192
	Inclined			"	52-55	"				"	All	191
	"			"	56-59	"				"	Upper Half	192
Lines Horizontal and Vertical							24-27	Fig. 8	24	123-124		
							"	Fig. 12	27	"		
Lines Hidden and Center				101-114	Fig. 9.3	104				42-44	All	45-47
				"	" 9.7	108				"	All	48-51
Graphic Solutions	51-57	1-4	57-58	200-209	13,16-17,21	279-280	38-39	Fig. 17-19, 21	38-39	114-124	Fig. 119, 121-123	120-121
	70-80, 84			"	22,24-26	"	"	E-4	43			
	"			"	12	278						
Shape and Size Description	9-13, 18-20, 23-25, 41-45	1-4	49-50	33-50, 81-99	65-68, 75-78	287, 289-290	25-27	A-6	14	32-34	All	35-41
				"	87-90	"	"	D-2	34	52	All	53-63
				"	105-108	293				88-89, 96-102	All	103-113
				"	119	299						
Purpose and Use of Section	80-83	1,2	83	60-65	143	308				74-77	All	82-83,87
	"	3,4	84	"	147	310	51	G-1	52	"	All	79-80
	"	6	84	"	152	312	"	G-6	57	"	All	8, 86
	Revolved	5	84	"	153	313				"	All	81, 85



COURSE OF STUDY IN INDUSTRIAL DRAWING 2a

Learning Units	Fryklund and Kepler			French and Svensen			Hale-McGinnis-Hill			Farnham and McCabe		
	Ref. Page	Problem		Ref. Page	Problem		Ref. Page	Problem		Ref. Page	Problem	
		Number	Page		Number	Page		Number	Page		Number	Page
Fasteners												
Conventional Threads	85-88	1	88	115-132	222	335				131-135	All	136
Thread Symbols				"	223	335				137-138	All	139
Bolts and Nuts				"	234	336				140-143	All	144-145
Working Drawing												
Detail	58-70			133-146	296	358						
	"			"	301	361						
Assembly	92-94	1, 2	95	"	303	362						
	"			"	305	364						
Exploded				168-171	402	391						
				"	403	391						
Cams and Gears												
Plate Cam				210-216	432	393						
Cam With Roller				"	434	393						
Spur Gear				"	436	393						
Spur Gear and Pinion				"	438	393						
Electrical Drawing	120-126	1-4	122							77-78	9	79
Piping Drawing				144-146	322	371						
				"	323	371						
Welding Drawing	68-70			190-199	420	392						
				"	431	392						
Aircraft Drawing				177-189	418	181						
				"	419	181						
Furniture Drawing				149-165	286	353						
				"	293	356						

of these columns has been subdivided into three sections. The Reference Page provides selected references for reading about a particular Learning Unit. The last two columns have been placed under the Problem. Under Problem may be found a selected problem Number and the Page on which the problem may be located.

Industrial Drawing Ia has been designed as an introductory course. Basic principles and essentials of drawing have been incorporated into this course to give the student a background for further industrial drawing. A liberal amount of problems have been included and there should be enough variation in the degree of difficulty of problems to take care of individual differences.

Industrial Drawing Ib is a continuation of Industrial Drawing Ia. Here, the student will become familiar with many types of drawing used in industry, such as sheetmetal drawing, map drawing, graphs and charts, and different types of pictorial drawings. This will have concluded the student's first year of drawing and should he wish further specialized drawing he will have been provided the necessary background to pursue it. Should the student not pursue further drawing, he will have the necessary knowledge of industrial drawing that is so much needed in life today.

Industrial Drawing IIa is somewhat specialized and Industrial Drawing Ia and Ib should be a prerequisite to it. In this course the major area of work is machine drawing. The student is also introduced to other areas of specialized drawing used in industry such as electrical drawing, piping drawing, welding drawing, aircraft drawing and furniture drawing. These have been added to acquaint the student with the many types of drawing in industry as otherwise he may never become familiar with them.

COURSE OF STUDY IN INDUSTRIAL DRAWING 2b

Learning Units	Fryklund and Kepler			French and Svensen			Waffle			Ericson and Soules		
	Ref. Page	Problem		Ref. Page	Problem		Ref. Page	Problem		Ref. Page	Problem	
		Number	Page		Number	Page		Number	Page		Number	Page
Architectural Drawing	141-143			237-241			1-2			43-45		
Architectural Lettering	26-35	1-9	29-30	241-242	493-496	405	3-8			47-48,		
	"	1-8	33-34	"	497-500	406				82-83		
				"	501	406						
Symbols and Conventional Representation	154-155			247-249			17-19			48-50		
Architects' Scale	37-39, 94, 147			241						45-47		
Principles of Design	143-147						187-214			51-77		
Preliminary Planning	152-154			240			190-271			16-20		
Complete "Set of Plans"	Problem to be a result of pupil-teacher planning including the following:											
Floor Plan	147,152-155			249-250			229-233			98-103		
Foundation Plan				250			38-41			69,120		
Plot Plan				250			190-199			45		
Roof Plan	158			246			257-259			74-75,94		
Elevations: Sides, Front and Rear	155-156			250			240-249			95-97		
Wall Section				243-244			107-111			93-94		
Construction Details	156			244-246			49-106			127		
				250								
Framing Plan: Ceiling, Floor, Elevation				242-244, 246			257					
Perspective				161-165			293-310			45-46		
Specifications	159-161						49,268-269					

Industrial Drawing IIb concerns only architectural drawing and provides valuable experiences in house planning. The prerequisite to this course should be Industrial Drawing Ia and Ib. The order in which Industrial Drawing IIa and IIb are taken should have no effect on each other. The student should be allowed to enroll as his schedule permits. Architectural drawing has been designed for the pupils and teacher to work out a common problem for the class. All drawings made should become a part of the complete set of plans which will be the problem of each student. No drawing exercises should be required of the student unless it is to become a part of his complete set of plans.

Pencil and ink tracing has been omitted from the suggested course outline because it is a service unit. However, it should be included in the course, the time for inclusion to be decided upon by the teacher. There is no logical time for its inclusion and it may be introduced at any point during the first year of drawing. The amount of tracing, both pencil and ink, should be governed by the needs of the particular group of students and for that reason no suggested problems or exercises have been included. It is recommended that the student be introduced to pencil and ink tracings by having him first make a drawing and then do a pencil tracing. Another drawing should be selected for making an ink tracing. The teacher should explain the importance of pencil and ink tracing to reproduction methods and its uses in industry. No great amount of skill may have been developed but the student will derive educational values from the work experience and knowledge of industry.



### An Equipment List for a Maximum of Ten Students

The following is a list of the necessary equipment for a class of ten students in industrial drawing. The prices listed are the approximate costs of school quality material taken from several catalogs of leading manufacturers of drawing supplies and instruments. It is recommended that the school furnish equipment which is of a permanent nature and may be used over a period of years and by different groups of students taking drawing at different hours during the day.

Part of the following list of equipment and supplies may be purchased from local retail stores. However, many communities will not have a local source for these materials, and it will be necessary to order them from one of the companies listed under the topic "Sources of Equipment and Free and Nearly Free Related Teaching Materials".

The equipment list has been divided into four parts according to the amount of use and expendability of each item. The Equipment for a General Tool Cabinet consists of instruments and drafting equipment which is not in everyday use but may be needed from time to time throughout the course. The Equipment for Each Student consists of instruments and drafting equipment which will be in everyday use by the students. The Equipment for the Drawing Room, with the exception of the white printer, consists of drawing room furniture and equipment which is deemed necessary for properly conducting a drawing class. All of the equipment and furnishings are of a permanent nature and should be furnished by the school.

The fourth part is Supplies to be Furnished by the Student and consists of drawing supplies which the student will personally use throughout the course, and is expendable.

A reproducing machine has been included in the equipment list because of the great amount of reproducing that is done in industry. Students should have the opportunity to see how original drawings are reproduced for use in the work shops. Many schools will be financially unable to purchase even a relatively cheap reproduction machine but the ingenious industrial drawing teacher may build one, at little cost, from any number of plans available.

### Equipment List

#### Equipment for General Tool Cabinet

Number	Name of Equipment	Total Price
3	Irregular Curves	\$ 4.75
2	Protractors, 6"	1.50
1	Riefler Drawing Set, #G07	24.00
1	Engineers Scale	1.50
1	Chalk Board Drawing Set	7.80
1	Triangle, 30°-60°, 12"	.73
1	Triangle, 45°-90°, 12"	<u>1.10</u>
	Total Price	\$ <u>41.38</u>

#### Equipment for Each Student

Number	Name of Equipment	Total Price
10	T square, 30"	\$ 41.00
10	Triangles, 30°-60°, 10"	8.00
10	Triangles, 45°-90°, 8"	8.00
10	Riefler Drawing Sets, #G0	75.00
10	Architects Scale	13.50
10	Drawing Board, 23" x 31"	58.50
10	Dusting Brushes, 5"	<u>9.00</u>
	Total Price	\$ <u>213.00</u>

#### Equipment for the Drawing Room

Number	Name of Equipment	Total Price
10	Drawing Desks (if built in shop to accompanying specifications)	\$200.00
10	Drawing Stools	54.40
1	Filing Cabinets (built in shop)	30.00

Equipment List (Continued)

Number	Name of Equipment	Total Price
1	White Printer, Spee-Dee, 18"x 24"	\$ 89.50
1	Drawing Board Lockers (built in shop)	30.00
1	Pencil Sharpener	<u>2.75</u>
	Total Price	\$406.25

Supplies to be Furnished by the Student

Number	Name of Equipment	Total Price
1	2 H Drawing Pencil	\$ .10
1	4 H Drawing Pencil	.10
1	6 H Drawing Pencil	.10
1	Ruby Eraser	.08
1	Art Gum, 1"	.06
1	Quire Drawing Paper	.60
1	Roll Drafting Tape, 3/4" x 10 yds.	.39
1	Pencil Pointer	<u>.10</u>
	Total Price	\$ 1.53

Sources of Equipment and  
Free and Nearly Free Related Teaching Materials

The manufacturers of drawing equipment and supplies include much valuable instructional materials in their catalogs. Many of them distribute, free of charge, wall charts, leaflets, pamphlets, descriptive circulars and drafting problems which contain information for ready reference and also serves as a source of information for student reports and individual assignments. Also, several of the companies have available at small cost handbooks, instruction books, lesson plans, and displays which are valuable for supplementary information, teaching aids and classroom instructional material. The many wall charts of decimal equivalents, conventional symbols, and basic standards, placed on otherwise blank wall spaces, serve as a quick source of needed information. Although many are issued as advertising material, they serve as a means of better classroom teaching.

The drafting room of today can well afford to fill blank wall spaces, bulletin boards and display cabinets with these instructional and teaching aids.

Drawing teachers should secure all available material for use in their drawing courses and keep a file of catalogs. All companies are listed in alphabetical order, with products manufactured or distributed, their catalogs and advertising material, and free or nearly free teaching aids.

The List of Companies and Names of Teaching Aids

1. Alvin Co., Dept. G., Windsor, Conn., Alvin Catalog: drawing, drafting and design aids.
2. American Technical Society, 848 East 58th Street, Chicago 37, Ill., Teaching Aids. Catalog: Listing all American Technical Society Books and Study Guides.
3. American Lead Pencil Co., Hoboken, N. J.  
Sketching with Venus Pencils, with one free Venus Drawing Pencil, 25¢.  
Portfolio of Prize-Winning Pencil Drawings in 1951 Venus Scholastic Art Awards, with one free Venus Drawing Pencil, 10¢.
4. American Iron and Steel Institute, 350 Fifth Ave., New York, N.Y., Building Codes and Fire Safety.
5. Atkins and Cox, E. C., 402 South Illinois St., Indianapolis 9, Ind. Wall Chart. Shop Management Chart.
6. Berger Scientific Supplies, Inc., 342 Madison Ave., New York 17, N.Y. Literature and prices: Materials and equipment for engineers, architects, surveyors and draftsmen.
7. Brodhead-Garrett Co., 4560 East 71st St., Cleveland 5, Ohio. B-G Master Catalog: Lumber, tools, supplies and equipment of all types.
8. Brown and Sharpe Mfg. Co., Providence 1, Rhode Island. Training aids; decimal equivalent charts in wall and pocket size; wall charts illustrating micrometer, vernier, and protractor readings; booklets on how to use the various tools; big tool charts.
9. Canvas Products Corp., 19 East McWilliams St., Fond Du Lac, Wis. Shop Organization Booklet.

10. Department of Agriculture, Forest Products Laboratory, Madison 5, Wis.  
Practical Suggestions on Frame House Construction
11. Delmar Publishers, Inc., Orange St. and Broadway, Albany 1, N. Y.  
Instructional Materials
12. Dick Co., A. B., 5700 West Touhy Avenue, Chicago 31, Ill.  
How to Plan and Publish a Mimeographed School Newspaper  
How to Give New Life to Your Mimeographed Paper  
"Color-Light" Your Mimeographed School Newspaper  
Handbook for the Mimeographed High School Paper  
How to Use Mimeograph Color Inks
13. Douglas Fir Plywood Assoc., Tacoma Building, Tacoma 2, Wash.  
Douglas Fir Plywood, Architectural Catalog
14. Eagle Pencil Co., 703 East 13th St., New York, N. Y.  
Drafting Booklet
15. E. K. Elliott Co., Pittsburgh, Pa.  
School Drawing Supplies
16. Eugene Dietzgen Co., 2425 N. Sheffield Avenue, Chicago 14, Ill.  
School Catalog  
Use and Care of Drawing Instruments. A helpful 36 page illustrative booklet for students.  
Lettering Charts. A 3" x 7 1/2" card showing the fundamental strokes in lettering  
Decalcomania Type Lettering Guide for T squares. a 2" x 7" "stick-on" lettering guide for T squares, samples of drawing and tracing papers.  
Print-Making Equipment for schools
17. Gramercy Import Co., Inc., 6 State St., New York 4, N. Y.  
Operation Craftsman, fascinating story of the history of German drawing instruments.
18. Hamilton Mfg. Co., Two Rivers, Wis.  
School Furniture: A student table for every requirement.
19. Higgins Ink Co., Inc., 271 Ninth Street, Brooklyn 15, N. Y.  
Ink Sketching  
Higgins Catalog Folder  
A Biography of the Founder  
History of Ink  
Bottle Holder Color Chart
20. Hunt Pen Co., Howard C., Camden 1, N. J.  
Speedball Elementary Alphabets, 20¢  
Set of Six Educational Charts of Lettering Instruction

21. Keuffel and Esser Co., Adams and Third Streets, Hoboken, N. J.  
Drafting and Reproduction, Equipment and Materials Catalog  
Graph Sheets, Co-ordinate Papers and Cloths  
Leroy Lettering and Symbols  
Elementary Instructions for Operating the Slide Rule  
How to Use the Builders Level  
Hand Level  
Right Angles with Pocket Instruments  
Drafting Instruments and Materials for Engineering Schools  
and Colleges  
K & E School Catalog
22. Kewaunee Manufacturing Co., Adisin, Michigan  
 Drawing Tables and Stools
23. A. L. Leitz Co., 520 Montgomery St., San Francisco, Calif.  
 Catalog and price list containing supplementary items.  
 Sample book of drawing and tracing papers
24. Mayline Co., 623 North Commerce St., Sheboygan, Wis.  
 Classroom Furniture
25. National Lumber Mfg. Assoc., 1319 18th St., N. W., Washington 6,  
 D. C.  
House-Framing Details, 10¢  
Manual on Sheathing for Buildings  
Maximum Spans for Joists and Rafters, 10¢
26. Ozolid Products Division, Johnson City, New York, (branch office at  
 325 West Huron St., Chicago, Ill.)  
 Sensitized materials, whiteprint machines, developing machines  
 and specialities. Sample book of Ozolid papers, cloths and  
 foils.
27. Pease Co., The C. F., 2601 West Irving Park Road, Chicago 18, Ill.  
 General Catalog  
 Pease 60-G Whiteprinting and Developing Machine  
 Pease Sheet Dryer  
 The Pease Continuous Automatic Whiteprinting Equipment
28. Post Co., The Frederick, P. O. Box 1091, Chicago 90, Ill.  
Your Guide to School Buying -- Drafting and Drawing Material  
 Specials  
Decalcomania of Decimal Equivalents -- to be placed on the  
 T square  
Decalcomania of Line Gauges and Lettering Guide -- to be placed  
 on the T square
29. Sheldon, E. H., and Co., Muskegan, Mich.  
 Sheldon School Shop Equipment and Shop Plans, School Furniture

30. Speed-O-Print Corp., 1801 Larchmont Ave., Chicago 13, Ill.  
 Dealer Catalog  
Manual of the Duplicating Process  
Copy Control
31. South Bend Lathe Works, 425 East Madison St., South Bend 22, Ind.  
Modern School Shops
32. Southern Pine Assoc., Canal Bldg., New Orleans 4, La.  
The Way to Build the House to Last (framing)  
Principles of Frame Construction (miniature chart)
33. Stacor Equipment Co., 479 Troy Avenue, Brooklyn 3, N. Y.  
 Catalog: Blueprint filing cabinets, drafting tables, tracing tables.
34. U. S. Blue Print Paper Co., 111 N. Wacker Drive, Chicago 6, Ill.  
 All materials and instruments required for drafting departments including blue print and direct positive print papers.
35. United States Department of Labor, Bureau of Vital Statistics, Washington 25, D. C.  
Occupational Outlook Summaries
36. V. and E. Mfg. Co., Pasadena, Calif.  
Vemco Drawing Instruments -- a descriptive circular of eight pages.  
Vemco Drafting Machines -- a booklet on the adjustments and uses of Vemco Drafting Machines.
37. F. Weber Co., St. Louis 1, Mo.  
 Drawing materials, drawing instruments and drafting room furniture.
38. Westinghouse Electric Corp., 306 Fourth Ave., P. O. Box 1017, Pittsburgh, Pa.  
Eight Principles of Kitchen Planning

#### Visual Aids

The following list of films has been taken from the latest references in the field of audio-visual aids. They are still being produced as of this date. Many films which have been formerly used but are not now being produced may be secured from other sources. State depositories have many out-of-production films which are still good teaching aids. These may be secured by contacting the state depository of films or by writing

for a catalog of available films.

1. According to Plan: Introduction to Engineering Drawing, 1947, sound, b&w, (Engineering Drawing Series). Correlated with the book Engineering Drawings by Thomas E. French. Introduced to demonstrate the need for engineering drawing and its importance as a "language" or means of communication for the coordinated work of the many people involved in modern production.
2. Auxiliary Views (2 parts), McGraw-Hill, 1947, sound, b&w, (Engineering Drawing Series). Correlated with the book Engineering Drawing by Thomas E. French. Supplementary filmstrips also available.
  - Double Auxiliaries, (15 min.). This film shows why a single auxiliary view does not give an accurate picture of an oblique face. The theory of the double auxiliary or oblique view is described in detail by use of combined animated drawings and animated models.
  - Single Auxiliaries, (20 min.). Shows that three views obtained by projection upon the principal planes do not represent true shapes of some surfaces that have slanting faces. Film demonstrates projection of the slanting surface on a plane which is parallel to it for the true picture of the surface.
3. Auxiliary Views (2 parts), McGraw-Hill, 1948, sound, b&w, (Mechanical Drawing Series). Correlated with the book Mechanical Drawing by Thomas E. French. Supplementary filmstrips also available.
  - Part I (10 min.). Explains and defines auxiliary projection; shows the construction of an auxiliary elevation.
  - Part II (10 min.). Describes three types of single auxiliaries, auxiliary elevations, right and left auxiliaries, and front and rear auxiliaries, illustrated by household articles with slanting surfaces which require auxiliary views for complete representation.
4. Drafting Tips, Pennsylvania State College, AV, 1943, 28 min., sound, b&w, \$90.00 (rent \$2.75).
  - Part I. Instruction is given in the use and care of drafting equipment, with proper emphasis on the three essentials, cleanliness, accuracy and orderliness.
  - Part II. Contains instruction on proper sheet layout and the use of an alphabet of lines, depicts the best procedure in developing a drawing from beginning to end.
5. Drawings and the Shop, McGraw-Hill, 1947, 15 min., sound, b&w, (Engineering Drawing Series). Correlated with the book Engineering Drawing by Thomas E. French. Supplementary filmstrips also available.



Describes the relationship between the making of the drawing and various production operations in shop and factory. Brings out some of the reasons for certain drafting requirements, thus laying a better understanding of dimensions which is taken up in the next text-film. The flow of work, as called for in the various drawings of typical metal products, is traced through the pattern shop, foundry, forge, machine shop, and the assembly shop. Representative operations in each of these departments are demonstrated.

6. Elements of Design: Composition, Young America, 1950, 11 min., sound, b&w. Discusses composition as one of the basic elements of design and its function in the art and industry of everyday life.
7. Elements of Design: Light and Shade, Young America, 1950, 11 min., sound, b&w. Discusses light and shade as one of the basic elements of design, and their function in the art and industry of everyday life.
8. Elements of Design: Line, Young America, 1949, 11 min., sound, b&w. Discusses line as one of the basic elements of design and its function in the art and industry of everyday life. Shows the effects achieved by use of straight lines, curved lines, S-shaped lines, circles, and their various combinations.
9. Elements of Design: Shape, Young America, 1950, 11 min., sound, b&w. Discusses shape as one of the basic elements of design, and its function in the art and industry of everyday life. Shows the effects achieved by use of circles, squares, rectangles, triangles, and their various combinations.
10. Introduction to Mechanical Drawing, Floyd W. Cocking, 1932 (revised 1940), 20 min., silent, b&w. Mechanical drawing is presented for the beginner. The necessary materials are lined up and the correct methods of procedure are demonstrated. Drawings are actually made of articles requiring one, two and three views.
11. Language of Drawing, McGraw-Hill, 1947, 10 min., sound, b&w, (Mechanical Drawing Series). Correlated with the book Mechanical Drawing by Thomas E. French. Attempts to answer the question, "Why study mechanical drawing?", and to stimulate the beginning student's interest in the subject. Through glimpses of many jobs in factories, shipyards, laboratories and shops, the student sees that modern production requires many people to work together and that their work must be successfully coordinated. Before each person can find out exactly what he is supposed to do, or give instructions to others, it is demonstrated that all must know something about mechanical drawing, the common language of the building world.

12. Orthographic Projection, McGraw-Hill, 1947, 11 min., sound, b&w, (Engineering Drawing Series). Correlated with the book Engineering Drawing by Thomas E. French. Supplementary filmstrips also available. Animation is used to explain the method and purpose of preparing front, side and top views of an object.
13. Perspective Drawing, California University - Flm. Sdes. Dept., 1951, 8 min., sound, b&w. Produced by the Motion Picture Division, Department of Theater Arts, U.C.L.A. Based on a portion of the book of the same title by Joseph William Hull. Using a cube as a basic form, the film describes individually the one-point, two-point and three-point perspective techniques.
14. Practical Lettering, Floyd W. Cocking, 1942, 25 min., silent, b&w. Demonstrates the construction of each letter and number in Commercial Gothic, the basic style for drafting, and hand lettering.
15. Principal Dimensions, Reference Surfaces, and Tolerances, UW - Govt., 1945, 18 min., sound, b&w. Produced by the U. S. Office of Education, Accompanying filmstrip, \$1.25. The relationship between the blueprint and a rough and finished casting is shown; how to compare casting dimensions with blueprint specifications; how a cross-section view is derived from a full view; how to use a blueprint as an aid in selecting reference surfaces from which to take other dimensions; how to use a blueprint in checking the accuracy of finish; how to interpret tolerances; and how to use the blueprint for checking the finished work.
16. Principles of Scale Drawing, Coronet, 1949, 10 min., sound, b&w, color. Educational consultant: Harold P. Faucett. Determining scale, using measuring and scaling tools, understanding terms, and the vital importance of scale drawings in modern industry are shown.
17. Sections, McGraw-Hill, 1947, 10 min., sound, b&w, (Mechanical Drawing Series). Correlated with the book Mechanical Drawing by Thomas E. French. Supplementary filmstrips also available. Shows the need for sectional views, formed by imaginary cutting away of part of the object, thereby revealing interior details and making it easier to read the drawing. The film goes on to explain various symbols used in sectioning.
18. Sections and Conventions, McGraw-Hill, 1947, 15 min., sound, b&w, (Engineering Drawing Series). Correlated with the book Engineering Drawing by Thomas E. French. Accompanying filmstrips also available. Points out the need for the sectional view, formed by an imaginary cutting away of part of the object, thereby revealing interior details and making it easier to read the drawing, also easier to construct the object. The meaning of special symbols used in sectioning is explained.

19. Selection of Dimensions, McGraw-Hill, 1947, 20 min., sound, b&w, (Engineering Drawing Series). Correlated with the book Engineering Drawing by Thomas E. French. Accompanying filmstrips also available. Introduces principles which govern the choice of dimensions. These principles are shown to be based on two factors: (1) the functional characteristics of the object, which includes consideration of the accuracy demanded and the relation of the portion to other elements of the unit or machine; and (2) the manufacturing methods used in making the object.
20. Size Description, McGraw-Hill, 1947, 16 min., sound, b&w, (Mechanical Drawing Series). Correlated with the book Mechanical Drawing by Thomas E. French. Accompanying filmstrip also available. Presents reasons why uniformity in dimensioning practice is essential and explains that this uniformity depends upon observance of certain standards in: (1) use of symbols; (2) choice of dimensions; and (3) location of dimensions. The first step in learning this common language consists of extension lines, dimension lines, arrowheads, figures, notes, finish marks, etc.
21. Shape Description (2 parts), McGraw-Hill, 1947, sound, b&w, (Mechanical Drawing Series). Correlated with the book Mechanical Drawing by Thomas E. French. Filmstrips also available.  
Part I. (11 min.) Begins by demonstrating the inadequacy of a written or spoken description of an object when a designer wants to tell others how to build it. The only accurate method of conveying this information is to make several drawings showing how the object looks from different views. The film then describes the theory of orthographic projection.  
Part II. (8 min.) The step by step procedure of constructing a drawing using orthographic projection is demonstrated and reasons for each step are explained. The film follows through on one drawing and establishes certain principles of procedure which the student can apply in making drawings of his own.
22. Shop Procedures, McGraw-Hill, 1947, 17 min., sound, b&w, (Mechanical Drawing Series). Correlated with the book Mechanical Drawing by Thomas E. French. Accompanying filmstrip also available. How finished drawings are used as detailed instructions in every step of manufacturing. From the drafting room the drawings are seen going to the blueprint machine to be reproduced by the dozens and distributed to all those workmen who will have a part in making the finished product. The film then shows many of these workmen at their jobs, using blueprints in the pattern making shop, the foundry, the forging shop, the machine shop, and the assembly shop.
23. The Draftsman, Mohnke, 1942, 11 min., sound, b&w, (Your Life Work Series). Produced by Vocational Guidance Films. Shows various steps necessary in the men trained for particular types of

detailed preparation of plans for a building. Presents the kinds of drafting used from freehand sketches to detailed finished drawings; each phase of the development being handled by work.

### Filmstrips

1. Engineering Drawing (6fs), McGraw-Hill, 1948, silent, b&w, each \$4.00. Based on the motion pictures with the same titles. Correlated with the book Engineering Drawing by Thomas E. French, published 1948. Titles are:
 

(a) Auxiliary Views: Double Auxiliaries	26 frames
(b) Auxiliary Views: Single Auxiliaries	38 frames
(c) Dimensioning Techniques	48 frames
(d) Orthographic Projection	40 frames
(e) Sections and Conventions	44 frames
(f) Drawings and the Shop	43 frames
  
2. Inside Story of a Good Home, 1948, sound, 15 min., Southern Pine Association. This slidefilm presents the evolution of a home from the forest, through the manufacture of the lumber, to the completion of the structural framework, and portrays the details of construction from the foundation to the roof.
  
3. Mechanical Drawing (7fs), McGraw-Hill, 1948, silent, b&w, each \$4.00. Based on the motion pictures with the same titles. Correlated with the book Mechanical Drawing by Thomas E. French, published 1947. Titles are:
 

(a) Shape Description, Part 1	33 frames
(b) Shape Description, Part 2	32 frames
(c) Shop Procedures	41 frames
(d) Sections	32 frames
(e) Auxiliary Views, Part 1	32 frames
(f) Auxiliary Views, Part 2	34 frames
(g) Size Description	33 frames

### Student-Personnel Organization for Industrial Drawing Classes

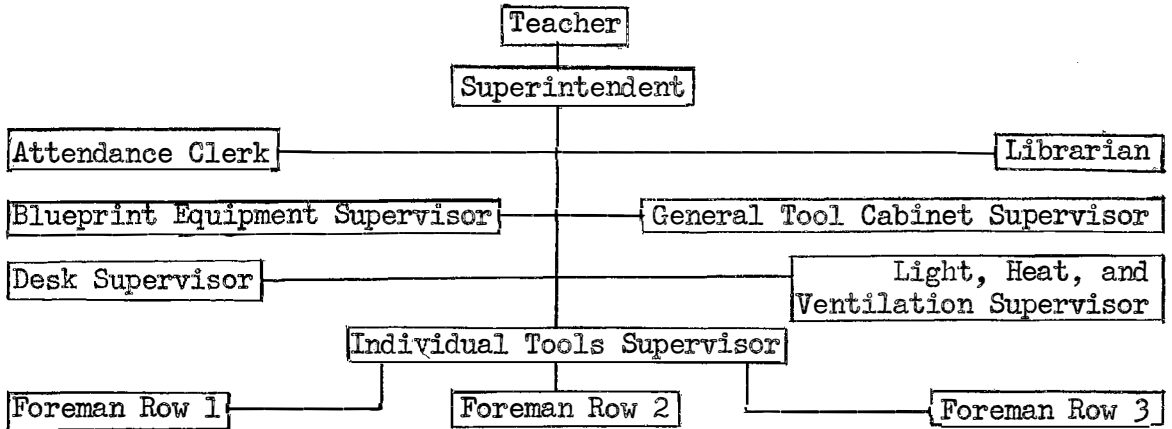
There are a number of variations in student-personnel organization plans and each may claim some educational value. One plan of organization is for the officers to be elected to a short term of office. This provides democratic practice in group action and provides for most of the students to hold office. It has the disadvantage however of partiality between students and the operation of cliques within the group. The plan which seems to offer greater advantages, but which is less democratic in practice, is by rotation of job assignments. Under this plan of organization the instructor assigns each student a job from which he rotates at a predetermined length of time. The amount of time spent upon each job before rotation may be determined by the number of job assignments and class size. Although this type of plan is teacher controlled, each member of the class will have an opportunity to try his hand at each job, partiality of students and instructor is eliminated, development of leadership ability is assumed by all capable students, and work assignments can be readily checked. It is recommended that student assignments be changed weekly in drawing classes.

The educational values of student-personnel organization are as follows:

1. Aids efficient and effective teaching, especially where large classes are concerned.
2. Assists in handling multiple class activities, especially individual instruction.
3. Acquaints the student with terminology and organization of industry.
4. Aids in developing a spirit of individual and group cooperation.

5. Develops responsibility and self-reliance.
6. Stimulates student interest.

Student-Personnel Organization Chart



Duties of Student-Personnel

Superintendent

1. The superintendent will be in charge of the class during the absence of the instructor.
2. Assume charge of the class when visitors occupy the teacher's time.
3. Signal clean-up time, and supervise cleaning-up and replacing equipment, supplies, and materials.
4. Aid students when so directed by the teacher.

Attendance Clerk

1. Check absent and tardy students and report them to the teacher.
2. File absent and tardy reports in their respective places.
3. Maintain any special reports or forms for the class.
4. Assist the teacher in keeping the progress chart up to date.

Librarian

1. Check materials in and out of library.
2. Post charts, pictures, bulletins, posters and other information of interest to the class on the bulletin board.
3. Keep study center or library clean and in a presentable manner.
4. Arrange books and periodicals in their proper places.
5. Check loan cards for over-due materials.

Blueprint Equipment Supervisor

1. In charge of blueprinting room or area when it is being used.
2. Does not permit more students to enter the blueprint room or around the working area than can work efficiently.
3. Is responsible for seeing that the blueprint equipment has been cleaned by persons using it.
4. Is responsible for cleaning the blueprint room or area and replacing supplies and materials.
5. Is responsible for cutting and storage of blueprinting paper.

General Tool Cabinet Supervisor

1. Accountable for all the special instruments located in the General Tool Cabinet at the beginning and ending of each class period.
2. Reports missing, broken or damaged instruments to the teacher at once.
3. Assists in getting out displays or models for class use.

Desk Supervisor

1. Checks tables at end of the period to see that they are left in an orderly manner.

2. See that all stools have been placed under the tables.
3. Collects material to be handed in from the Row Foremen and gives it to the teacher.
4. Distributes materials for the teacher to the Row Foremen.

#### Light, Heat and Ventilation Supervisor

1. Adjusts blinds for light, turns on artificial light if necessary.
2. Checks heat by thermometer on wall.
3. Maintains proper ventilation.

#### Individual Tools Supervisor

1. Responsible for checking each individual student's equipment at the close of the class period before or as it is being stored.
2. Reports missing, broken or damaged instruments to the teacher at once.

#### Row Foremen

1. Distributes drawing plates, instruction sheets or other materials to students in his row.
2. Collects material to be handed in and passes it to the Desk Supervisor.
3. Responsible for seeing that paper and other trash is not lying on the floor in his area.



## APPENDICES

## APPENDIX A

Annotated Bibliography of Industrial Drawing Books

In addition to the recommended textbooks, all of which should be made available, at least ten more books selected from the following list should be in the drawing room or school library. It would be much better to have them in the drawing room should the students need some quick references.

1. Bailey, Charles H., Mechanical Drawing for Beginners, Charles A. Bennett Co., Inc., Peoria, Illinois, 96 pages, paper cover, 1940, \$0.96. Explains principles and procedures in sufficient detail to enable the class to go forward with little or no advice. Problems are complete in themselves and extra problems supplement the regular course.
2. Bartholomew, Roy A., and Orr, Francis S., Learning to Read Mechanical Drawings, Charles A. Bennett Co., Inc., Peoria, Illinois, 49 pages, paper cover, 1937, \$0.88. A method for rapid and economical teaching of the fundamentals of mechanical drawing using only the simplest equipment on the regular schoolroom desk. Provides sufficient information for reading blueprints and shop drawings, and affords the basis for training by means of sketches in orthographic, oblique, isometric, and perspective. 7th and 8th grade book.
3. Berg, Edward, and Elleson, George, Machine Drawing Problems, Charles A. Bennett Co., Inc., Peoria, Illinois, 148 pages, paper cover, 1944, \$1.60. A course of thoroughly practical problems for high-school students. Presented by means of data and sketches and as partially completed problems to be solved by the student. Teaches good construction and emphasizes a high standard of technique.
4. Berg, Edward, Mechanical Drawing Problems, Charles A. Bennett Co., Inc., Peoria, Illinois, 197 pages, paper cover, 1948, \$1.76. Planned for use in the first two years of mechanical drawing at the high school level. Devoted to teaching the basic principles of drawing for the over-all industrial arts field, rather than specialized aspects of drawing for vocational purposes.
5. Berg, Edward, Mechanical Drawing, I and II (revised edition), Bruce Publishing Co., Milwaukee, Wisconsin, Vol. I, paper, 128 pages,

\$0.88; Vol. II, paper, 97 pages, \$0.80. Complete edition, paper, 220 pages, \$1.80. 1948. Texts for the ninth and tenth grades, now revised to conform to new drawing and drafting-room practices of the American Standards Association.

6. Buss, Tumac C., Jr., Simplified Architectural Drawing, American Technical Society, 258 pages, 1947, \$5.00. Fills gap between mechanical drawing and architectural design. Incorporates professional methods of the modern drafting room.
7. Coover, Shriver L., Workbook in Mechanical Drawing, McGraw-Hill, New York, 201 pages, 1947, \$2.40. A functional workbook in mechanical drawing for beginning students. Presents projects and problems of general interest, suitable for the school or home workshop, rather than meaningless exercises or engineering drawing problems.
8. Coover, Shriver L., Drawing, Sketching and Blueprint Reading, McGraw-Hill, New York, 1954, \$3.96. This text has been planned to meet the needs and interests of secondary students, with the chief approach in each unit being through blueprint reading and sketching.
9. Dalzell, J. Ralph, and McKinney, James, Architectural Drawing and Detailing, Second Edition, American Technical Society, Chicago, Illinois, 212 pages, 1946, \$3.00. A comprehensive survey of architectural drawing, detailing, rendering in pen and ink, together with an abundance of practical problems.
10. Elwood, Franklin G., Problems in Architectural Drawing, Charles A. Bennett Co., Inc., Peoria, Illinois, 160 pages, 1950, \$3.28. Completely revised and reset. A combination textbook and project book of modern design -- ranch-type homes, ultra-modern public buildings, up-to-date garages.
11. Ericson, Emanuel E., and Soules, Roy L., Planning Your Home, Charles A. Bennett Co., Inc., Peoria, Illinois, 131 pages, 1938, \$3.60. For use in homemaking as well as in industrial arts courses. First part analyzes and illustrates problems of home planning; second part, architectural drawing simplified and applied to features of home planning. A pioneer in its field.
12. Ermeling, Willard W., Fischer, Ferdinand A. P., and Greene, George, G., Mechanical Drawing, First Year, Bruce Publishing Co., Milwaukee, Wisconsin, paper, 80 pages, 1924, \$0.55. Designed to develop the technical skill of the student and to train him to visualize and reproduce simple objects by drawing. Contains unique teaching devices in the form of cutouts for the four types of solids for studying projection.
13. Ermeling, Willard W., Fischer, Ferdinand A. P., and Greene, George G., Mechanical Drawing, Second Year, Bruce Publishing Co.,

Milwaukee, Wisconsin, paper, 120 pages, 1940, \$0.90. Continues work of first book but is in every sense complete textbook. Offers complete work in conics, sections, developments, sheet-metal work, machine drawing, and architectural drawing.

14. Farnham, Walter E., and McCabe, Francis T., Mechanical Drafting Essentials, Second Edition, Pentrice-Hall, Inc., New York, 196 pages, 1948, \$3.40. This combination text and workbook presents in logical sequence the alphabet, vocabulary, grammar, idioms, and constructions of the graphic language in such a way as to enable the student to obtain a reading knowledge of this language and to develop the techniques of its penmanship in the most direct manner.
15. Fleming, Joseph W., Barich, Dewey F., and Smith, L. C., Applied Drawing and Sketching, American Technical Society, Chicago, Illinois, 156 pages, 1953, \$2.00. Teaches a skill through the use of material that is universally useful in everyday life.
16. French, Thomas E., and Svensen, Carl L., Mechanical Drawing, Fifth Edition, McGraw-Hill Book Co., Inc., New York, 437 pages, 1948, \$3.48. The purpose of this book is to present mechanical drawing as a definite educational subject with the following objectives: to develop the power of visualization; to strengthen the constructive imagination; to train in exactness of thought; to read and write the language of industry; and to give modern commercial practice in making working drawings.
17. Giesecke, Frederick E., Mitchell, Alva, and Spencer, Henry C., Technical Drawing, Third Edition, The Macmillan Company, New York, 1952, \$8.00. This volume is intended as a comprehensive treatment of the science of technical drawing arranged logically and containing a large group of practical problems which afford a highly flexible aid to the teacher in the development of drawing.
18. Goff, Francis L., Problems in Drafting and Design, McKnight and McKnight Publishing Co., Bloomington, Illinois, paper cover, 120 pages, 1947, \$1.00. Fifty drafting problems ranging from simple to detailed drawings. All types of parts.
19. Green, Daniel, Drawing for Life and Industry, Bruce Publishing Co., Milwaukee, Wisconsin, paper, 188 pages, 1947, \$1.56. Approaches the teaching of drawing from situations useful in ordinary walks of life of the fields of specialization. Fifty-eight projects in instruction-sheet form excellently organized and easily adaptable to either a six-week, eight-week, or year's course.
20. Hale, E. M., McGinnis, Harry, and Hill, Cary L., Introduction to Applied Drawing, McKnight and McKnight Publishing Co., Bloomington, Illinois, 80 pages, 6"x9" paper cover, 1952, \$0.80. A six to nine weeks drafting text at the junior high level. Twelve units cover fundamental drafting principles.

21. Hoelscher, Randolph P., and Mays, Arthur B., Basic Units in Mechanical Drawing, John Wiley and Sons, Inc., New York, Second Edition, 305 pages, 1941, \$3.25. Book I. Organized in groups of teaching units. Principles are based on the best of current practice and may be applied in any specialized field drawing. An advanced text in machine drawing with a small amount of architectural drawing.
22. Kepler, Frank R., and Bettencourt, William, Mechanical Drafting Handbook (revised and enlarged edition), Bruce Publishing Company, Milwaukee, Wisconsin, paper, 192 pages, 1949, \$1.20. This enlarged and completely revised edition contains a collection of usages, standards, conventions, and tables based on present-day practices prescribed by the American Engineering Standards Committee.
23. Kenison, Irvin, McKinney, James, and Plumridge, Tom C., Mechanical Drawing, American Technical Society, Fourth Edition, 330 pages, 1947, \$3.00. This book presents the skills and technical knowledge necessary to become adept in making neat and accurate drawings. Based on a careful analysis of the work requirements of a draftsman.
24. Levens, A. S., and Edstrom, A. E., Problems in Mechanical Drawing -- First Course, McGraw-Hill Book Co., New York, 57 pages, 1952, \$1.76. A new series of problems in workbook form for use with French and Svensen's Mechanical Drawing and the accompanying films.
25. Levens, A. S., and Edstrom, A. E., Problems in Mechanical Drawing -- Second Course, McGraw-Hill Book Co., New York, 56 pages, 1951, \$2.12. Primarily designed for use in high schools, the book may be used in any course in elementary drawing as a workbook keyed to French and Svensen's Mechanical Drawing and the accompanying text-films.
26. Luzadder, Warren J., Fundamentals of Engineering Drawing, Third Edition, Prentice-Hall, Inc., New York, 1946, \$5.95. Needless repetition is a waste of the students' time and tends to make the instructor's work monotonous. With this thought in mind, an attempt has been made to create a nearly self-teaching book with simple explanations of all of the more common difficulties.
27. McGee, R. A., and Sturdevent, W. W., General Mechanical Drawing, Bruce Publishing Co., Milwaukee, Wisconsin, 192 pages 1935, \$2.20. Emphasis is placed on: (a) interpretation of drawings; (b) appreciation of mechanical drawing in industry; (c) information on occupations depending on drafting; (d) ability in the making and using of drawings; and (e) methods used by draftsmen in industry. Work is arranged on three levels of difficulty.

28. McKinney, James, Plumridge, Tom C., and Burke, Arthur, Mechanical Drawing Workbook, American Technical Society, Chicago, Illinois, 164 pages, 1947, \$2.75. "Learning by doing" is the plan of this logical presentation of drawing problems. Produced on regular drafting paper.
29. Ray, J. Edgar, Graphic Architectural Drafting, McKnight and McKnight Publishing Co., 256 pages, 1954, \$4.80. This book, through a series of drawings in the form of sketches, isometrics, perspectives, and working drawings, covers in detail the methods of construction and assembly.
30. Roberts, William E., Beginning Mechanical Drawing, Charles A. Bennett Co., Inc., 142 pages, paper cover, 1943, \$1.48. Equally adaptable for use as a school text in the junior high school grades or by the independent student who wishes to learn the fundamentals for himself. Organized on information-operation plan.
31. Shaeffer, Glenn N., and Bass, William A., Basic Mechanical Drawing, Bruce Publishing Co., Milwaukee, Wisconsin, paper, 96 pages, 1946, \$0.96. This recent contribution to mechanical drawing clearly interprets basic principles and processes. Problems are arranged in nine sections permitting an excellent approach to new principles and processes in varying degrees of difficulty to provide for individual differences.
32. Waffle, Harvey W., Architectural Drawing, Bruce Publishing Co., Milwaukee, Wisconsin, 334 pages, 19 , \$3.96. Intended for one or two years of architectural drawing in high school. Excellent as "tryout" material for boys who believe they want to enter the field of architecture.

## APPENDIX B

Recommended Periodicals

Magazines are an additional source for instructional materials and should be a part of every shop library. The following periodicals are recommended for industrial drawing classes.

1. American Builder and Building Age, Simmons-Boardman Publishing Corp., 79 W. Monroe St., Chicago 3, Illinois, Monthly, \$3.00 per year.
2. Architectural Forum, Times, Inc., 9 Rockefeller Plaza, New York 20, Monthly, \$5.50 per year.
3. Better Homes and Gardens, Meredith Publishing Co., 1714 Locust St., Des Moines 3, Iowa, \$3.00 per year.
4. House Beautiful, Hearst Corp., 572 Madison Ave., New York 22, Monthly, \$5.00 per year.
5. Industrial Arts and Vocational Education, Bruce Publishing Co., Milwaukee, Wisconsin, Monthly, \$3.00 per year.
6. Machine Design, The Penton Publishing Co., Penton Building, Cleveland 13, Ohio, \$10.00 per year.
7. School Shop, School Shop, 330 South State St., Ann Arbor, Michigan, September through June, \$3.00.
8. The Home Craftsman, Home Craftsman Publishing Co., 115 Worth St., New York 13, Bi-monthly, \$2.00 per year.
9. The American Home, The Country Life-American Home Corp., 444 Madison Ave., New York City, Monthly, \$1.00.

## APPENDIX C

Bibliography of TestsStandardized Tests

1. Hunter, Walter L., Mechanical Drawing Test, set of four true-false tests. Charles A. Bennett Co., Inc., Peoria, Ill.  
Packet of 25 duplicates, each \$0.25.
2. Mitchell, Weston W., Drawing Aptitude Test, 16 pages, 6" x 9", self cover, McKnight and McKnight Publishing Co., Bloomington, Ill.  
Useful as aptitude test, achievement test to group students, as teaching device.  

Specimen set (test, manual, key)	\$0.35
1 to 3 packages, per package	2.00
4 or more packages, per package	1.50
3. Quinlan, Charles, Jr., Reading Problems in Mechanical Drawing, Charles A. Bennett Co., Inc., Peoria, Ill., per packet of 25 duplicates, \$0.25; 100 duplicates, net, \$0.60.  
A series of seven sheets of problems for class instruction, or for use as tests. Answer key sent with an order. Sample sheet sent free on request.
  1. Plane and curved surfaces
  2. Plane surfaces
  3. Plane and curved surfaces
  4. Full sections, cylindrical
  5. Quarter sections, cylindrical
  6. Full sections, plane and curved surfaces
  7. Broken sections, plane and curved surfaces

The following articles on drawing tests may be found in issues of the Industrial Arts and Vocational Education magazine, Milwaukee, Wisconsin.

- |                  |   |
|------------------|---|
| Aton, Ren.       | "Architectural Drawing Test No. 6"<br>January, 1935 |
| Aton, Ren.       | "Architectural Drawing Test No. 7"<br>June, 1936    |
| Barocci, Louis   | "Mechanical Drawing Test"<br>February, 1953         |
| Bell, Richard M. | "A Comment on Test"<br>May, 1937                    |
| Bowers, W. H.    | "Architectural Drafting Test"<br>January, 1947      |



- Bowers, W. H. "Final Mechanical Drawing Test"  
January, 1942
- Bowers, W. H. "Test on the Fundamentals of Mechanical Drawing"  
February, 1941
- Calendar, Anthony "Mechanical Drawing I - Test"  
April, 1947
- Crawford, J. E. "Special Perception Test for Determining Drafting Aptitude" January, 1942
- Crowe, James W. "9B Mechanical Drawing Test"  
May, 1942
- Donelson, R. N. "Mechanical Drawing Test"  
May, 1937
- Hjerstedt, W. G. "Mechanical Drawing Test"  
April, 1940
- Hjerstedt, W. G. "Mechanical Drawing Test"  
June, 1941
- Hjerstedt, W. G. "Mechanical Drawing Test"  
January, 1942
- Hjerstedt, W. G. "Mechanical Drawing Test"  
February, 1943
- Hjerstedt, W. G. "Vocabulary Test for Mechanical Drafting Class"  
June, 1945
- Klein, R. M. "Mechanical Drawing Test"  
October, 1937
- Kroll, H. W. "Dimensioning Test for Mechanical Drawing"  
December, 1938
- Loofgreen, Andrew G. "Achievement Test in Mechanical Drawing"  
February, 1949
- Mergeler, Harry F. "Orthographic Projection Test"  
February, 1943
- Moore, F. G., and  
Mason, W. R. "Writing Objective Tests for Shop Instruction"  
May, 1943
- Norris, Hugh "Mechanical Drawing Test for Second Year Students in High School" January, 1935

Radford, S. S. "Methods of Testing in Mechanical Drawing"  
April, 1940

Radford, S. S. "Mechanical Drawing Test"  
June, 1941

Radford, S. S. "Methods of Testing in Mechanical Drawing"  
January, 1942

Robinson, H. H. "Examination for the Architecture Drafting Class"  
November, 1937

Schubert, C. H. "Completion Test for Students of Drafting"  
December, 1946

Schubert, C. H. "Multiple-Response Test for Students of Drafting"  
March, 1947

Stern, B. J. "Manipulative Mechanical Drawing Test"  
October, 1937

Stintsman, H. G. "Mechanical Drawing Test"  
May, 1945

Sturtevant, W. W. "Blueprint Reading Test"  
February, 1944

Tidball, "Blueprint Reading Test"  
November, 1938

Watson, R. J. "Architectural Drawing Test"  
May, 1941

Weith, M. E. "Mechanical Drawing Test"  
October, 1935


Whiting, Robert M. "A True-False Test in Mechanical Drawing"  
April, 1940

Wilson, L. R. "Industrial Arts Test"  
February, 1943

## APPENDIX D

Industrial Drawing Check List

The checking of the drawings should be done in a systematic manner. The following check list will enable the instructor to standardize the checking of student drawings. It will assist him to point out to the student the specific errors that have been made, and if desired, place an evaluation on each error. If the check list is made available to the student, either by individual copies or as a wall chart, it will help the student in checking his own drawings for completeness and accuracy.

The instructor may check errors on the drawing by using the usual check mark with a numeral and letter in it. For example: , referring to the check list would inform the student that those lines did not meet at a definite point so that a neat joint resulted.

When this check list is used and given to each student, it may be reproduced on one sheet, single spaced.

Check List for Industrial Drawing

## 1. VIEWS

- A. Selection -- Have proper views been selected which most clearly picture the object?
- B. Placement -- Are the views placed in proper relationship and located so that the sheet is balanced?
- C. Scale -- Is the drawing too large or too small for the sheet?
- D. Completeness -- Are there too many or not enough lines?

## 2. LINES

- A. Type -- Has the right kind of line been used in each part of the drawing?
- B. Weight -- Are the lines of proper width and density?

- C. Uniformity --- Are all lines of each type the same throughout the drawing?
- D. Junction --- Do the lines meet at a definite point so that a neat joint results?
- E. Erasure --- Are the erasures adequate and neat?

### 3. DIMENSIONING

- A. Placement --- Are dimensions conventionally located to give good balance and readability?
- B. Completeness --- Have any dimensions been omitted or duplicated?
- C. Accuracy --- Do the dimensions conform to those of the problem?

### 4. ARROW HEADS

- A. Size --- Are the arrow heads the proper size for good appearance?
- B. Weight --- Are the lines of the arrow heads of correct width and density?
- C. Shape --- Are they properly proportioned and conventionally formed?
- D. Uniformity --- Are the arrow heads the same throughout the drawing?

### 5. LETTERING

- A. Size --- Are the letters of appropriate size?
- B. Weight --- Are the lines of the letters of correct width and density?
- C. Shape --- Are they properly proportioned and conventionally formed?
- D. Spacing --- Is the proper spacing used between letters and words?
- E. Guides --- Have guide lines been used and properly spaced?

### 6. SPECIFICATIONS AND NOTES

- A. Placement --- Are the specifications and notes conventionally located, easily read and well balanced on the sheet?
- B. Completeness --- Are there sufficient specifications and notes to give necessary information?

C. Accuracy -- Do specifications and notes give correct information?

7. CLEANLINESS

Is the drawing free from dirt and smudges?

## APPENDIX E

An Index of Useful Projects, Hints, Valuable Suggestions  
and Teaching Aids for the Drafting Teacher

1. Bedker, R. R., "Sections for the Drafting Room", Industrial Arts and Vocational Education, 32:292-294, September, 1943. The author uses gremlins to help impress upon the students and to clarify points covering sectioning in drafting. Gremlins are used to show how, to identify, and enliven drafting as a whole.
2. Beeker, Samuel G., "Storing Drawing Boards", Industrial Arts and Vocational Education, 39:297, September, 1950. In drawing rooms that lack sufficient storage cabinets for drawing boards, the author has developed a suitable storage rack which is simple and inexpensive to build.
3. Boekeloo, Howard W., "Template for Drawing Guide Lines for Lettering", Industrial Arts and Vocational Education, 39:249, June, 1950. Instead of having separate triangles for slant lettering, a regular 30°-60° triangle was slanted to the correct angle and serves a dual purpose.
4. Bryant, Frederick J., "Four New Teaching Aids in Mechanical Drawing", Industrial Arts and Vocational Education, 34:79-81, February, 1945. Four new teaching aids, as described by the author, (1) an orthographic projection stand, (2) a layout sheet, (3) perspective lines and pointer, and (4) guide line spacers.
5. Buros, H. R., "Cross-Section Paper for the School Shop", Industrial Arts and Vocational Education, 29:254, June, 1940. The author describes a method of drawing projects by making squares on paper to facilitate the sketching of curved lines through plotted points by the freehand method.
6. Byron, Floyd E., "Grading Card for Mechanical Drawing", Industrial Arts and Vocational Education, 30:72-73, February, 1941. A new card for grading drawing plates is described in this article. The class is divided into three groups, according to ability, A, B, and C. The grading card is 5" x 7", upon which is ruled lines for fifty plates with extra lines for occasional tests. The students are assigned plates according to their ability rating and this grade is recorded on the card under the proper column.
7. Carey, John A., "A Simple Adjustment Drafting Table", Industrial Arts and Vocational Education, 39:16, January, 1950. An inexpensive drafting table design is offered for students to use at home.

8. Chellman, H. R. L., "Blueprint Machine", Industrial Arts and Vocational Education, 38:174-75, April, 1949. Complete instructions and drawings have been presented for building a simple blueprint machine.
9. Chick, Joseph S., and Novak, Benjamin J., "Industrial-Arts Drafting Course Based on Student Interests", Industrial Arts and Vocational Education, 39:182, May, 1950. A proposed course of study for drafting based upon interests of the student.
10. Close, L. Clark, "A Grading System that Improves Student's Work", Industrial Arts and Vocational Education, 35:4-5, January, 1946. A stamp containing the words linework, accuracy, dimensioning, lettering and final grade is placed upon the student's drawing after it is completed. The grade is placed on the drawing in the presence of the student and improvement of the drawing is discussed.
11. Cook, Louis T., "Extending the Life of the Drawing Board", Industrial Arts and Vocational Education, 40:222, 22Z, 24Z, May, 1951. The author uses a panel recessed into the drawing board, which each student uses during the course. Panels are placed in lockers after class so the next class may use the board.
12. Cressman, Paul Jr., "A Drafting Jig", Industrial Arts and Vocational Education, 31:225, May, 1942. For drawing a large number of vertical lines, the author attaches a pair of 45° triangles together with scotch tape. It is also useful when drawing diagonal lines in cross-section drawing.
13. Cyirr, K. H., "Lesson Sheet on Dimensioning", Industrial Arts and Vocational Education, 38:14A, January, 1949. A lesson sheet has been worked out showing examples of correct and incorrect dimensioning practices.
14. Darby, Frank P., "Individual Interest Ballot in the Drafting Room", Industrial Arts and Vocational Education, 31:327-28, October, 1942. The ballot contains information about the students' interests, activities, objectives, and other information the instructor may use in selecting study materials to suit individual needs and guidance purposes.
15. Dean, John W., "A Handy Projection Box", Industrial Arts and Vocational Education, 34:365-66, October, 1945. This article describes in detail how to make a transparent projection box and how to use it.
16. Duerksen, George N., "Progress Record for Mechanical Drawing", Industrial Arts and Vocational Education, 34:476, 20A, December, 1945. The author has devised a way of keeping a progress record of the students work from the time he enters the industrial-arts drawing class until he departs from school. Incoming students from other schools can also be rated by the card to determine

where they should begin.

17. Erickson, Chester E., "Visual Aid for the Drafting Room", Industrial Arts and Vocational Education, 43:142, April, 1954. Transparent celluloid models made from discarded x-ray film will help students in visualizing problems of intersection.
18. Foss, M. F., "Visual Teaching Aids", Industrial Arts and Vocational Education, 29:26, January, 1940. This article describes three teaching aids: (1) Finding the line of intersection between two solids by the use of modeling clay (illustrated by pictures). (2) Plywood models, with small handles attached, are used as a means of teaching boys to distinguish the three views used in orthographic projection. The views are painted contrasting colors. The handles are painted black. (Illustrated by pictures.) (3) A large scale made of plywood or cardboard, 6' long and 6" wide, is fitted with wire hooks and screw eyes so that it may be fastened above the blackboard. Several drills are used to demonstrate scale reading. (Boxwood Scale) (Illustrated by picture.)
19. Glazener, E. R., "Folding Drawing Board Stand", Industrial Arts and Vocational Education, 40:132-33, March, 1951. Two different types of folding drawing board stands are shown. They may be folded and stored conveniently out of the way or stand to serve as a small table.
20. Gordon, Harvey, "Compact Drawing Board Carrying Kit", Industrial Arts and Vocational Education, 41:31-32, January, 1952. For students who need to take drawing equipment home overnight, a carrying case complete with drawing board and equipment can be made for the student to use.
21. Grinager, Kenneth, "Perspective Arms", Industrial Arts and Vocational Education, 30:409, November, 1941. Two straight edges can be made from celluloid, sheet plastic, or wood, fastened at the vanishing points, permit the straight edge to be moved to any selected point.
22. Groneman, Chris H., "Suspended Wall Cabinet", Industrial Arts and Vocational Education, 29:68-69, February, 1940. An inexpensive wall cabinet similar to that used in ordinary school rooms for maps, is used for displaying charts and other visual teaching aids. The material can be fastened on window shade rollers which are easily procurable in any furniture store. Working drawings and an excellent picture of this project are included.
23. Haltrop, William F., and Olsen, Bernard R., "Portable Drawing Desk", Industrial Arts and Vocational Education, 42:25-28, January, 1953. This portable drawing desk has been designed for the home rather than the drawing room and may furnish storage space for drawing materials, instruments, reference books and drawings.



24. Heath, Earl D., "An Improved Drawing Board and T-Square", Industrial Arts and Vocational Education, 41:162, May, 1952. To help keep the blade secured to the head of the T square and help eliminate inaccurate workmanship, the drawing board has been rabbetted to accept the head so as to support it along the edge and lower side.
25. Hageman, Bob, "Tracing Made Easy", Industrial Arts and Vocational Education, 34:269, June, 1945. The author has constructed a light box which he uses for large amounts of tracing, sketching, and mimeograph stencils.
26. Hopwood, Ralph E., "Portable Drafting Blackboard", Industrial Arts and Vocational Education, 36:301, September, 1947. Made to resemble a drawing board with paper attached for the purpose of showing proper technique.
27. Jester, G. A., "Architectural Models", Industrial Arts and Vocational Education, 29:340-342, October, 1940. This article describes the construction of miniature model houses of three kinds; clay or plastelline, cardboard, and wood. The models are constructed as a hobby similar to model airplane building. (No illustration.)
28. Kellogg, D. H., "New Sketch Sheet for Drafting Room", Industrial Arts and Vocational Education, 30:259-260, June, 1941. Here is described a valuable teaching aid for freehand sketching. A stencil is cut with periods or dots, either in a horizontal and vertical lines or on the isometric axes. The rows can be any convenient distance apart, 1/4, 1/2 inch, etc. The sheets are mimeographed and are distributed to the class. The tiny dots do not detract from the readability of the sketch.
29. Kimball, Earl, "What's Wrong with my Drawing?", Industrial Arts and Vocational Education, 37:417-19, December, 1948. The author points out the importance of dimensioning and the confusion of the student, and tells how he has tackled this problem.
30. Klein, M. R., "Spelling List for the Drafting Room", Industrial Arts and Vocational Education, 29:59-60, February, 1940. This list contains 250 words or terms used readily in all drawing classes. The list is helpful and useful in the student's English classes. It is suggested that it may be mimeographed and made available for distribution to all the students.
31. Maley, Donald, "Perspective Drawing Teaching Aid", Industrial Arts and Vocational Education, 37:171-73, April, 1948. This teaching aid has been developed to enable the student to visualize better some of the basic ideas of perspective drawing.
32. Morley, Franklin P., "Teaching-Learning Device for Mechanical Drawing", Industrial Arts and Vocational Education, 41:233-34,

September, 1952. This teaching device will prove valuable to supplement the three-plan, transparent projection box which is universally used to teach orthographic projection.

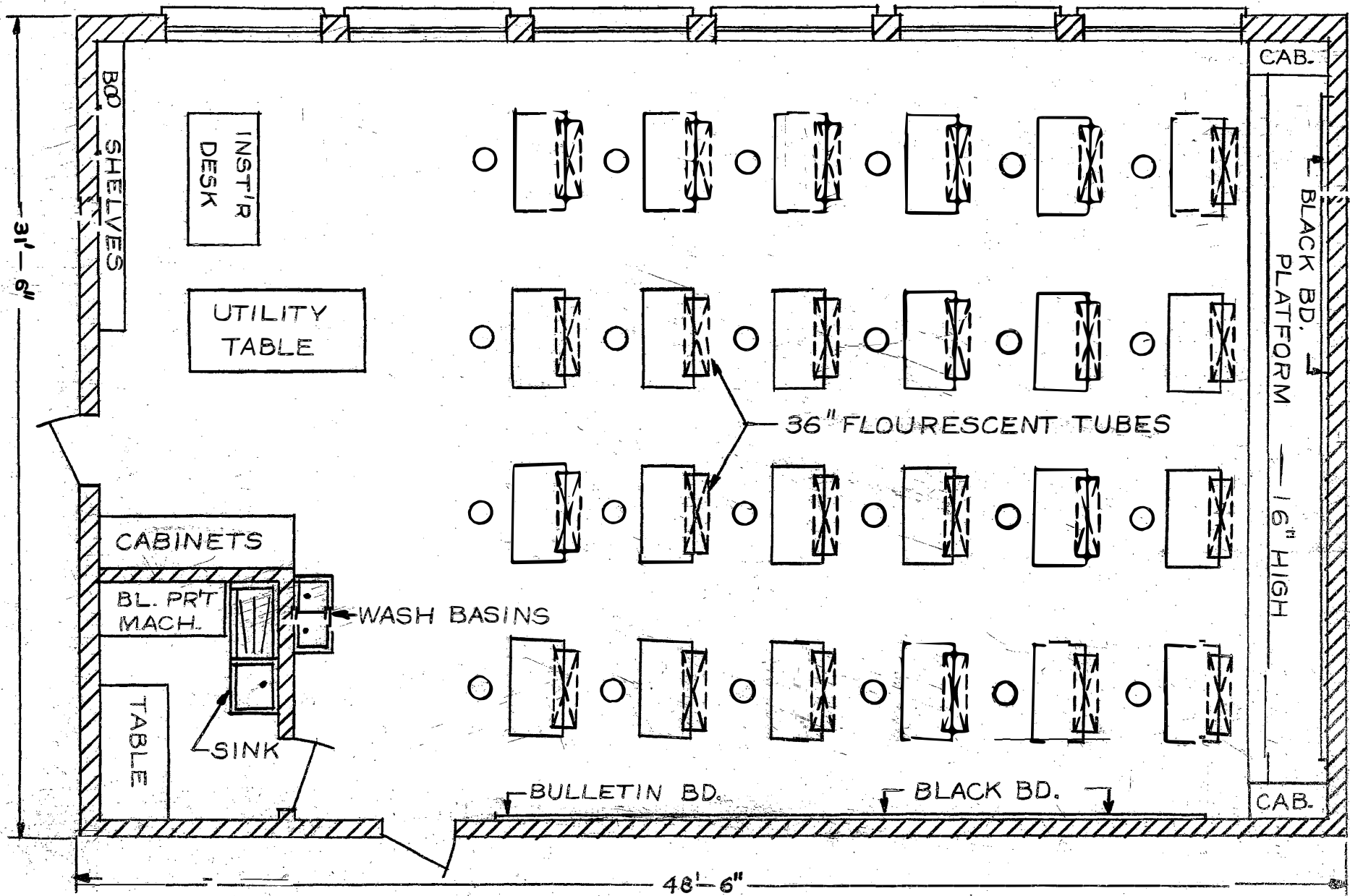
33. Murray, R. E., "A Triangular Scale Model", Industrial Arts and Vocational Education, 39:21, January, 1950. In order to present clear and accurate information on how to read a scale, the author has designed and built a model large enough to use before the class.
34. Murray, R. E., "Revamping Pencil Sharpener for Pointing Up Drafting Room Pencils", Industrial Arts and Vocational Education, 37:34-35, January, 1948. By grinding the cutters on old pencil sharpeners, the author has turned them into drafting room pencil pointers.
35. Nelson, Maurice J., "A Portable Desk", Industrial Arts and Vocational Education, 29:389-390, June, 1941. This article describes a small desk for the instructor mounted on casters. It has an elevated hinged top, two large drawers (11" x 15") are for filing on the left side. It has a bookshelf and plate holder on the right side. The entire desk is 43" high, 25 3/4" long, and 16 1/4" wide. Excellent working drawings and pictures are provided.
36. Newton, F. N., "Instrument Cabinet for the Drafting Room", Industrial Arts and Vocational Education, 38:159-61, April, 1949. A complete set of drawings are presented for building an instrument storage cabinet.
37. Nicholas, Clemens, "Functional Method of Teaching Mechanical Drawing", Industrial Arts and Vocational Education, 29:60-62, February, 1940. Herein is described a basic content course consisting of five basic elements:
  - (1) Manipulative Skills
  - (2) Geometry
  - (3) Thinking in Three Dimensions
  - (4) Symbols and Nomenclature
  - (5) Materials

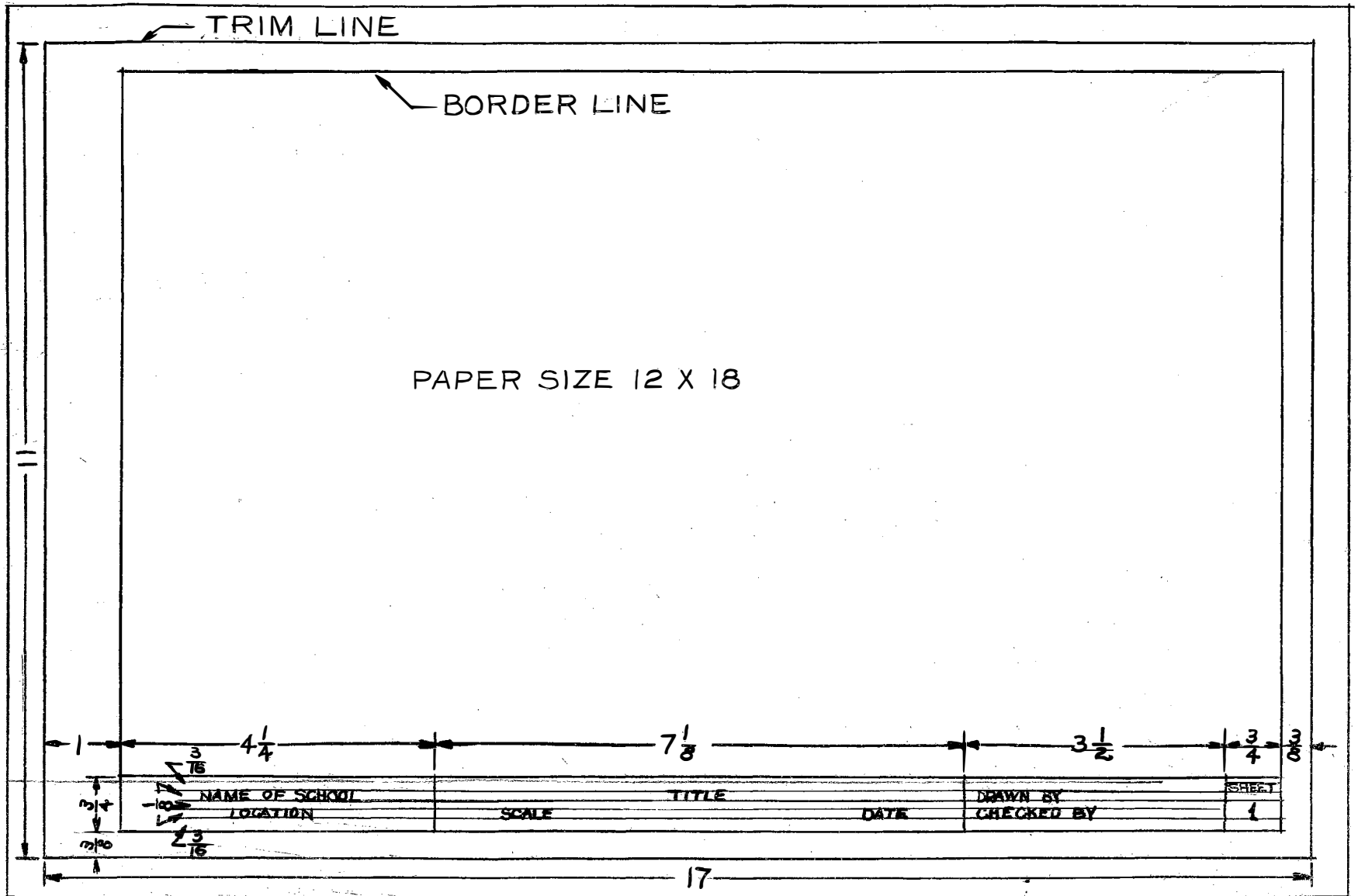
The value of blueprint reading before the student takes up the study of drafting is especially stressed.
38. Norton, John M., "A Rating Scale", Industrial Arts and Vocational Education, 29:161, April, 1940. A rating scale has been devised in an attempt to make grading a more logical and helpful method of getting a true personality of the student.
39. Ostorgaard, A. J., "Objective Evaluation of Drafting Plates", Industrial Arts and Vocational Education, 43:154, April, 1954. For evaluation on an impartial basis and also as a measure to show the student his drawing weaknesses, the writer has designed a rubber stamp to be placed on the drawing and checked by the teacher.

40. Paterson, Grant M., "A Good Transparentizer", Industrial Arts and Vocational Education, 29:70, February, 1940. A new method of making blueprints is described in this article. The blueprints are made from sketches made on opaque paper without resorting to the tedious process of making tracings on paper or cloth. The sketches are made transparent by treating them with the chemical, Diethyl Pnthalate, which dissolves the cellulose in the paper. Hand-drawn or typewritten lantern slides may also be produced by this means. The chemical is inexpensive and is easily procurable at any drugstore.
41. Polowriak, Peter G., "Lucite Projection Box", Industrial Arts and Vocational Education, 39:157-160, April, 1950. Full information on how to construct a projection box of transparent lucite and how it should be used is presented.
42. Russell, Edgar Farr, "Dress Up Your Mechanical Drawing Room", Industrial Arts and Vocational Education, 29:323-324, October, 1940. This describes the extensive use of various kinds of information and visual teaching aids which are prominently displayed in various attractive ways. The lengthy list includes:
- (1) Information and pictures of engineering colleges.
  - (2) School notices, especially of all related subjects of mechanical drawing.
  - (3) Drawing information, tables and diagrams.
  - (4) Blackboard.
  - (5) Drawings. (Commercial blueprints, etc.)
  - (6) Home room notices.
  - (7) Civic section display. All notices which develop civic consciousness.
  - (8) Superior drawings of pupils.
  - (9) "Hall of Fame" section. Pictures of outstanding students and their hobbies. Aviation, radio, engineering, etc.
  - (10) Color:
    - (a) American Flag
    - (b) Bookshelf-catalogs of technical colleges
    - (c) Current industrial arts magazines
    - (d) Models of machines; gears, bearings, etc.
43. Sechrest, Charles H., "How to Read a Rule", Industrial Arts and Vocational Education, 31:269, June, 1942. Included in this article is a method of teaching pupils to read a rule, a testing device, and a test on reading the rule.
44. Shearer, Leroy R., "A Demonstration T-Square", Industrial Arts and Vocational Education, 37:69-70, February, 1948. The author has developed a device for demonstrating correct procedure and technique at the blackboard using the same procedure, technique and tools the students use.

45. Sherman, D. R., "Handy Blueprinter", Industrial Arts and Vocational Education, 41:286-87, October, 1952. For about twenty dollars this hand blueprinter can be made in the shop and is an asset to every drawing room.
46. Shindler, Carlton H., "Drawing Board Support for the Workshop", Industrial Arts and Vocational Education, 38:281-282, September, 1949. For shop teachers who must teach drawing in the woodshop the author offers building plans for a drawing board support to be used on the workbench.
47. Shuster, Arthur F., "Scale Guard", Industrial Arts and Vocational Education, 29:389, November, 1940. This is a working drawing of a scale guard easily made of light tin or galvanized iron. Both ends are bent around a 20d spike. Drawing is excellent. (For architects boxwood scale.)
48. Sturtevant, W. W., "Exercise Blocks for Teaching Mechanical Drawing", Industrial Arts and Vocational Education, 29:247-48, June, 1940. This article describes the construction of several blocks of wood, which are used as models for orthographic projection. It is well illustrated by drawing.
49. Trout, Maurice E., "A Projection-Box Table", Industrial Arts and Vocational Education, 29:76, February, 1940. This describes a projection box, similar to the conventional "glass box". Here, however, the sides are made of transparent celluloid, and hinged in the regular manner. For sketching in the views, white tempera paint and small water color brushes are used. After each problem this paint is easily washed off with a moist cloth or sponge.
50. Weigl, William, "How to Keep Drawings Clean", Industrial Arts and Vocational Education, 41:319, November, 1952. It is suggested that to help keep drawings clean a small block with a piece of cotton on it be used for cleaning the pencil point after pointing. It is also suggested that the eraser be cleaned by sanding on the pencil pointing pad.
51. Willoughby, George A., "Mechanical Perspective", Industrial Arts and Vocational Education, 41:161, May, 1952. A lesson plan has been developed for drawing a two-point perspective complete with the method of procedure and example drawing.
52. Wills, William W., "Glossary of Architectural Terms", Industrial Arts and Vocational Education, 29:56-58, February, 1940. This glossary contains over two hundred terms used in architecture classes. Each term is clearly defined in the language of the common workman.

53. Yankee, Herbert W., "Do's and Don't's in Dimensioning", Industrial Arts and Vocational Education, 41:293-94, October, 1952. The author has worked out a series of illustrations showing correct and incorrect dimensioning technique with an accompanying explanation of each illustration.

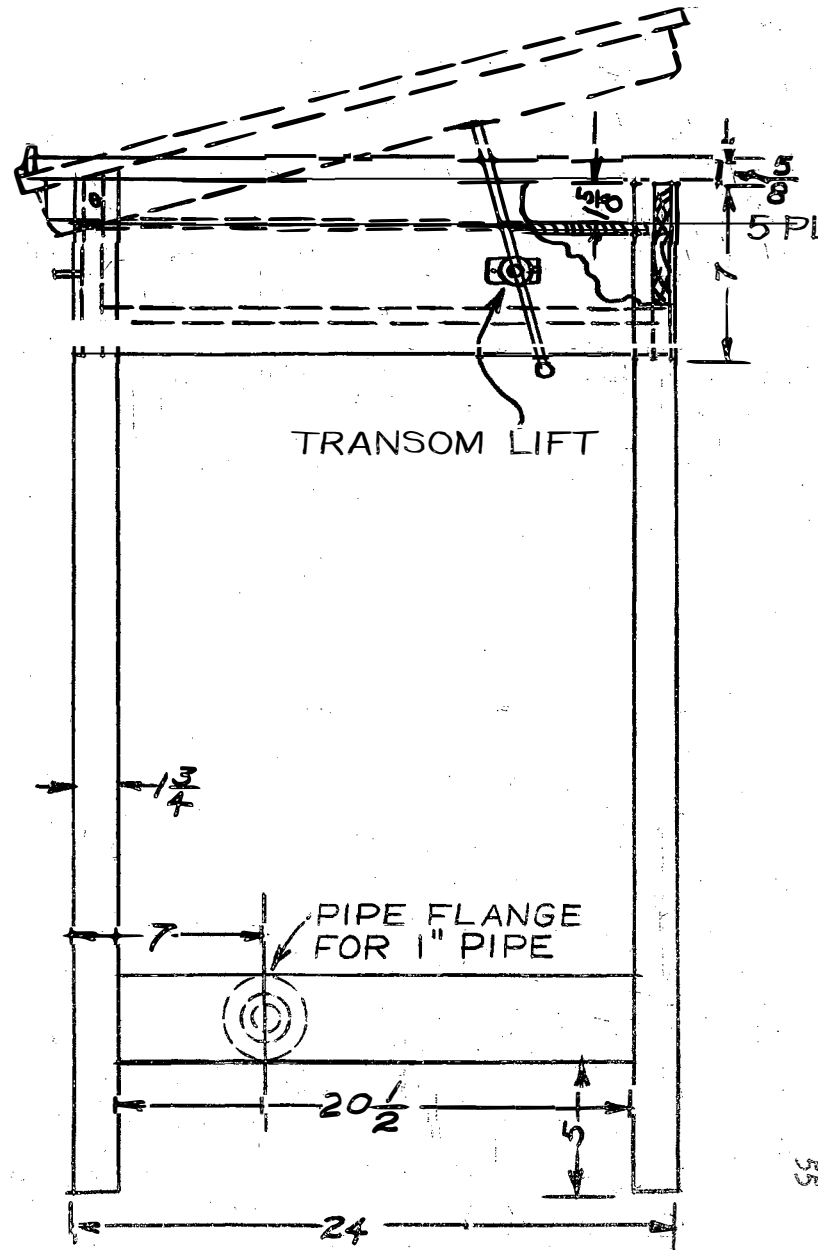
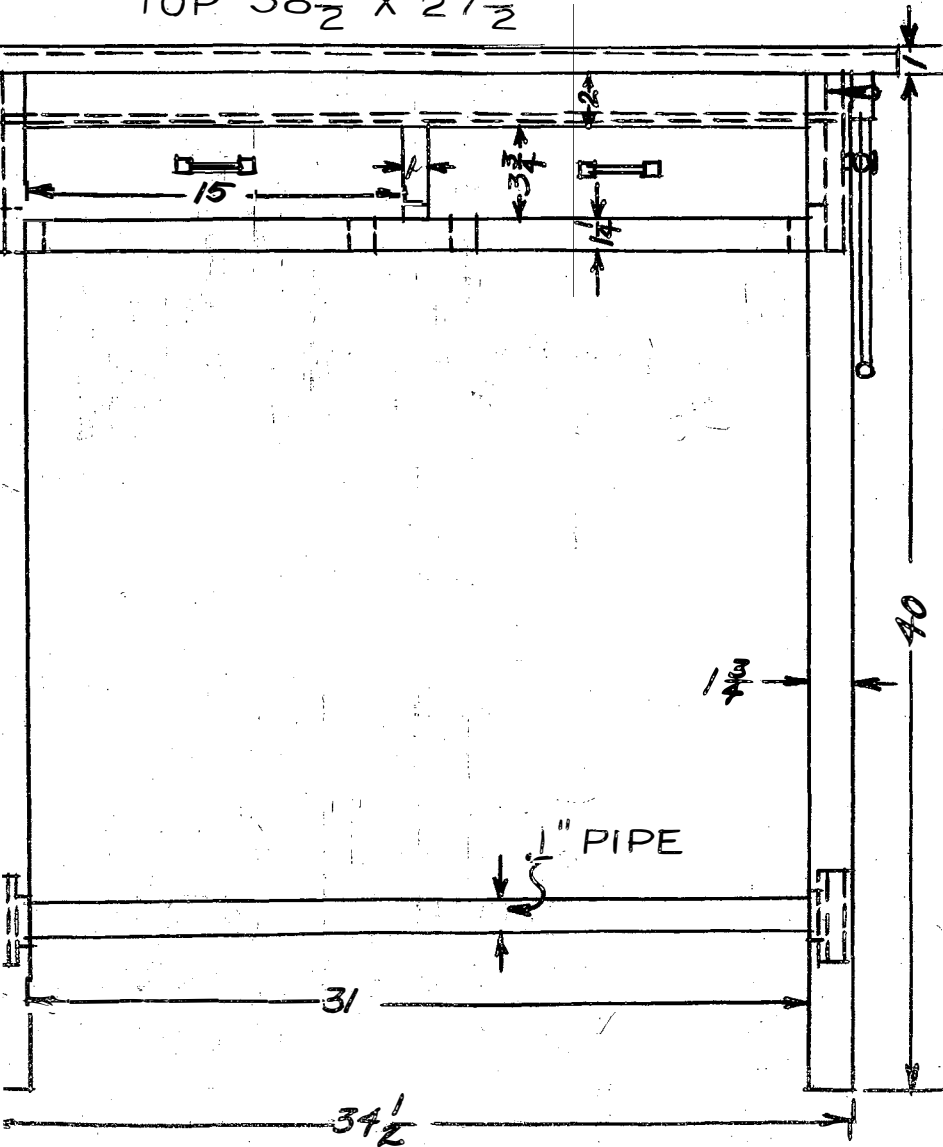




ORIGINAL DRAWING BY JOHN B. TATE

INDUSTRIAL DRAWING SHEET LAYOUT

TOP  $38\frac{1}{2}$  X  $27\frac{1}{2}$

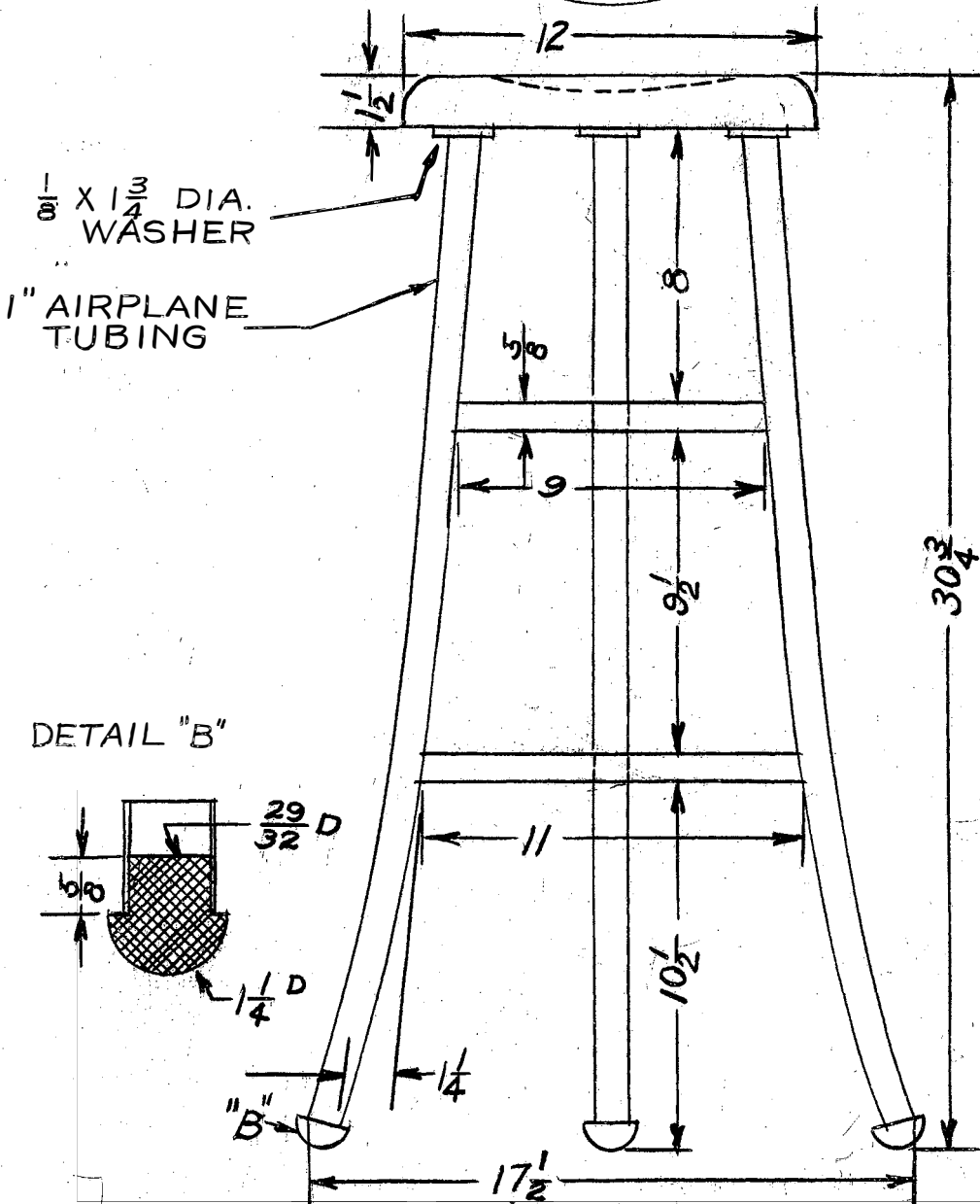
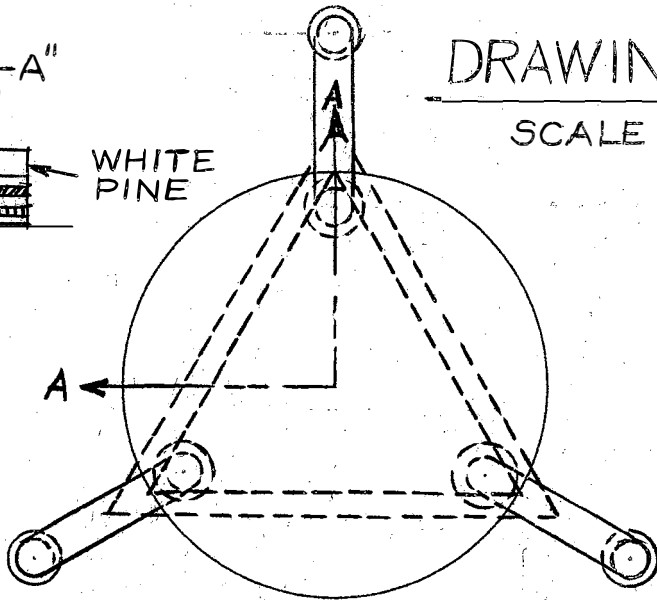
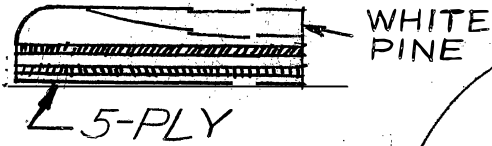




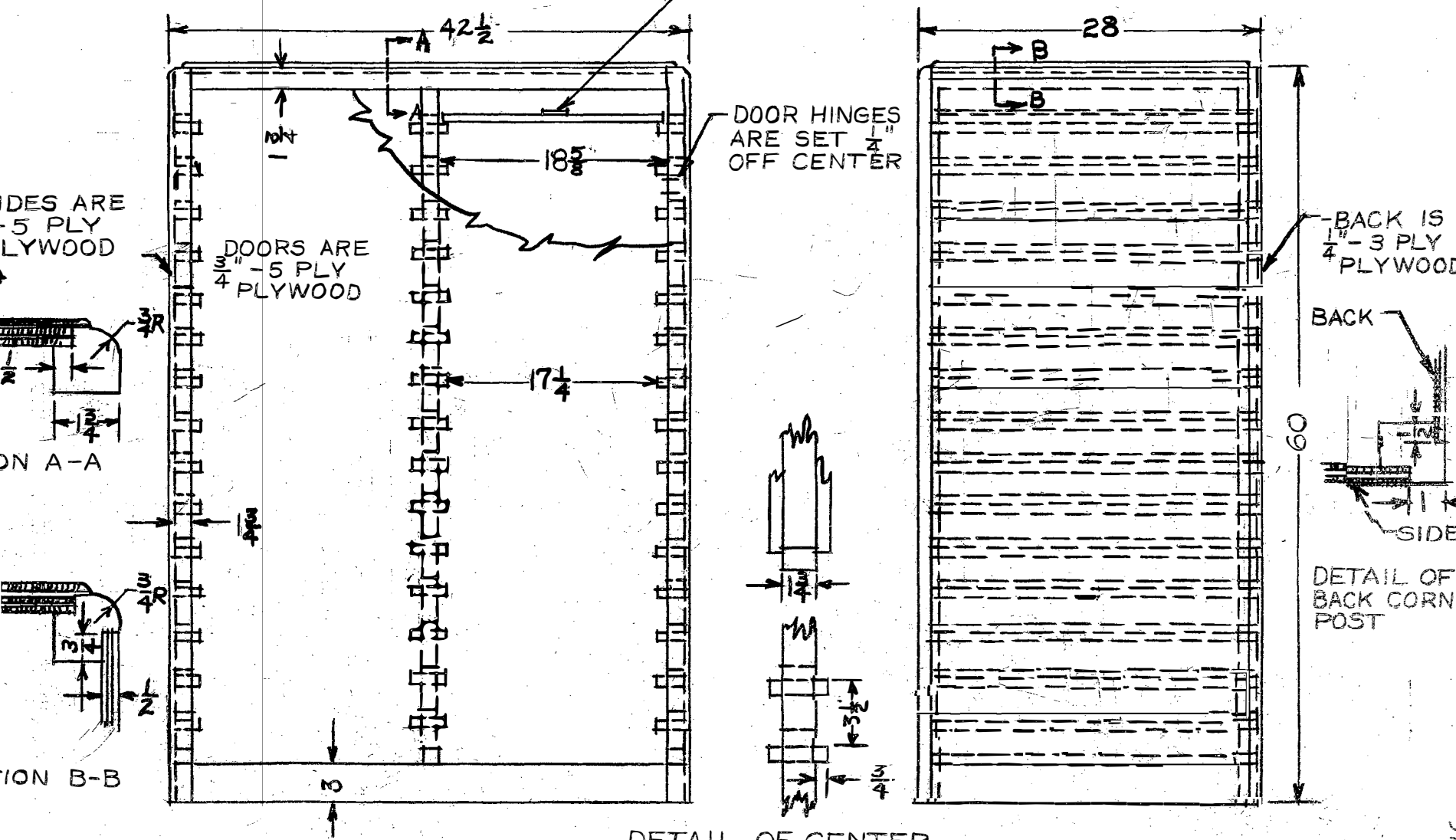
# DRAWING STOOL

SCALE -  $\frac{3}{16} = 1$

SECTION "A-A"  
SCALE  $\frac{1}{4} = 1$



NOTE: CABINET DESIGNED FOR 32 - 18" X 24" DRAWING BOARDS  
AND 32 - 24" T-SQUARES



DETAIL OF CENTER  
SUPPORT AND RAIL  
SCALE  $\frac{1}{8}" = 1"$

REPORT TITLE: A SUGGESTED COURSE OF STUDY FOR INDUSTRIAL DRAWING IN  
OKLAHOMA HIGH SCHOOLS

NAME OF AUTHOR: Rudolph L. Lack

REPORT ADVISOR: Cary L. Hill

The content and form have been checked and approved by the author and report advisor. Changes or corrections in the report are not made by the Graduate School office or by any committee. The copies are sent to the bindery just as they are approved by the author and faculty advisor.

NAME OF TYPIST: Dorothy Watkins