AN INVESTIGATION OF FURNITURE AND EQUIPMENT STANDARDS FOR BUSINESS EDUCATION CLASSROOMS

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Submitted to the Faculty of the Graduate School of
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in partial fulfillment of the requirements
for the Degree of
DOCTOR OF EDUCATION
July, 1953

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PREFACE

Business teachers have been aware of the need for establishing standards for business education furniture and equipment for many years. Yet, in spite of this awareness, there has been little work done toward that end.

In addition to the need for standards, business teachers in small schools have been faced with another problem of great importance. Many schools do not now have adequate furniture and equipment, and they would be unable to secure funds to purchase new equipment, even if standards had been established.

This study has, therefore, a twofold purpose. First, is the establishment of standards for business education furniture and equipment which can be used by all schools and business teachers. Second, is the presentation of sound, practical, functional designs which can be used by schools which desire to construct their own business education furniture and equipment.

I am sincerely grateful to Dr. M. R. Chauncey, my major professor, for the patience, kindness, and understanding which he displayed at all times. I would also like to express my appreciation to Dr. Millard Scherich and Dean J. Andrew Holley for their counsel and for the great amount of time which they allowed me.

J. E. B.

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CHAPTER I

INTRODUCTION

> ...Students can gain much from the inspiration of the general setting in which the skill building takes place. The physical plant and equipment should be one which experience has found to be the best.[1]

Although the meaning of this quotation is obvious, one may still find some unanswered questions. What, in the equipment phase of the quotation, has experience found to be the best? An ever-present question is the problem of securing the equipment, even after one has found out what equipment is best.

Patented, factory-made furniture and equipment of the type which is covered in this study is expensive. A wealthy school is often able to secure new equipment as it is needed. A school which is currently under construction may be able to secure modern furniture and equipment by virtue of the fact that the bond issue, or other appropriation which financed the construction, also provided for furniture and equipment. The schools which already have equipment which will do, however, and the schools which operate on very limited budgets, may have to do without needed furniture and equipment because of the high prices.

It is primarily for those schools which have neither the equipment nor the available funds that this study was begun. In order for the proper inspiration to come about in classes of business education, some way must be

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[1] Harm Harms, Methods in Vocational Business Education (Cincinnati: South-Western Publishing Company, 1949), p. 38.

found to make adequate equipment available to all schools, regardless of size, financial structure, or location. Our democratic society provides a great number of schools, and one of our educational objectives should be to provide proper facilities for good instruction in all of these schools. It is hoped that this study will help fulfill this objective.

THE PROBLEM

The study is divided into two main problems. First, the study will develop a list of standards for wooden furniture and furniture-type equipment needed for the more common business education subjects taught in today's secondary schools. Second, on the basis of the standards thus determined, the study will provide drawings and plans for the construction of inexpensive furniture and equipment, or suggestions for the modification of existing pieces of furniture and equipment.

In the process of designing business education furniture and equipment to meet the established standards, attention will be centered on two major points: (1) designs which can be built with the minimum facilities usually found in the industrial arts shops of small high schools; and (2) low-cost materials.

NEED FOR THE STUDY

Among those prominent in the field of business education who have advocated studies of this kind are Eyster (as quoted by Enterline[2]) and Humphrey.[3]

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[2]H. G. Enterline, "Needed Research in Business Education, Administration and Supervision," The National Business Education Quarterly XX (Summer, 1952), 46.

[3]Federal Security Agency, Office of Education, Research in Business Education (Washington: Government Printing Office, 1946, Misc. 3222), p. 6.

The American Association of School Administrators has also indicated a need for such a study as is evidenced by the following quotation from a recent yearbook:[4]

> So essential is good serviceable furniture and equipment for school buildings that great care and precaution should be exercised in its selection and installation. Selection should be made in the light of the best educational theory and practice in the field where it is to be used. A sufficient quantity of the highest quality materials available should be demanded by educators in order to make the new buildings measure up educationally to the physical characteristics of new and scientifically designed buildings.

It was discovered that there were few usable lists of standards by which a classroom teacher or school administrator could be guided in the purchase or construction of business education furniture and equipment. It was almost impossible for the school to turn to business for such standards, either, for Gager[5] reported that 1951 marked the establishment of the first two office standards. These standards had been established by the National Office Management Association, working with the American Standards Association. One of the standards was entitled "Dimensions of Desks and Tables for General Office Use, X2.1.1-1951."

LIMITATIONS OF THE STUDY

Limitations are:

1. The area of school layout, furniture, and equipment is a large and complicated one. This study is concerned only with that phase relating to furniture and equipment especially needed by teachers

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[4]"American School Buildings," Twenty-seventh Yearbook of the American Association of School Administrators (Washington: The National Education Association, 1949), p. 245.

[5]A. H. Gager, "First American Office Standards Accepted by ASA," Office Executive 26 (August, 1951), 26-27.

and students of business education in secondary schools and colleges.

2. The source of the standards is confined to current literature concerning furniture and equipment. This study recognizes the fact that there is a scarcity of studies relating to the standards concerned, and this limitation is a major factor.
3. Only one furniture design in this study has been used in a classroom or laboratory by the investigator. The one design which has been used is the upright typewriting demonstration stand, and the design offered here differs slightly from that which was used.
4. The final standards have not been validated by a committee or jury of business teachers.
5. Not all furniture and equipment used in the business education classrooms can be made by the school with the same high standards and at costs below that for which it can be purchased from regular school furniture distributors. Chairs are an illustration of this limitation, and although a brief set of standards has been developed for chairs, no attempt is made to design chairs for construction in the school work shops.

ASSUMPTIONS BASIC TO THE STUDY

The assumptions underlying this study are:

1. A review of related literature will be a valid basis for the development of standards for this study. Even in view of the dearth of research in the area of business education furniture and equipment, it is assumed that the literature which is available will be a suitable basis for the standards. This assumption is

based upon the supposition that most articles relating to business education furniture and equipment are based upon actual experiences with classroom problems and needs in the schools.

2. Furniture and equipment in the business education classrooms should be chosen so that they will fit students of differing physical builds, or so that they can be easily and quickly adjusted to fit the student.
3. Furniture and equipment which is sound and functional in style and design is conducive to more effective teaching and learning.
4. There will be two rooms of the school building set up for business education classwork; or, if that is not possible or practical, there will be one large room which can be divided into at least two separate sections.
5. Schools can, by using the accompanying designs, build durable, functional furniture and equipment in their own industrial arts shops. The furniture and equipment thus constructed will be provided at a very great saving to the school, and may provide furniture and equipment which would otherwise be unobtainable.
6. The task of constructing furniture and equipment in school shops will provide an additional learning experience for those students who actively participate in the building of the objects of furniture and equipment needed. These participating students will actually be taking part in a useful, necessary program of lasting importance, and one in which they can be justly proud of their respective contributions.

DEFINITIONS OF TERMS

The definitions of the terms used in this study are:

1. Business education is defined as that part of the curriculum which is concerned with the training of secondary school students in business skills and basic business fundamentals. The skills are taught in such subjects as typewriting, shorthand, and bookkeeping. The basic business principles are presented in such subjects as consumer economics, introduction to business, general business arithmetic, and courses of a like nature. Work experience is included if it is concerned with the training in business skills and fundamentals, but does not need to be considered separately at this time. Training in the distributive occupations is not included in the definition of business education as that term is used in this study, although many students study in both fields.
2. Furniture and equipment are interpreted in this study as being wooden furniture and equipment used for instructional purposes. They do not include such items as bookcases, filing cabinets, storage cupboards, metal furniture and equipment, or office machines.

PROCEDURE USED

It has already been stated that there is a scarcity of literature on business education furniture and equipment, but from a study of the available literature it was possible to arrive at certain important standards of construction. Some of the standards, for example, came from articles dealing primarily with some other phase of business education but from which contributions to this study were obtained. Some of the standards came from

articles written especially about one or more pieces of business education equipment. A few standards came from educational areas other than the area of business education, from business, and from governmental agencies.

Not always was it possible to call on the authorities for standards, either. A glance at the bibliography will reveal names of individuals who have not yet achieved the rank of authority, but this fact does not need any qualification. Fries,[6] for example, has stated that since equipment standards for business education have not been established, we must proceed on the experiences of others in the field, and he does not restrict his statement to any particular group of educators.

The procedure or research method used was library study of the available current literature concerning the problem, and within the limitations already established. Research findings, observations, and opinions of teachers are listed and compared; from these are drawn the standards for the purchase or construction of the furniture and equipment.

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[6]Albert C. Fries, "Building Facilities and Equipment for Business Education," The American School and University, Volume XVIII (New York: American School Publishing Corporation, 1946), p. 159.

CHAPTER II

ENROLLMENTS IN BUSINESS EDUCATION COURSES TODAY

The first problem with which this study is concerned is the development of standards for wooden furniture and furniture-type equipment needed for the more common business education subjects taught in today's secondary schools. It is therefore necessary to determine accurately which courses are the most popular. This study will consider student enrollment as the gauge of popularity, rather than the number of times the course is offered, since student enrollment is more significant.

The enrollment figures which are presented in this chapter show a remarkable consistency in course popularity. Nichols[1] reports that there has been little change in this pattern during the past half century, and Given[2] acknowledges the enrollment rankings but questions the soundness with which the students are enrolled in the courses. Concerning the relationship of schoolwork to office employment Given says:

> .....Government figures show that the largest group of gainfully employed are those that may be classified under the heading of clerical activity. The second largest group of gainfully employed people in business activity are those in the accounting and secretarial fields. It may be seen that there is a direct inverse ratio between those individuals gainfully employed in business and the number of students enrolled in the various commercial curricula.

Research studies and government surveys show that the so-called

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[1]Frederick G. Nichols, "Criticism, Comment and Challenge," The Journal of Business Education XXV (October, 1949), p. 9.

[2]John N. Given, "The Organization of a High School Commercial Department," The American School and University, Volume XI (New York: American School Publishing Corporation, 1939), pp. 351-352.

traditional courses of typewriting, bookkeeping, and shorthand are the most popular courses along with a relative newcomer, introduction to business. (Introduction to business is only one of several names which are used to refer to this course covering the general principles of business. Other names by which the course is known include elementary business training, general business, survey of business, junior business training, etc.) Most of the people concerned with business education are generally aware of this popularity ranking, but the following references provide substantial evidence to support their beliefs.

United States Totals. From the national point of view, Tonne[3] reported in 1947 that typewriting was the most popular business course in terms of student enrollment, followed by bookkeeping, shorthand, and elementary business training. The 1948-1950 Biennial Survey of Education in the United States indicated that Tonne's findings still prevailed.

Table I, taken from the 1948-1950 Biennial Survey of Education in the United States,[4] shows course enrollments, by states, as reported to the Office of Education. In addition to the total pupil enrollments, the Office of Education also shows what per cent each particular course enrollment is of the total high school enrollment. Only the ten most popular business education courses, in terms of enrollment, are listed in Table I.

The following quotations, also taken from the 1948-1950 Biennial Survey of Education, give significant interpretations to the figures listed in the table:

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[3]Herbert A. Tonne, Principles of Business Education (New York: The Gregg Publishing Company, 1947), p. 15.

[4]Federal Security Agency, Office of Education, "Offerings and Enrollments in High School Subjects," Biennial Survey of Education in the United States, 1948-1950 (Washington: Government Printing Office, 1950), pp. 21-22, 37-38.

TABLE I

ENROLLMENTS IN SELECTED HIGH SCHOOL BUSINESS EDUCATION COURSES
All High Schools in United States, 1948-1950

Rank According to Enrollment	Name of Course	Number of Pupils Enrolled			
		For 1/2 Year Course	Per Cent of Total Enrollment	For Full Year Course	Per Cent Of Total Enrollment
1	Typewriting I	31,059	.4	872,973	12.6
	II	15,613	.2	287,690	4.2
	III	522		7,538	.1
2	Bookkeeping I	12,548	.2	385,533	5.6
	II	5,233	.1	64,404	.9
	III	551		3,650	.1
3	Shorthand I	5,312	.1	284,968	4.1
	II	3,718	.1	125,133	1.8
4	General Business	36,815	.5	242,762	3.5
5	Business Arithmetic	58,311	.8	191,379	2.8
6	Business Law	84,964	1.2	45,621	.7
7	Office Practice	17,564	.3	90,637	1.3
8	Economic Geography	32,601	.5	57,444	.8
9	Business English	21,945	.3	34,675	.5
10	Consumer Economics	20,308	.3	18,564	.3

Source: United States Government, Federal Security Agency, Office of Education, "Offerings and Enrollments in High School Subjects," Biennial Survey of Education in the United States, 1948-1950. Washington, D. C.: Government Printing Office, 1951. Pp. 21-22, 37-38.

> The total enrollment in subjects in the field of business education in regular and senior high schools is more than 60 percent of the total pupil enrollment in these schools.
>
> More than 1 in every 5 pupils of those enrolled in grades 9 through 12 is taking typing.....In 1949 approximately as many pupils were enrolled in typewriting (which is seldom a required subject) as in advanced United States history (which is always a required subject).....

Enrollments in Individual States. Looking at the enrollment picture in individual states, it is noted that geographical location of schools has little influence on the business education courses taught. In a 1946-1947 study in the state of Virginia by Landrum;[5] a 1949 report by the Connecticut State Department of Education as quoted by Nichols;[6] a 1949-1950 Texas secondary school study by Soncrant;[7] a 1948-1950 reference to the state of Oklahoma taken from the previously mentioned Office of Education study;[8] and a 1950-1951 survey in Wisconsin[9] it is found that the state trends show little difference from those of the national scene. A 1952 survey of New York City[10] discloses a similar situation in the nation's largest city.

In Table II, the pupil enrollment rankings of the above listed surveys are shown in comparison to the Office of Education figures for the entire United States. The consistency in popularity mentioned earlier in this chapter is readily seen.

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[5]Merle L. Landrum, "Business Education in Virginia," The Balance Sheet XXXII (May, 1951), pp. 403-406.

[6]Nichols, "Criticism, Comment and Challenge," op. cit., p. 9.

[7]Helen Soncrant, "Business Education Courses Offered in Texas High Schools," The Balance Sheet XXXIII (January, 1952), pp. 208-211, 219.

[8]Federal Security Agency, Office of Education, "Offerings and Enrollments in High School Subjects," op. cit., pp. 37-38.

[9]"Wisconsin Survey of Small High Schools," The Balance Sheet XXXIV (November, 1952), pp. 132-134.

[10]Ethel F. Huggard, "Welcome to New York City Public Schools," The National Business Education Quarterly XXI (Fall, 1952), pp. 13-15.

TABLE II

RANKINGS OF BUSINESS EDUCATION COURSES, BASED ON TOTAL STUDENT ENROLLMENTS
(From Selected Surveys)

Location	Typewriting	Bookkeeping	Shorthand	General Business	Business Arithmetic	Business Law	Office Practice	Economic Geography	Business English	Consumer Economics	Distributive Education	Other
United States	1	2	3	4	5	6	7	8	9	10		
Oklahoma	1	2	3	4	5	7	8	9	6	10		
Texas	1	2	3	5	4	7	6[x]	8	10		9	
Virginia	1	3	2	4								
Wisconsin	1	2	3	4								
New York City	1	2[y]	3	7	5	8	6				4	9,10

[x] Includes "Office Practice" and "Secretarial Training."

[y] Includes "Bookkeeping," "Accounting," and "Record-keeping."

Summary. In summary, typewriting is clearly the most popular course in our secondary schools followed by bookkeeping, shorthand, and introduction to business. These four courses are followed in descending order of rank by business arithmetic, business law, office practice, economic geography, business English, and consumer economics. The emphasis of this study will, therefore, be on the furniture and equipment needs of these ten business education courses.

CHAPTER III

THE BASIS FOR THE STANDARDS

The term "standard," as used in this study, is defined as a rule, or model, or test by which anything is tried in forming a correct judgment respecting it. The term is very similar to criterion, the difference lying mainly in the interpretation placed upon it. In this study, the two terms are considered to be synonymous. An illustration of the use of standards in judging business education classroom furniture and equipment is shown by the following.

Picture a classroom which has been set aside for bookkeeping instruction. The desks are the old-style classroom desks, dark in color, with a sloping top. The desk tops are chipped, scratched, and otherwise marred in such a way as to provide an uneven writing surface.

Standards for bookkeeping desks, as developed in this study, will be applied to the desks in this classroom to see whether or not these particular desks provide for the best teaching and learning situation. Is the desk top area large enough for bookkeeping? Are the desks of assorted heights so that students of different sizes can all be comfortably seated? Is a dark color or a light color best for a bookkeeping desk? Standards will be applied to these and other questions; if the desk in the classroom meets all of the standards, it can then be considered satisfactory. If the desk meets only part of the standards, someone will have to determine whether or not the standards which have been met are sufficiently important for the desk to be called adequate. If the desk meets none, or only a few, of the standards,

the school should endeavor to provide more satisfactory furniture and equipment for the bookkeeping students.

Basis for Standards. The basis of the standards has not yet been established. Who is going to establish them? Upon what basis will they be established?

In Chapter II it was reported that furniture and equipment standards would have to be established by the experiences of people in the field. This belief is held by others in education, as well as by representatives of business and government. In 1934, Reeves[1] quoted the following statement of Charles W. Knudsen:

> The criteria for judging anything whatsoever represents only a condensation and generalization of the opinion of persons who are presumably competent to act as judges of particular qualities.

Reeves goes on to say that "an examination of criteria in various phases of education tends to prove the above quotation."[2] A statement published by the Carnegie Foundation, as quoted by Leffingwell and Robinson,[3] also bears out this method of establishing standards.

These references are from the field of education. What does business think of the setting of standards for furniture? Since part, if not a major part, of business education is considered as vocational preparation to supply business and industry with new and replacement personnel, the opinions of business and industry may reveal worth-while information regarding standards.

Speaking as a representative of the National Office Management

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[1]Stanley Newman Reeves, Tests of Quality for School Equipment and Supplies (Nashville: Abstract of Contribution to Education No. 135, George Peabody College for Teachers, 1934), p. 37.

[2]Loc. cit.

[3]William Henry Leffingwell and Edwin Marshall Robinson, Textbook of Office Management (Second Edition; New York: McGraw-Hill Book Company, Inc., 1943), pp. 392-393.

Association, Gage[4] presented this thought to a group of businessmen who were concerned about standards:

> What is an office standard? An office standard represents the best current knowledge of an item or a practice designed to meet the necessities of current conditions. Thus standards are not static. As fast as knowledge and conditions change, the standard must be advanced parallel to that progress. This definition is not peculiar to office standards. It is true of any standard. Another definition, though less scientific, is that a standard is a landing in the flight of stairs of knowledge on which to rest in the course of climbing from step to step in the accumulation of experience.

A quotation from a governmental agency and public utility helps substantiate the thought which is being presented. The Tennessee Valley Authority as a large-scale user of office furniture should be qualified, as could be said of many other business concerns, to competently act as judge of particular qualities such as were mentioned by Reeves. In a publication from the Office Property Section concerning furniture and equipment, The Tennessee Valley Authority[5] had this to say about standards:

> Standardization of equipment is based on a study of equipment needs and selection of the types which fill those needs most satisfactorily. Criteria of selection include efficient operation, adaptability, durability, appearance, and economy. The specifications for the equipment selected cover such physical characteristics as design, size, color, construction, and in a few cases may specify a particular patented product.

Of some interest is the fact that the officials of the Tennessee Valley Authority felt that since not all of their requirements could be met because of wartime steel rationing and other restrictions, substitute furniture would be accepted and used on a temporary basis until the time when "... this furniture will be disposed of. . .and standard color and sizes substituted."[6]

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[4]Edwin B. Gage, Standardization, A Factor in Office Management (Reprint of a talk delivered to New York Chapter, National Office Management Association, Belmont-Plaza Hotel, October 17, 1945), pp. 1-2.

[5]Tennessee Valley Authority, Office Property Section, Standard Office Equipment (Knoxville: Tennessee Valley Authority, May, 1943), p. 1.

[6]Ibid., p. 2.

Not many schools, or business organizations can afford to dispose of furniture and equipment with such ease. This is all the more reason that furniture and equipment standards should be made available so that a wise selection can be made for business education classrooms.

Present Sources of Standards. Standards, therefore, will be established by the published findings or opinions of the past experiences of people who have been concerned with the evaluation of furniture and equipment of the type being considered in this study, whether they are in government, business, or education. This procedure should produce a usable, objective set of standards.

It has already been pointed out that studies concerning business education furniture and equipment are too few. There have been many studies relating to machines, but it appears that furniture has been taken for granted; e.g., it was mentioned in Chapter I that 1951 marked the first attempt to set down standards for office desks. The best large-scale attempt to establish standards is the 1948 Yearbook of the Joint Commission of The National Business Teachers Association and The Eastern Business Teachers Association.[7] This yearbook did not cover the principles relating to "home-made" furniture; rather, it included a great deal on the problems relating to the entire physical plant and to room layout for business education.

Standards, however, are not completely lacking. Bennett[8] made a monumental study in the late 1920's especially relating to school seating problems, and much of his material is still accepted as the best available standards

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[7]"Physical Layout, Equipment, Supplies for Business Education," American Business Education Yearbook, Volume V (New York: The National Business Teachers Association and The Eastern Business Teachers Association, 1948), 344 pp.

[8]Henry Eastman Bennett, School Posture and Seating (Boston: Ginn and Company, 1928), 323 pp.

for that type of school equipment. The American Council on Education has sponsored some important research on the subject of school furniture,[9, 10] and numbers of The American School and University contain articles relating to research, classroom experiments, and established procedures (e.g., Marcus and Nocka[11]). These are but a few of the sources of the information which are available and which will be used in this study.

Business has also attempted to help in this matter of standards. The Policyholders Service Bureau of the Metropolitan Life Insurance Company,[12] the National Office Management Association,[13] and the American Standards Association[14] are examples of business organizations which have contributed valuable information toward furniture and equipment standardization.

Special School Furniture and Equipment Standards. The contributions made by governmental agencies and business organizations may require some qualification when applied to school furniture and equipment needs. School furniture and equipment should closely resemble the furniture and equipment found in the offices in which the student may find employment, but not everything necessary to office working conditions is even desirable to the

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[9] Specification for Chair Desks, Series VII, School Plant Research, Volume 6, Number 2 (Washington: The American Council on Education, 1942), 32 pp.

[10] Specification for Folding Chairs, Series VII, School Plant Research, Volume 6, Number 1 (Washington: The American Council on Education, 1942), 41 pp.

[11] Frederick E. Marcus and Paul F. Nocka, "An Integrated Redesign of School Furniture," The American School and University, Volume XIV (New York: American School Publishing Corporation, 1942), pp. 242-245.

[12] Policyholders Service Bureau, Trends in the Standardization of Office Furniture (New York: Metropolitan Life Insurance Company, 1935), 13 pp. (mimeographed).

[13] Edwin B. Gage, Office Standards, Developing Standardization in the Office and Principles of Specific Standardization of Office Equipment, National Office Management Association Bulletin, Number 2 (Philadelphia: National Office Management Association, April, 1946), 43 pp.

[14] Gager, op. cit., pp. 26-27.

school classroom. Illustrations of necessary considerations would include:

> Should the school typewriting desk have as much drawer space as the typewriting desk found in most business offices? Drawers should have a real purpose; will the school desks have drawers? If so, will they be functional?
>
> What supplies are ordinarily kept in desks of business concerns? Are these supplies necessary to school classrooms? Who will furnish the supplies, the school or the student? Will the matter of supplies affect design?
>
> The ordinary office desk is larger than the traditional classroom typewriting desk. Can the school afford the luxury of large desks, with a resulting loss of typing students per class, or should the school use small desks so that more students can be accommodated?
>
> Many patented school desks have a sloping writing surface; few, if any, secretarial or clerical office desks have sloping tops. Should the desk in bookkeeping, for example, be flat as it ordinarily will be in a business office, or should the school use the sloping desk anyway?

Perhaps the above questions exaggerate the situation, but the school classroom atmosphere is often difficult to change into an atmosphere similar to that which is found on the job. Even such items as comfort features (e.g., padding in the chairs) can be sacrificed in the classroom without any sacrifice to the learning situation because the student is ordinarily at his desk for only one hour at a time. Comfort should not be underestimated in establishing the best learning situation, but neither comfort nor convenience should be as important as the provision of good facilities for the largest possible number of students.

Polishook[15] believes that the basic principles for the selection and maintenance of classroom furniture are essentially the same as those for machines except that less detail, expense, and service are involved. His criteria which apply specifically to furniture and equipment are:

Selection of Equipment:

1. Select equipment on the basis of durability.
2. Select equipment on the basis of cost and its relationship to durability.
3. Select equipment on the basis of cost and suitability for student use.
4. Select equipment on the basis of relationship to:
   a. Number of students
   b. Degree of competency desired
   . . . . . .
   e. Replacement plan
   . . . . . .
6. Select equipment under a well established plan of acquisition.
7. Discard obsolete equipment.

Model Classrooms. Agnew, in planning the two model classrooms which were shown at the 1950 National Business Show by the Office Executives Association of New York,[16] may not have been quite so concerned about the cost of the equipment. Without question, such a setting would inspire almost any student who was fortunate enough to be able to attend a school with such up-to-date facilities. Metal desks, adjustable posture chairs, glass partitions between the rooms, and other ultra-modern fixtures set the scene. The

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[15] William M. Polishook, "Selection and Maintenance of Equipment," American Business Education Yearbook, Volume IX, Chapter 16 (New York: The National Business Teachers Association and The Eastern Business Teachers Association, 1952), pp. 236-239.

[16] "Model Classrooms at New York Business Show," The Journal of Business Education XXVI (December, 1950), 170.

model classrooms may even have surpassed the esthetic aspects mentioned by Gage:[17]

> Office equipment has both esthetic and utilitarian aspects. Probably most employees could accomplish highly accurate and neat work on a crude pine table. . .it has been done many times. Yet good looking and well designed furniture, fixtures and appliances are a definite asset. . .

It is doubtful that many schools can afford a classroom furnished in such a manner as illustrated in the 1950 Show, but it is not necessary to accomplish our education on the crude pine tables which Gage mentions, either. Almost any school can build "good looking and well designed furniture" in its own shops with the aid of students, interested parents, or other patrons willing to devote time and skills to help improve the school. Classrooms equipped as those shown in the model classrooms are something to strive for, but while this long-range, expensive program is being financed the majority of the schools may have to accept something less than this esthetic ideal.

Nichols[18] wrote the following in the depression days of 1932, and the opinion is still worth consideration:

> Expensive desks are unnecessary. Drop-leaf desks, for example, cost too much and are otherwise wasteful for beginning pupils. They occupy too much valuable space and offer a constant temptation to use the room for subjects other than typewriting, thus increasing the number of machines required. They contain drawers which, unless locked, offer constant temptation to pupils. . .

While school financing may have been more difficult during the depression years, economy is no less important now than it was then. If the principle of transfer of training means anything at all, good teaching should be able

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[17] Gage, Office Standards, Developing Standardization in the Office and Principles of Specific Standardization of Office Equipment, op. cit., p. 18.

[18] Frederick G. Nichols, "Equipment Needed for a High School Commercial Department," The American School and University, Volume V (New York: American School Publishing Corporation, 1932), pp. 228-229.

to help complete the transfer of a pupil's understandings acquired in a classroom with inexpensive but sound "good looking and well designed furniture" to an office situation in which almost any other type of office furniture can be found.

Summary. In summary, it can be stated that the standards for the business education furniture and equipment which will be established by this study were gathered from the reports of teachers; governmental, educational, and individual research; and the experiences of some business organizations and governmental agencies. The basis for these standards is experience, supplemented by the research which has been done on the problems of school furniture and equipment for business education classrooms.

CHAPTER IV

CLASSROOM FURNITURE STANDARDS

The development of suitable standards for classroom furniture is, as has been previously stated, an important matter but one which has been neglected. Too often business teachers and administrators have been concerned only with the machines with which the business education department was equipped.

This lack of standards has led to differences of opinion regarding some of the more important principles concerning the equipping of the business education rooms. An illustration of these differences, and one which is related to the size, type, and design of the furniture, is that of the space allocated to the business department.

In the list of the assumptions concerning this study, number four states that there will be at least two rooms of the school building set aside for business education classwork; or, if that is not possible, that there will be one large room which can be divided into at least two separate sections. Studebaker[1] agrees with this assumption as does Nichols[2] who does not believe that the typewriting desks should be used for any purpose other than typewriting practice and instruction. Whitcraft,[3] does not agree:

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[1] M. E. Studebaker, "Layout and Equipment for Business Education Departments on the Secondary-School Level," The American School and University, Volume XII (New York: American School Publishing Corporation, 1940), p. 375.

[2] Nichols, "Equipment Needed for a High School Commercial Department," op. cit., p. 229.

[3] John E. Whitcraft, "Typewriting Equipment for the Small High School," American Business Education Yearbook, Volume V, op. cit., p. 152.

> The day has passed when the small high school can set aside one room to be used exclusively for one, two, or even three typewriting classes a day. The increasing high costs of new building construction and the generally crowded conditions in the old school buildings have focused attention on efficient room utilization. . .facilities are needed in order that the typewriting room can be used for other business classes.

In the above difference of opinion which mainly involves the question of whether the typewriting room should be used for courses other than typewriting, the difference could be partly taken care of through one of the assumptions related to the study. As the study progresses, other differences will be brought out and compared in a similar manner.

Not all of the differences can be solved by the use of the assumptions, limitations, or other devices of like nature. It will sometimes be necessary to make an arbitrary decision in order to break a deadlock in opinion for which there does not seem to be weight of evidence for either viewpoint. The arbitrary decision will be made so that some definite principle or standard can be listed.

GENERAL STANDARDS

The general standards, standards which apply to all types of furniture and equipment covered by this study, will not be repeated with each new piece of furniture or equipment. Instead, the general standards will be listed in this beginning section of Chapter IV, and special standards will be grouped under each particular type of furniture and equipment. These general standards, along with sources of the standards, are listed without any definite order of importance. Duplications have been omitted except where a standard is enlarged upon.

American Council on Education:[4]

No open joints, splits, knot holes, or other defects shall show on. . .finished edges.

All. . .surfaces [should be] uniformly sanded smooth and free from checks, slivers, or other defects.

All exposed edges. . .shall be rounded and sanded smooth.

The use of gliders is recommended to lessen noise in the classroom and facilitate moving. . . The smooth, hard glider surface will slide easily without scratching or marking the floor.

General Services Administration, Federal Supply Service:[5]

3.1.1 The wood used in the exposed parts of the furniture shall be bright, well-sanded, and free from. . .defects which will affect the appearance or which may affect the strength of the . . . product.

3.1.1.2 The wood shall be uniformly air-seasoned before kiln-drying and the moisture content of wood parts at the time of assembly of the desks shall be from 5 to 9 percent.

3.2.3 Joints shall be tongued and grooved or mortised and tenoned, following the best practices of cabinet construction.

All work shall be thoroughly glued, glue-blocked, and secured with screws when necessary.

The desk tops shall be secured to the framing with screws or with suitable metal fasteners. . .

3.3.3 Exterior wood surfaces, with the exception of the underside of the desks, shall be finished to a true and smooth surface. . .and stained to the required color with a nongrain-raising, light-fast, solvent-type stain.

American Association of School Administrators:[6]

. . .furniture should be done in natural wood or blonde finish with light-reflection value of from 30 to 40 percent. . .

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[4]Specification for Chair Desks, op. cit.

[5]General Services Administration, Federal Supply Service, Federal Specification AA-D-198, Desks; Wood, Executive Office (Washington: Government Printing Office, 6 March 1951).

[6]"American School Buildings," op. cit.

. . .care. . . [should be] used to guard against gloss or high polish.

Perkins and Cocking:[7]

Furniture that is moved must be built to withstand it.

[Furniture] . . .should fit the user and be comfortable.

[Furniture] . . .should be finished so as to avoid glare and reflect light. . .Light blond finishes have a large reflective value and should be used in all schoolrooms. . .should have a dull finish to avoid glare.

[Furniture] . . .should promote health and good posture.

[Furniture] . . .should be light in weight.

Where adults and children use the same space, a change of seating is required.

Association for Childhood Education International:[8]

Furniture and equipment should be strong, durable, well finished.

Association for Childhood Education International:[9]

The material from which the furniture is made should be suitable.

The color should be pleasing.

The surface should be easy to clean.

The surface should be durable.

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[7]Lawrence B. Perkins and Walter D. Cocking, Schools: Progressive Architecture Library (New York: Reinhold Publishing Corporation, 1949), pp. 182-184.

[8]Equipment and Supplies (Washington: Association for Childhood Education International, 1937), 37 pp.

[9]Recommended Equipment and Supplies (Revised Edition; Washington: Association for Childhood Education International, 1949), 44 pp.

Morgan:[10]

Panels on the back and sides give added reinforcement.

Desk legs should have metal binding around the base to prevent chipping and splitting.

Bennett:[11]

There should be no obstruction. . .to interfere with the operator's legs. . .

Cheney:[12]

All surfaces should be free from machine marks.

Linoleum on table tops should be protected on the edges with moulding which is mitred at the corners.

McLeary:[13]

Furniture should be attractive.

Gage:[14]

Plain "neutral" colors to tone in with decoration scheme.

There should be few ledges to collect dirt and dust.

Gage:[15]

The finish should be durable.

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[10]Odus L. Morgan, "Your Typing Room—Can You Afford It?" Business Education World XXIV (May, 1944), 510-514.

[11]Bennett, School Posture and Seating, op. cit., p. 175.

[12]Ray Eugene Cheney, Equipment Specifications for High Schools: Their Use and Improvement, Teachers College, Columbia University Contributions to Education, No. 612 (New York: Bureau of Publications, Teachers College, Columbia University, 1934), 87 pp.

[13]Ralph D. McLeary, "The Coming Revolution in Classroom Furniture Design," The School Executive 71 (August, 1952), 44-45.

[14]Gage, Developing Standardization in the Office and Principles of Specific Standardization of Office Equipment, op. cit.

[15]Gage, Standardization, A Factor in Office Management, op. cit.

SPECIFIC STANDARDS

The Adjustable Typewriting Desk

Height. Many business teachers now believe that the height of typewriting desks used in the classroom is too low if that height is not 27" or more. In the past, it was quite customary to use a table surface which was from 24" to 26" from the floor, but 26" is now considered too low for most people. From this point on there is little agreement as to what the exact correct height is, other than agreement in very general terms.

One of the lowest heights listed was that of the Tennessee Valley Authority which had the specification in its catalog of office equipment as follows: "Typewriter bed 25 5/8" from the floor" for its drop-head type of desk.[16] Even lower, however, was the Virginia State Department of Education specification which listed "Individual typewriter tables, 30" x 18", adjustable to heights of 24" to 29".[17]

Going to other extremes, Lamb[18] says:

> You will find that tables with tops 30 inches from the floor are suitable for most of the members of the class. A few students should have 28- or 29-inch tables, and one or two tall, long-armed students would be more comfortable at a 31-inch writing height. If you may order tables of only one height, however, you should order the 30-inch tables and plan to make the adjustment for the short-armed student (who would do better at the 28- or 29-inch table) by raising the chair; and for the long-armed student (who needs the 31-inch table) by raising the typewriter, preferably by means of a shallow "lift box" that will bring the machine to the desired height. When such a

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[16] Tennessee Valley Authority, Standard Office Equipment, op. cit., p. 16.

[17] A. L. Walker and Marguerite Crumley, "Vocational Office Training," Monograph 70 (Cincinnati: South-Western Publishing Company, 1948), p. 11.

[18] Marion M. Lamb, Your First Year of Teaching Typewriting, (Cincinnati: South-Western Publishing Company, 1947), p. 26.

"lifting" device is used, the typewriter should be fastened firmly to the device. . .

Lamb[19] and Van Derveer[20] both refer to the 30° angle of the forearm of the typist in relation to the typewriter table height. An experiment was carried on with regard to this by the United States Department of Agriculture Training Division, Office of Personnel, and the facts were later turned over to the General Research Committee of the Society for the Advancement of Management for co-evaluation along with the Training Division. Lamb makes a detailed explanation as follows:

> After some experimentation, Mrs. Johndreau, Mr. Braum, and Dr. Strong designed a box to place on typing boards or desks to elevate the typewriter to the desired heights—2", 3", and 4", and they were installed in the Training Division for trial use by the typists.
>
> First of all, the typist's chair was adjusted so that the typist's feet were comfortably flat on the floor and so that the back support fit into the 'small' of the back at waist level. After the chair had been adjusted so that it helped the typist keep her back and shoulders straight, the typewriter was raised so that the forearms of the typist were at a 30° angle and her hands parallel to the slant of the keyboard. The size of the lift box used depended of course upon the height needed to place the typist's arms and hands in this position.
>
> The adjustment of equipment to typists in the Division of Training proved so successful that. . .the Training Division held several large demonstration meetings to introduce the idea to typists throughout the Department. . .
>
> The next step in this project, according to Mrs. Johndreau and Mr. Braum, is to establish scientifically the fact of increased production resulting from the proper adjustment of the typewriter and the typing chair to the operator. The Division of Training has received many reports of improved work and improved morale, but so far there has been little attempt to measure the benefits scientifically.

Also worth noting with regard to height are the following observations, somewhat in conflict, which are made by widely-known educators. Harms,[21]

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[19] Ibid., pp. 27-28.

[20] Elizabeth T. Van Derveer, "Planning and Equipping A Clerical Practice Room," The American School and University, Volume XXI (New York: American School Publishing Corporation, 1949), p. 231.

[21] Harms, op. cit., p. 73.

speaking for higher desks, says:

> Students tend to gravitate to higher tables if they are available. It seems to be more natural for one to reach up to the keyboard rather than to allow the wrists to be level or to slant downward.

Selby,[22] taking another view, admitted general disagreement as to desk height and said:

> Some experiments tend to prove that 30 inches is better than 27, although the chief advantage of the greater height seems to be that the body is in better position to get support for the back from the chair in which the typist sits. In typewriting, fingers and arms are not likely to become fatigued before the back starts to ache. Physical fatigue is not an important factor in a typewriting class.

The consensus of opinion seems to be that 27" is the lowest practical height and 30" is probably high enough to fit any but the most exceptionally large students. This is illustrated by the findings and recommendation of Whitcraft[23] who wrote, "the majority of the tables should be about equally divided between 28" and 29", a few should be 27" and 30" in height." It also ties in with the previously mentioned Department of Agriculture study in the following manner: lift boxes of two, three, and four inches were used on typewriting tables which were 26" in height, and since most of the typists in the Department needed the lift boxes it follows that most typewriting desks should be at least 28" high.

Adjustability. Since this is the section dealing with adjustable rather than fixed-top desks, adjustability should be considered in regard to height. It is therefore necessary that certain important facts be stressed at this point.

Previous mention has been made of the theory advanced by the Department

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[22] Paul O. Selby, "Equipment for the One-Room Business Department," American Business Education Yearbook, Volume V, op. cit., p. 149.

[23] John E. Whitcraft, "Typewriting Equipment for the Large High School," American Business Education Yearbook, Volume V, op. cit., p. 165.

of Agriculture and of the actual tests performed by Bennett regarding the height of desks. In part, these studies indicate that from the point of view of student posture, health, and performance, certain desk heights are better for the pupils than other desk heights. If the school desires to provide students with desks of the proper height for typewriting instruction, the desks will undoubtedly have to be adjustable so that the desk top and typewriter height can be changed to fit each individual student. Adjustability is more desirable and economical than the practice of having a great many desks of various heights which are assigned to the different students who will occupy the room during any school day, some of which will be unoccupied during each class period.

Two types of adjustability are commonly used, one providing a means of changing the height of each leg of the desk, and the other providing a means of changing the height of the typewriter without changing any other part of the desk. Adjusting leg height is satisfactory providing the height does not need to be changed from one class period to the next. The confusion, wasted time, and danger of upsetting desks and machines while adjusting each desk leg to a new height does not seem to be practical if the period-by-period adjustment is necessary. The other method is that of using a machine well which is set in the desk and which is fitted with a platform which can be raised and lowered to fit individual student needs.

In referring in any manner to one or two or three sizes of something to try to fit everyone in a group, one has difficulty with the term "average." From the point of view of the group there probably is a figure which can be used to fit the "average" in one way or another although this same figure seldom, if ever, fits a specific individual--and it is with actual people that we are concerned. It is difficult to imagine how one fixed-top desk would fit every pupil assigned to it during each school day. Some time

during that day, and probably more than one time, the desk will be either too high or too low for a student. One would infer, then, that a well-type desk is the solution providing the well is adjustable, for it is not practical to adjust each of the four legs of the desk when a change is needed in the desk height.

Since some of the authorities recommend the use of an adjustable typewriter desk, and since research findings have indicated that typists are happier and do better work if the height of the machine is adjusted to fit certain physical characteristics of the individual,[24] adjustability should be a standard by which typewriting desks are measured. An adjustable desk may not be the panacea for all typewriting ills, but it may be a partial cure for current difficulties such as poor posture and typing fatigue, and a partial remedy for poor techniques as well.

Individual Desks. Many business educators are also in agreement on the principle of individual desks for the students in the typewriting classroom (e.g. Morgan,[25] Reynolds[26]), although Selby[27] says that "long tables holding three typewriters are probably preferable to the individual type. . ." As the majority opinion favors the use of a separate typewriting desk for each student, the individual-type desk will be considered as a standard for judging typewriting desks.

Drop-Head Desks. General agreement is also found on the matter of eliminating the drop-head type of desk from the typewriting classroom,

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[24] Lamb, Your First Year of Teaching Typewriting, op. cit., pp. 27-28.

[25] Morgan, op. cit., pp. 510-514.

[26] Helen Reynolds, "Equipment for the Typewriting Classroom," The American School and University, Volume XIV (New York: American School Publishing Corporation, 1942), pp. 307-308.

[27] Selby, "Equipment for the One-Room Business Department," op. cit., p. 149.

although Selby[28] disagrees when the school has only a one-room business department and that one room must be used for other courses, as well as typewriting. Whitcraft[29] recommends the combination desk although he would like for it to be adjustable (he acknowledges the fact that no such desk was on the market at the time of his writing, but indicated that such a desk design was being studied). One of the main objections to the drop-head type of desk is the constant danger of damage to typewriter carriages which occurs when the desk is closed while the carriage is extended too far in one direction or the other; another objection is that the typing well is usually too low, often as low as 24" and seldom higher than 26".

Desk Top Working Area. Total top space for the typewriter desk is difficult to set at a definite figure. There are many variations in opinions and many different desk styles; two separate sets of standards are being presented, although it will be noted that both accomplish the same fundamental purpose. The purpose of having two standards for desk top area is to give schools with limited classroom area the opportunity to achieve, by adaptation, the most economical distribution of space.

There was little variation in the width of the desk since most specifications were either 19" or 20". Eighteen inches was also mentioned, although not frequently. The 20" size was chosen because of the added strength which is provided when a machine well is cut into the wider desk top.

Most length figures ranged from 30" to 36", but these desks offered a working area on only one side of the desk top whereas it is known that a student often needs space on both sides of his typewriter when learning or

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[28] Ibid., p. 148.

[29] Whitcraft, "Typewriting Equipment for the Small High School," op. cit., p. 153.

practicing certain skills and techniques. An illustration of wasted space with a small desk is easily seen on many of the drop-head type desks on which the desk top space to the left of the machine is often only two to four or five inches. It is very difficult to use this space for anything at all; paper will not safely rest upon that small a surface, nor will envelopes, books, or other necessary items. A wider desk allows for the typewriter to be placed in the center of the desk (or, if the desk is so constructed, for the well to be in the center of the desk) giving working space on both sides of the machine. Chain feeding of envelopes, typing and the subsequent filing of small file cards from the blank card to the file itself, and other skills which require the use of working space on both sides of the typewriter can be learned by the student actually doing the jobs rather than by merely talking about them.

If classroom space permits, then, the proposed typewriting desk will be 20" wide by 46" long with a 16" platform on either side of a 14" typewriter well. Adequate working space is provided on either side of the typewriter so that the typewriter carriage, under normal conditions, will have room to move without bothering other working tools or materials.

Since schools may not be able to provide this much floor space for the typewriting desk, another set of dimensions is presented. This second desk provides for a 13 1/2" platform on the right of the typewriter well which is also 14" in width, and a 4 1/2" edge to the left of the typewriter well. On the left of the desk, however, is a 12" shelf which can be folded up into position to provide an additional working area whenever such working space is needed. The top area dimensions of this desk are 20" for the width by 32" for the length, with an additional 12" in working area provided by the folding shelf.

The standard in so far as the top area is concerned is that working space be provided on either side of the typewriter. With a fixed-top typewriting desk, this will not be a problem since the typewriter can be placed at whatever spot on the desk top the typist wants it; with a typewriter well, though, there is a definite problem.

The reader might wonder at this point why the alternative desk has a smaller working platform to the right of the typewriter than the larger desk. If plywood is used for the desk top, and such a possibility cannot be overlooked, a 32" length will allow the school to secure three desk tops from a standard sheet of plywood which is ordinarily 96" long. Anything longer than 32" would result in waste, or hard-to-use lengths of plywood which would make the total cost of the desk a good deal more. No standards have been sacrificed by the shortening of the desk to fit the smaller classroom, and the economy achieved in the planned use of the material will be significant.

Drawers. The question of drawer space in a classroom typewriting desk will of necessity come up because students do have books and supplies which have to be taken care of. Smaller articles such as typewriter erasers, cleaning brushes, rulers, pencils, and sundry other items also need to be stored. Should the desk provide a storage space for these?

Whitcraft[30] wants three drawers without locks in his combination desk; Selby[31] would like drawer space, each drawer being provided with a lock. Others usually omit the matter or give it only casual attention for personal feelings are often very positive on the matter of drawer space. Why? Well, there is the problem of Johnny who constantly forgets his key (if the drawer has a lock) and teacher must stop in the middle of something he is doing in

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[30] Ibid., p. 153.

[31] Selby, "Equipment for the One-Room Business Department," op. cit., p. 148.

order to secure the pass key and open the desk drawer for Johnny. Then, when there is no lock, Mary is apt to say, "Someone is always taking my paper and I never have any"; or as Tommy says, "Someone is always throwing gum and candy wrappers in here on my typing paper." Perhaps open shelf space in the form of pigeon-holes or lockers without doors, placed alongside the entrance to the typewriting room would serve the purpose much better. Mary's paper might still disappear, but it would put the responsibility upon her to do something about storing it in a safe place; if the gum and candy wrapper menace was still a problem, Tommy might be given the job of monitor to see that students used the waste basket for such trash.

Since some teachers do have use for drawer space, the accompanying plan for the fixed top typewriting desk does have drawers included. The use of drawers in the typewriting desk is an optional matter and is not a standard by which these desks will be judged. There will be no standards with regard to locks on the drawers, either.

Sturdiness. In the literature of business education one will continually find adjectives such as solid, sturdy, stationary, and vibrationless used in reference to typewriting desks. Sturdiness is important to the typewriting desk, particularly with respect to two factors which are peculiar to the instruction of typewriting. First, the very act of typewriting produces vibration when the type bars hit the platen, and a jarring action is caused from the carriage moving from side to side. Both of these movements have a tendency to cause the desk to move or "scoot" over the floor. Second, the vibration itself will tend to loosen the joints and braces of the table, thus creating a repair problem. A very important standard of construction is the matter of sturdiness, regardless of the term used to describe it.

A quite natural question at this point is the matter of fastening the

typewriting desk to the floor in order to make the desk more rigid. Klaus,[32] Walker and Crumley,[33] and Harms[34] are among those who discuss the possibility of fastening the desks to the floor, whereas others decry such practice as being away from modern educational trends. It seems unfair to compare a skill subject of the nature of typewriting or shorthand transcription to another subject where the group or seminar approach can be used, since at no time can the students safely move desks (with the typewriters on them) around the room for such a form of class participation; nor would such a practice be particularly valuable to the building of typewriting skills.

It does not seem that the question of modern educational methods would be at all pertinent when considering whether or not to fasten the typewriting desk to the floor. At the same time, however, it may be that other factors are influenced by this bolting-down of desks and a combination of all of the factors would indicate that it would be better to leave the desks free. The determining factor is probably the local situation, and it appears that this is not a necessary general standard. In no way will it affect the design of the desk, either.

Panels. Rigidity can be accomplished in another manner which will protect the desk and also ease the mind of the teacher. One-quarter inch plywood panels, sixteen inches high, across the front and both sides of the desk will add a great deal of strength to the typewriting desk and help cut down on vibration. At the same time this paneling will help protect the teacher from the uncomfortable feeling which may arise because, as Bennett[35] phrases

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[32] Mildred S. Klaus, "A Small City High School Business Department," American Business Education Yearbook, Volume V, op. cit., p. 30.

[33] Walker and Crumley, op. cit., p. 11.

[34] Harms, op. cit., p. 73.

[35] Henry Eastman Bennett, "Democracy and School Desks," The American School and University, Volume XIII (New York: American School Publishing Corporation, 1941), p. 326.

it, of the lack of "genteel modes of entering or leaving a desk." In addition, it would also prevent embarrassment with respect to the lack of knowledge of some young women on the genteel modes of sitting at a desk.

The most important matter served by the panels may be the added strength which is given the desk, but the comfort feature is a matter of no little importance. Since some form of bracing is essential to a typewriting desk, the double purpose served by the panels indicates that this may well be an important standard.

The Fixed-Top Typewriting Desk

The prior section, which covered certain standards pertaining especially to classroom typewriting desks, suggested that the typewriting desk should be adjustable. This is undoubtedly a good standard for it shows an attempt to consider the posture, comfort, and efficiency of the student. Some schools may not be able to provide adjustable desks because of the need to use the typewriting classroom for non-typewriting purposes which require a flat-top desk. It is therefore necessary to provide standards for a typewriting desk which can meet the classroom situation just mentioned.

Height. The standards for the height of an adjustable typewriting desk have already been established, and these standards will not change between a desk which is adjustable and one which is not. A matter of importance at this time, though, is the allocation or distribution of the various fixed top desk heights. Lamb has made conflicting statements. In a 1947 book,[36] she indicated that a 30" height was suitable for most of the members of the class with a few requiring 28", 29", and 31" desks. In 1950, she recommended the 28" and 29" desks as being the most necessary with other sizes being

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[36] Lamb, Your First Year of Teaching Typewriting, op. cit., p. 26.

added in small numbers.[37] In the previous section Whitcraft[38] was quoted as recommending that the majority of the desks should be 28" and 29" with a few included of other heights, and the United States Department of Agriculture study[39] proved that 28" was the minimum height for most people. Tonne, Popham, and Freeman[40] also say that "most tables and desks should be raised to 28, 29, 30, or even 31 inches. . ." With these authorities in somewhat general agreement, then, it seems safe to state that the "majority" of the desks should be 28" and 29" in height with smaller quantities of other sizes. The proportion is the next problem.

Bennett[41] may give a clue to the matter of height with his figures (which are still accepted as valid by the American Association of School Administrators[42]) on the "practicable Distribution of Standard Seat Sizes for the Several Grades." For high schools he lists three seat heights as being the most necessary:

14 3/4"	25%
16"	40%
17 1/4"	35%

As typewriting is often taught in the 9th and 10th grades, it may be well to use Bennett's three chair height percentages as a rule of thumb for ordering 27", 28", and 29" typewriting desks. In addition, provision would

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[37] Marion M. Lamb, Your First Year of Teaching Shorthand and Transcription (Cincinnati: South-Western Publishing Company, 1950), p. 130.

[38] Whitcraft, "Typewriting Equipment for the Large High School," op. cit., p. 165.

[39] A Study of Typewriter Height (New York: The Society for the Advancement of Management, (no date given), 9 pp.

[40] Herbert A. Tonne, Estelle L. Popham, and M. Herbert Freeman, Methods of Teaching Business Subjects (New York: The Gregg Publishing Company, 1949), p. 102.

[41] Bennett, School Posture and Seating, op. cit., p. 143.

[42] "American School Buildings," op. cit., p. 255.

have to be made for higher desks for the taller pupils if the so-called 30° angle principle of the Department of Agriculture findings, mentioned previously, is to be followed.

The local situation, e.g., the grades in which typewriting is taught, the racial characteristics affecting body build, etc., will largely determine what heights will be needed, and this factor should be closely surveyed before ordering or building. Obviously, it would be much better to build taller desks and find that they have to be shortened than to build shorter desks and find that blocks or other elevating devices have to be put under the legs in order to give the desk additional height.

Desk-Top Working Area. The length and width of the fixed height typewriting desk can follow the size of the smaller of the adjustable typewriting desks, 20" x 32". Since the desk top will be flat, the typewriter can be moved about to make working area available for techniques which require space on either side of the typewriter. The 32" length will also fit in with the standard size of plywood sheets, but the desk may be lengthened if desired, or if other desk top material is to be used.

No other new or revised standards have to be established for the fixed-top typewriting desk. The same standards of rigidity, design, construction, and so forth apply equally well to both types of desks with the adjustability feature being the only major difference. Drawers are optional.

The Fixed-Top Bookkeeping Desk

Desk-Top Working Area. As in the case of the typewriting desk, there are conflicting opinions concerning the various standards for the bookkeeping desk. Size of table top working area is still important as is the

proper height of the desk. Regarding the size of the working area Nichols[43] says:

> In the subject of bookkeeping, emphasis has been shifted from the routine recording of entries to the principles of accounts and their significance in constructing a set of records for the guidance of management. Multitudinous vouchers, forms, and blanks no longer play a large part in giving instruction in this course. No longer is the extra-large "commercial desk" required, with its lift top or drawer space for supplies, and "rack" on which to lay temporary blanks, forms, vouchers, and "files" when not in use. Such a desk is wasteful of space and unnecessarily expensive. A somewhat smaller, flat-top desk. . . will meet all requirements. . .

Since this 1932 opinion of Nichols, then, what is the present trend? Is his statement still valid? Among those who give dimensions, such as Harms,[44] Selby,[45] and Tonne, Popham, and Freeman,[46] almost all prefer the small individual desks. Klaus,[47] as an exception, is notable because she uses long community-type tables in her recently-built Reno, Nevada, Senior High School. The following quotation illustrates Klaus' point:

> Since bookkeeping students need a large space for supplies, the work tables will be 32 inches high, built to give each student a 4-foot by 3-foot working space. The long tables will be partitioned off by a 4-inch partition between the "desks."

As the current literature did offer so little information which could be used as a basis for the standard of the top working area of the bookkeeping desk, an arbitrary decision will have to be made. This decision will be based upon the information which is available, but the major portion of the

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[43] Nichols, "Equipment Needed for a High School Commercial Department," op. cit., p. 230.

[44] Harms, op. cit., pp. 217-218.

[45] Paul O. Selby, The Teaching of Bookkeeping (New York: The Gregg Publishing Company, 1945), p. 201.

[46] Tonne, Popham, and Freeman, op. cit., pp. 265-266.

[47] Klaus, op. cit., p. 34.

reliance will be upon the opinions of Selby[48] and Olson.[49]

Selby suggests that approximately 792 square inches of table working area is necessary, but later says that "Space is saved by using a smaller desk." He suggests three smaller sizes that are now "widely offered" as follows:

36" x 20"	720 sq. in.
30" x 22"	660 sq. in.
26" x 21"	546 sq. in.

Olson listed six commercially manufactured desk sizes as follows:

32" x 22"	704 sq. in.	
36" x 26"	936 sq. in.	Variations
38" x 26"	988 sq. in.	of one
38" x 22"	836 sq. in.	Manufacturer
36" x 20"	720 sq. in.	
34" x 19"	646 sq. in.	

In keeping with the Selby suggestion of a large working area, but not up to his maximum of 792 square inches of working space, the arbitrary decision has been made to have the top area 22" wide and 32" long. This provides 704 square inches in which to work and, with the exception of the three extra-large desks manufactured by the one manufacturer, is the approximate maximum of the manufactured desks listed above.

In addition to the fact that this arbitrary decision of establishing the bookkeeping desk top dimensions at 22" x 32" compares favorably with the opinions of business educators such as Selby and Olson, both specialists in bookkeeping, the dimensions are sound when applied to construction principles. First, the 22" x 32" dimensions will furnish six bookkeeping desk tops from a standard 4' x 8' sheet of plywood, and the economy of this type of planning has already been pointed out. Second, this desk size is quite similar to the

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[48] Selby, The Teaching of Bookkeeping, op. cit., pp. 200-202.

[49] Milton C. Olson, "Bookkeeping Equipment," American Business Education Yearbook, Volume V, op. cit., pp. 168-171.

typewriting desks mentioned previously, and the similarity will help create a type of mass production technique in the school shop to speed up production and help give rise to economy through less waste.

Adjustability. During this study, only one bookkeeping desk was found to be adjustable. This one desk was adjustable only by turning extensions which were fitted to each of the four legs. It appears that these extensions would be used only as one-time-a-semester adjustments, rather than as an hourly change, because of the obvious potential loss of time during the adjustment process.

Adjustability is evidently not considered necessary for the bookkeeping desk, either by the manufacturer or the majority of the educators who make suggestions for new designs to meet student needs. Whatever the reason for it, the lack of emphasis seems to eliminate adjustability from the list of standards for the bookkeeping desk.

Height. The height of the desk cannot be so easily determined. Writing height in bookkeeping, as in typewriting, should not be set by whim. Posture, comfort, and other factors which affect learning should be considered.

From a scientific point of view, Bennett[50] gives the following rule for desk top height:

> When the pupil is erect, with arms in writing position, the desk top should be in the plane of the underside of the forearms.

Perkins and Cocking[51] quote from W. W. Caudill's Space For Teaching with the following device for fitting the child to the desk: desk top is 3/7 of the height of the child plus one inch. The American Association of School Administrators[52] state the following rule:

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[50] Bennett, School Posture and Seating, op. cit., p. 211.

[51] Perkins and Cocking, op. cit., p. 183.

[52] "American School Buildings," op. cit., p. 251.

> The height of a flat-top desk should be one to two inches above elbow level of the pupil when properly seated and with the arm in a vertical position. If the desk top slopes, the edge next to the pupil should be a little lower in proportion to the slope.

The foregoing references, however, do not give any specific desk heights and it is not practicable to present every student with a special desk. Furthermore, in the case of Caudill's formula, it does not hold true that the sitting height of students can be accurately estimated by standing height.

Bookkeeping desk heights can be determined by reference to office standards. Gage [53] says the following about height of office desks:

> . . .height of desks and tables is important--the old standard, 30 1/2", is recognized to be too high--reduction to even 28" has been advocated.

Since 30 1/2" was said to be too high, and since the 28" height was prefaced by the words "to even," the correct height may correctly be interpreted to mean some height in between these two figures.

Gager, [54] when writing about one of the two first cases of office furniture and equipment standardization, actually sets a figure:

> . . .the height of the desk or table shall be either 29" or 30 1/4" if fixed, or adjustable between these levels.

The adjustability mentioned by Gager is the same type of adjustability which has previously been discussed--a sort of permanent adjustment rather than the kind which can be changed from hour to hour during the day. In addition, Gager's statement is applied to adults in the office rather than to students in the classroom. Even though bookkeeping is usually an upper division course, the adults might tend to be slightly taller than the students in the school.

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[53] Gage, Office Standards, Developing Standardization in the Office and Principles of Specific Standardization of Office Equipment, op. cit., p. 19.

[54] Gager, op. cit., p. 27.

Perhaps the local situation should again determine the heights to be used, but since (if the suggestions and plans of this study are followed) the school itself will construct the furniture it would be possible for uniformity to be sacrificed only to the extent of providing desks of three heights. Twenty-eight inch desks could be used for the shorter students and 30" desks for the taller, with the larger number of students being supplied with 29" desks.

As bookkeeping is almost always an upper division course, bookkeeping desks are made higher than those for typewriting because of the normal student growth which would be evidenced in the upper grades. The same proportion of desk sizes decided upon with regard to the three sizes of fixed-top typewriting desks can be applied to the three heights of bookkeeping desks (25%, 40%, and 35% respectively to 28", 29", and 30" heights). It is again noted that it is better to build desks too high, and have to cut them down, than to build them too low.

Sloping Desk Top. One other problem which confronts the builder of the bookkeeping desk is the question of whether or not to have a sloping desk top. Bennett[55] believes that any school desk top should be slanting, and much of his writing was directed along the promotion of that point. Fisk,[56] in writing about junior college needs, refers to a "large flat working surface . . .[which is]. . .essential for . . .bookkeeping." McLeary[57] urges the use of flat-top desks because that is what the student will use if he works in an office.

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[55]Bennett, School Posture and Seating, op. cit., pp. 191-213.

[56]McKee Fisk, "Equipment Needs in Junior College Business Education," The American School and University, Volume XIII (New York: American School Publishing Corporation, 1941), p. 373.

[57]McLeary, op. cit., p. 45.

The deciding factor is probably that a flat surface is essential to the process of bookkeeping as was mentioned by Fisk. A bookkeeping student will oftentimes have many necessary items laid out on his desk: pen, pencils, ruler, eraser, books, ink, business forms, or the like. A flat surface does not guarantee perfect order, but it goes a little further toward such a guarantee than does the sloped desk which allows items to roll, often to the floor. As it is believed that the flat-top desk for bookkeeping is the better, a flat surface should therefore be a standard by which bookkeeping desks are judged.

Drawers. Drawer space must come up for consideration again, but this time the advocates of drawers have a better case. Those who recommend locks for the drawers likewise have good arguments in their favor. It must be assumed, however, that if the opposition to drawers in typewriting desks was valid, some of those same points would still be valid in the case of bookkeeping desks.

Klaus[58] includes drawers in the tables of her bookkeeping room "to accommodate the various sizes of working papers, rulers, and forms with which bookkeeping students must work. . ." Other writers favor drawer space in the bookkeeping desk, too, and the fact that various and often expensive printed forms of large and varied sizes are required seems to be another reason for including the storage space. The same problems of lost keys will plague the teacher, but it does seem unfair and perhaps unwise to ask the student to carry and consequently abuse specialized forms for which storage space is difficult to secure. Also, waste paper in the drawers is usually not the problem in the bookkeeping desk that it is in the typewriting desk. Drawers, although not absolutely essential, may improve the classroom

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[58]Klaus, op. cit., p. 34.

teaching, learning, and storage situations, and are therefore included in the list of standards.

Writing Surface. As yet, there has been no consideration of the writing surface, and the bookkeeper, embryonic or skilled, does a considerable amount of writing with either pen or pencil. A smooth surface is necessary to this kind of study and skill building.

Gage[59] mentions ". . .furniture with linoleum or plastic tops" although Gager[60] does not mention writing surface at all in his list of desk standards. McLeary[61] recommended the use of plastic tops instead of wood (not just a plastic covering, but a desk top to be made entirely from plastic) but his recommendation was based more upon life expectancy than upon the writing surface itself. The process of gluing linoleum or plastic to a desk top, under pressure, is not a difficult task, and it can be done in the school shops.

The matter of the proper type of desk covering should receive serious consideration from the school. In addition to providing a high grade writing surface, the linoleum or plastic top will also provide a surface which is easy to keep clean and which is most difficult to mar except by deliberate action with a sharp instrument. This study therefore includes a suitable desk top covering as a standard of the best in classroom bookkeeping desks.

Panels. The principle of providing a plywood panel at the front and on both sides is again mentioned. As Olson[62] says with regard to one of the

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[59]Gage, Office Standards, Developing Standardization in the Office and Principles of Specific Standardization of Office Equipment, op. cit., p. 19.

[60]Gager, op. cit.

[61]McLeary, op. cit., p. 45.

[62]Olson, op. cit., p. 170.

manufactured desks, "... it is enclosed in front and on the sides for the comfort of feminine students." Other standards for the bookkeeping desk are covered by the general standards which were set down either at the beginning of the chapter or in connection with the typewriting desks.

The Shorthand Desk

In all probability there are few schools, other than the approximately 10 per cent who have enrollments of 500 students or more,[63] who need a separate room for shorthand instruction. To order specially built desks for shorthand classrooms in the small school which has less than 500 students might not be economical if the furniture is not used enough to justify the expenditure. An exception to this general statement would be the small school in a business or industrial area which had a steady demand for secretaries and stenographers.

There are standards which should be looked for, however, when selecting shorthand desks. If a desk can be found which will serve shorthand learning to the best possible extent and also be of use in other subjects, that desk should be used. Otherwise, shorthand may have to be taught in a classroom which was primarily designed for another subject. According to the United States Office of Education enrollment figures given in Chapter II, approximately six per cent of all high school enrollments are in shorthand classes. This figure would probably be higher in urban areas, lower in rural areas; but in few cases would it be significant except in the very large schools.

Desk-Chairs. Lamb[64] does one of the better jobs of describing furniture

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[63] Will French, J. Dan Hull, and B. L. Dodds, American High School Administration (New York: Rinehart and Company, Inc., 1951), p. 107.

[64] Lamb, Your First Year of Teaching Shorthand and Transcription, op. cit., p. 125.

for the shorthand room. Movable chairs with writing arms are acceptable but not desirable. In fact, in another place,[65] it is specifically said that "desks with slanting tops are not for the shorthand room," so this would indicate the inadequacy of most tablet-arm chairs and some desk-chairs. Fisk[66] agrees that arm chairs should not be used for shorthand. If adaptations have to be made, however, Lamb recommends the purchase of a few left side writing arms for the left-handed writers as well as the right side writing arms.

Height. Most of the other writers who comment on the desk for shorthand students recommend writing surfaces which are not too high to create a strain on the arm of the writer or too low to cause poor posture. Since Lamb has already been referred to as recommending flat-topped desks, it is probable that the desk used by the bookkeeping classes can also be used in the shorthand classes. The requirements are about the same with regard to height of writing surface, and since this is the case, some economy of operation is attained by using the same equipment for more than one class. Shorthand, like bookkeeping, is usually offered in the 11th and 12th grades, thus serving students of approximately the same size.

Co-operative Use of Desks. Some schools use the typewriting desks for shorthand and transcription as well as typewriting. The procedure is to move the typewriter to one corner of the desk and use the balance of the space for writing (this assumes a flat-top desk). New Mexico Highlands University, with single pedestal, fixed-top desks in the transcription rooms, is an example of a school which uses this procedure, and at one time or another classes in typewriting, shorthand, transcription, and office practice successfully use the desks. Left-hand pedestals are probably better than right-hand

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[65] Loc. cit.

[66] Fisk, op. cit., p. 374.

pedestals if this combination is to be used since it is difficult to work over the pedestal, and by placing the typewriter over it the student can work directly over the leg space.

Writing Surface. Of particular importance is the writing surface—hard wood or a linoleum or plastic covering—and the wood peneling for the front and sides of the desk. No new standards are necessary since standards established for typewriting or bookkeeping desks may apply.

The Calculating Machine Desk

There appear to be fewer opinions regarding standards for desks for office adding and calculating machines than for other types of furniture. Evidence of this lack of decision is voiced by Barnhart[67] in the following quotation:

> It is accepted that the table should provide an offset section for the machine; but should it be in the center of the table or at the right? If at the right, should it be at an angle to the operator or should the machine set at right-angles to the operator? What difference should the table have for more efficient housing in a classroom where operation is limited? . . .

In the model classrooms which were set up at the 1950 National Business Show, pictures appearing in one business education periodical[68] show only flat-top tables for the machines. No heights were mentioned for any of the furniture in this source.

Conversely, another business education magazine[69] carried an article

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[67] W. S. Barnhart, "Equipment Standards," Business Education World XXV (March, 1945), 352.

[68] "New York Business Show," The Balance Sheet XXXII (January, 1951), 228-230.

[69] R. L. Higginbotham, "How One School District Solved a Three Million Dollar Office Occupations Question," UBEA Forum IV (May, 1950), 29-30.

in the same year in which pictures taken in an actual school situation showed office machine desks with a well in the center of the desk. The article did not say that the equipment was new, but the pictures indicated that it was new and that a good deal of planning had been done—which might again indicate new furniture. As in the case of the model classroom at the National Business Show, there was no indication that the desks were adjustable or that there was an assortment of desk heights.

Height. Meehan[70] lists some of the equipment used in the National Business Show and gives the height of the desks for calculating machines at 30". One commercial manufacturing company has advertised a metal calculating machine desk,[71] 30 1/2" in height, with a well on the right side for machines; but in this source there is no indication as to whether the well is at an angle to the operator or at right angles to the desk. Should this height of 30" or 30 1/2" be considered standard? Vinton[72] does not think so. He says:

> A great many offices still place electric calculating machines on top of a thirty and a half inch high desk with the electric cord across the top of the desk. This places the machine at too great a height for efficient operation.

Height need not be a serious problem if we use desks with the well in the center. The adjustable typewriting desk which has been described earlier will fit the needs of this type of instruction if a well is desired in the middle of the desk top area. Adequate working area is provided, and the additional feature of adjustability is possible.

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[70] James R. Meehan, "Obtaining Adequate Facilities and Equipment," American Business Education Yearbook, Volume VIII (New York: The National Business Teachers Association and The Eastern Business Teachers Association, 1951), p. 287.

[71] School Equipment News, June, 1950, p. 4.

[72] George Vinton, "Office Layout and Planning," The Journal of Business Education XXI (March, 1946), p. 39.

Adjustability. Since adjustability does not seem to be an important factor as is evidenced by the lack of emphasis on it, that factor is not listed as a definite standard. There is little doubt about the convenience of the adjustable desk, however, if the principles set forth in the section on the adjustable typewriting desk are accepted. In addition, if the adjustable typewriting desks are being made by a school it might be the most economical plan to make the calculating machine desks by the same pattern and at the same time, providing the center well is acceptable.

The Machine Well. The only specific standard for the calculating machine desks being considered here, then, is the matter of the desk having a well for the machine to rest in. This is important in that the machine is protected from falls; the machine is placed in a more comfortable operating position while the writing position is also more nearly normal; and if electric machines are used, the cord may be run through a hole in the well platform to help prevent accidents caused by the loose or dangling cord which is run across the top of the desk.

The Industrial Arts Department of New Mexico Highlands University, through the planning of Vernon V. Payne and Floyd W. Kelly, has built maple office machine desks with a diagonal well at the right hand side. The desks are 22" wide and 32" long; they are not adjustable but variations are allowed in the height so that exceptionally tall or short students can be accommodated (the 29" and 30" desks will fit most students). These desks have linoleum covered tops, and they might be used for purposes other than machines instruction (introduction to business, payroll accounting, etc.) since a good writing surface and a working area are provided. Editorially, it may be observed that wells on an angle and on the right hand side seem to fit most students. Casual observation will show that students usually turn the machines at an angle while using them, and since this appears to be the

most comfortable and the most natural position, the diagonal well should be considered in construction plans.

Careful consideration should be given to the width, height, and carriage movement of various types and brands of calculating machines if a well is to be used. It is possible that the center well type of desk should be adjustable to only two positions instead of four as in the typewriting desk. It is also possible that some sizes of calculating machines would need a wider well than the one required for a typewriter with a standard carriage.

The General Purpose Desk or Table

As defined for this study, the general purpose table or desk is different from the individual desk which is used in bookkeeping or shorthand. It is defined as a desk or table which can be used for group or conference work; it is also usable for collating working materials, as a stand for duplicating machines, and a display table. It is, as the name implies, a table or desk which has many purposes and uses.

General purpose desks and tables should be designed and constructed in accordance with the general standards which were referred to at the beginning of this chapter. There is a difficulty, however, in establishing specific sizes for the desks because of the many different uses to which the desk or table may be assigned.

Shape of Table. The shape of the desk has achieved no standardization, either. Today, for example, a school can purchase desks and tables of the general purpose type in several different shapes. Advertised in school journals are square, round, rectangular, and trapezoidal desks in varying dimensions.

Height standards are a little easier to determine, although the purpose for which the desk or table is to be used influences height. One office furniture company[73] manufactures "conference tables" in 29" and 30 1/2" heights. Library tables usually follow the same height patterns.

New Library Tables. The new Oklahoma Agricultural and Mechanical College library has furnished the reading rooms with tables of birch wood, 29" high. These library tables deserve special mention because they offer several new features, as mentioned below, and because they are quite new in furniture design. Edmon Low, Head Librarian at the College, reports that these tables were designed expressly for the new library and that the design has since become very popular with other libraries. A recent advertisement,[74] describing the new table, says:

> The new apronless table above permits the user to cross his legs in comfort. There is a clear height of 27 1/2" from the floor to the underside of the table. An arm chair may also be pushed completely under the table thus saving much valuable floor space.
>
> For longer life and utility, the tables are constructed with a steel-on-steel grip with the header fastened to the top by six machine bolts into embedded bushings, and the legs fastened to the header by two machine bolts into embedded bushings.
>
> Two shapes are available: The round or 48" diameter table shown and the rectangular model which comes in three dimensions.

Although this new type of desk could not be built by the majority of school shops, some schools could experiment with the possibility of constructing such a desk. In addition, it is emphasized here because it illustrates vividly the point which was brought out in an earlier chapter, namely that furniture and equipment standards are not fixed. In this particular instance, the design is radical, but the results indicate that the table will be one of the most functional classroom tables ever developed.

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[73] School Equipment News, February, 1951. P. 6.

[74] School Equipment News, August, 1952. P. 1.

Height. One textbook on office management which recommends some form of standardization in office furniture suggests 28 1/2" as "the most comfortable height for the greatest number of people."[75] Since there was such a little difference between this recommendation and the actual heights given in the above illustrations, no issue will be made of the variance in opinion.

Attention is called to the fact that the height which is best for library or conference work may not be adequate or suitable for a particular kind of office work such as collating or mimeographing. An important fact, however, is that the recommendations and actual observed heights are well above the older standards of 26 and 27 inches.

Summary of Desk Standards

Table III is a summary of the special standards for the business education desks covered by this study. The general standards, listed at the beginning of the chapter, are in addition to these special standards.

DEMONSTRATION EQUIPMENT

At the beginning of this section on demonstration equipment, one should recognize the fact that there are several accepted devices which may be used in the classroom to demonstrate typewriting techniques. It seems relatively unimportant to choose one device as being better than another because the abilities, preferences, physical characteristics, or personal traits of individual teachers may be highly important in deciding what is best in a given situation.

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[75]Leffingwell and Robinson, op. cit., p. 182.

TABLE III

SUMMARY--SPECIAL STANDARDS FOR BUSINESS EDUCATION DESKS

Name	Typewriting Desk		Bookkeeping Desk	Shorthand Desk	Calculating Machine Desk	General Purpose Table
	Adjustable	Fixed-top				
Size of Top	20" x 32" (20" x 46" (	20" x 32"	22" x 32"	20" x 32"	22" x 32"	Optional
Height	27"-30"	27"-30"	28"-30"	28"-30"	29"-30"	29"
Adjustability	Yes	No	No	No	Optional	No
Drawer Space	Optional	Optional	Yes	Optional	No	Optional
Locks on Drawers	Optional	Optional	Optional	Optional	No	Optional
Front & Side Panels	Recommended	Recommended	Recommended	Recommended	Recommended	No
Fasten to Floor	Optional	Optional	No	No	Optional	No
Individual Desks or Group Tables	Desk	Desk	Desk	Desk	Desk	Table
Flat- or Slanted-top	Flat	Flat	Flat	Flat	Flat	Flat
Machine Well	Yes	No	No	No	Yes	No
Linoleum, Plastic, etc., Top Covering	Not Necessary	Not Necessary	Recommended	Recommended	Recommended	Recommended
Banding or Moulding Around Top	Optional	Optional	Yes	Yes	Yes	Yes
Use of Tablet-Arm or Desk-Chairs	No	No	No	No	No	No

The really important matter is that some method of demonstration be used in the typewriting classroom. DuFrain,[76] Blackstone and Smith,[77] and Whitcraft[78] are but a few who list demonstration equipment as a necessity, and it is upon the statements of many educators, such as those mentioned, that this section on demonstration equipment is included.

The Upright Typewriter Demonstration Stand

Height. The upright, floor model demonstration stand will be considered first. Tonne, Popham, and Freeman[79] say, ". . .usually it is more convenient for the teacher to stand while demonstrating. . ." but indicate no height standards. Whitcraft[80] gives a height range of between 40 and 50 inches and assumes the stand is adjustable. DuFrain[81] is more definite with her height standards, which can be applied either to an adjustable stand or a fixed-height stand made specifically for one individual teacher:

> The demonstration stand should be high enough to enable the teacher to operate the machine from a standing position, so placed that the machine can be seen clearly by all of the students. . . The stand should be adjustable to the teacher's elbow height, or a little above.

In order to get a correct height for the demonstration stand, the teacher who is ordering the demonstration stand should experiment with a

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[76] Viola DuFrain, "A Demonstration Stand for Typewriting," UBEA Forum VII (November, 1952), 26, 38.

[77] E. G. Blackstone and Sofrona Smith, Improvement of Instruction in Typewriting (Second Edition; New York: Prentice-Hall, Inc., 1950), pp. 66-68.

[78] Whitcraft, "Typewriting Equipment for the Small High School," op. cit., p. 159.

[79] Tonne, Popham, and Freeman, op. cit., p. 102.

[80] Whitcraft, "Typewriting Equipment for the Small High School," op. cit., p. 159.

[81] DuFrain, op. cit., p. 26.

typewriter and a platform so that a correct height can be obtained. Earlier in the study it was mentioned that the Department of Agriculture had found that there was a lessening of fatigue if the forearms of the typist were at about the same angle as the typewriter keyboard;[82] DuFrain says in the above quotation that the relation of the elbow height, when in the typewriting position, to the table top is important. Experimentation will help solve the question for the individual teacher and is needed if the stand is not adjustable because once made, the height is very difficult to change. If only one stand of a fixed-height is to be made, and if several different teachers are to use it, it is doubly important for this experimentation to be performed.

A personal experience will illustrate the height problem when several different teachers use a demonstration stand which is not adjustable. In one situation, the writer had demonstration stands built to specification. In every classroom, more than one teacher used the equipment; so a height of 42" was decided upon as being the best height for the teachers concerned.

Standards for height are not a building problem if the school is able to buy any one of the several brands of adjustable typewriter demonstration stands which are on the market. Obviously, the stand can be heightened or shortened to fit the needs of the teacher.

Fixed height demonstration stands will provide another problem. If the stand is to be used by only one individual the height will be determined by tests on that individual; if it is to be used by several teachers, a compromise which will fit all of the teachers involved can usually be determined by tests.

Height standards, then, cannot be rigidly established for this type of

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[82]Lamb, Your First Year of Teaching Typewriting, op. cit., pp. 27-28.

furniture. A 42" stand is not high enough for the taller teachers, but lift boxes or other elevating devices can be successfully used to make the typewriter high enough. Teachers who are six feet or more tall need the higher equipment.

Stability. Next to height, probably the most important standard to seek in a typewriter demonstration stand is stability—the non-tipping factor. Most educators stress this point, and one can easily see its importance by considering the high costs of replacement and repair of damaged machines. As most demonstration stands of the upright type have casters on them, the non-tipping factor is quite important when considering unevenness of floors, especially those made of wood. Typewriters vibrate considerably when being used, too, and a typewriter which is off balance on the demonstration stand might cause the stand to tip over if proper balance is not maintained.

Mobility. Mobility is third in importance instead of second, only because mobility would be of less value if the teacher had undue worry with the thought of the machine and stand tipping over. Front-of-the-room demonstrations are necessary and probably most common, but the teacher also needs to do individual instruction and demonstration at the side of a student's desk and typewriter. The argument, formerly expressed, that the student can come up to the front of the room for a personal demonstration, is no longer heard. It is realized that the teacher can do a better job of individual instruction at the desk of the student, with the additional factor of not disturbing him or other members of the class.

Casters. Mobility and stability are influenced by the correct selection of casters. It has been found that one of the best casters for classroom use is the "wobble" or "creeper" type which revolves easily when it meets obstacles on the floor, rolls easily without marring the floor, and tends to

level the furniture to which it is attached. Next to the above, a rubber-tired caster is probably the best. Both types are considered noiseless. The selection of the proper type of caster constitutes a standard primarily because it affects both mobility and stability; the correct selection can also help protect the floor.

Adjustability. Since several brands of adjustable demonstration stands are on the market, the reader may be familiar with such a piece of equipment. Blackstone and Smith,[83] DuFrain,[84] and Allen[85] show pictures of commercial makes. The home-made demonstration stands vary in appearance and some are worthy of note.

Oelke[86] has written of a demonstration stand which was built to match some new typewriting desks which his school had acquired. He made it adjustable in a manner similar to the adjustable typewriting desks which accompany this study, and was thus able to vary the height to fit several different teachers. One of his main themes was the matter of uniformity between his equipment and that of the students. In addition to this upright demonstration stand he also used one of the old typewriting tables, somewhat modified, as a demonstration desk with which to give individual demonstrations. This demonstration desk was mounted on casters and could be moved around the room.

Home-made Stands. Nanassy and Stroup[87] stress the importance of

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[83] Blackstone and Smith, op. cit., p. 67.

[84] DuFrain, op. cit., p. 26.

[85] H. M. Allen, "The Case for Demonstration Stands," Business Education World XXX (June, 1950), 532.

[86] Lewis R. Oelke, "Typewriting Demonstration Stand," The Balance Sheet XXXII (October, 1950), 81.

[87] Louis C. Nanassy and Christine Stroop, "Designing the Typewriting Classroom for Business Teacher Education," UBEA Forum VII (November, 1952), 18-20.

demonstration stands and suggest that teacher training institutions have both home-made and commercial types. A partial picture of one of the home-made types is shown in the article but the reader can tell little about it except that it apparently consists of a high box-type platform for the typewriter and nothing else.

Sanders[88] has a set of detailed drawings from which a demonstration stand could be built from either new or used 1/2" pipe or conduit material. There is considerable welding on the stand, but this could be done at a slight cost, even if the school had to hire the work done. It is not adjustable, has a hard-wood typewriter base with a plywood paper shelf which slides under the hard-wood base, and can be built at a very low cost. It is not mobile, but could be made so by minor changes in the design.

This investigator[89] has also designed a demonstration stand which can be built at low cost. It is non-adjustable; is one of the few stands which has any storage space; uses the "creeper" type of caster mentioned previously; and is constructed with a heavy base to help eliminate the possibility of tipping. In addition to being a typewriter demonstration stand, it can be used as a platform for some kinds of audio-visual projection equipment, and the storage space is large enough to store cans of films, filmstrips, a filmstrip projector, and other items. Part of the storage space can be locked to protect the above-mentioned equipment as well as such typewriting supplies as stencils, ribbons, and other costly items.

Typewriter Platform Area. There does not appear to be any uniformity in the size of the platform upon which the typewriter will rest. One of the

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[88]Frank F. Sanders, "Demonstration in Typewriting," The Balance Sheet XXXI (November, 1949), 105-107, 117.

[89]John E. Binnion, "Make Your Own Demonstration Stand," New Mexico Business Educator XIII (March, 1952), 10-13.

commercial stands has a top of 16" x 16" and another has one which is 15" x 24"; of the home-made stands, Sanders uses a 13" x 13" top and the writer, a 20" x 21" top. There is obviously no standardization or uniformity, and the purpose may determine size. The 20" x 21" size fits a stand which has storage space large enough to accommodate a package of mimeograph stencils (length) and two reams of standard size paper (width). The others, having no storage problems, did not require such a large top area. All but one of the commercial models and one of the home-made stands had a folding leaf or other type of shelf to hold copy for the demonstrator, and the commercial table which did not have it provided a very large table top to hold both the typewriter and the copy.

There are other suggestions which have not been discussed and which need only brief mention. One is the use of a turntable, instead of a platform, so that the typewriter can be turned in order to point out different features and to enable one in any part of the classroom to see what is being pointed out.[90] Another suggestion is the bolting, or otherwise fixing, of the typewriter to the platform so the typewriter cannot "travel" or fall off during an unguarded moment. This latter suggestion can also be accomplished by placing moulding around the edge of the platform to keep the typewriter and other materials from falling to the floor.

Summary. In summary, it seems that there are few real standards for the upright typewriting demonstration stand. The nontipping feature is very important as is mobility, and these should be found in any acceptable stand. Height, size of typewriter platform, caster, materials from which the stand is built, storage space, and other features which have been mentioned should

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[90] Reynolds, "Equipment for the Typewriting Classroom," op. cit., p. 306.

be decided upon by the user who should base his decisions upon sound thought and investigation of his own situation and needs.

The Table-Top Demonstration Stand

A second kind of typewriting demonstration stand is the platform which fits on top of a desk or table to provide a non-permanent elevation for the typewriter. Most typewriting teachers who have been teaching for even a few years have probably used a box as a substitute for a demonstration stand of this type.

A box, however, is generally unsuitable for demonstration equipment. It may not be the correct height; it may be unsturdy; it may not hold up under the constant vibration of the typewriter; and it may be an eye-sore in the room.

Fedor[91] has designed a demonstration stand about which he writes:

> Various kinds of typewriter demonstration stands have appeared in many professional publications, but none of these stands incorporate all of the following features: rugged construction, inexpensive, holds copy with ease, won't tilt, light weight, and useful outside the typewriting room. Yet, there is such a stand which can be constructed in a few hours at a maximum expenditure of $2.16.

The stand which Fedor refers to is nothing more than an inverted box made of mahogany plywood sides and a solid maple top. Non-skid rubber gliders are on each of the four corners to help establish sturdiness. The designer suggests that it can be modified by adding drawers or shelves by leaving one of the sides open. The matter of height, since dimensions are given, is taken care of by changing the heights of tables or desks upon which the demonstration stand is set.

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[91]Laddie J. Fedor, "Build Your Own Typewriting Demonstration Stand," UBEA Forum V (April, 1951), 27.

The standard of sturdiness is as important in a desk-top demonstration stand as in any other article of furniture and equipment. Optional standards, such as those mentioned in connection with the upright demonstration stand, may be applied at the discretion of the user.

The Demonstration Platform

The advocates of demonstration platforms stress the importance of demonstrating in the same position and under the same conditions as the students for whom the demonstration is being conducted. The platform allows this, since it merely elevates a typewriting desk to a position which can be seen throughout the classroom.

Green,[92] in support of a demonstration platform, writes the following which indicates that the platform is the best immediate solution for many schools:

> Suppose you were the one who fell heir to a department that needed a lot of small things. (Most departments in small schools do.) What would you do after you had taken in all the shortcomings of the situation?

Size. She suggests a platform which is 4' x 3' x 8 1/2" in size and lists such advantages as: effective demonstration of sitting position and posture; simplicity of construction; low cost; and the encouragement of more demonstration. She also notes the utility factor of its being "just the right height" for many extra-curricular projects such as school plays and fashion shows.

Disadvantages. There are a few opponents to the platform method of demonstration as compared to the demonstration stand or table. Allen,[93]

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[92] Helen Hinkson Green, "We Prefer a Demonstration Platform," Business Education World XXX (June, 1950), 531.

[93] Allen, op. cit., pp. 532-533.

a business education teacher and also a manufacturer of one of the commercial demonstration stands, lists some of the disadvantages of the platform although in all fairness it seems that some of the disadvantages which he lists may also apply to his own design. He marks the hazard of tripping on the end of the platform and the possibility of injury in getting up on it or down from it; he suggests that the platform is a hazard to the equipment; and he calls attention to the possibility of having the chair slip or slide back too far, thus letting the demonstrator fall to the floor. Of special significance is the caution he brings up of laws—civil and insurance liability--which prevent the use of platforms in some states. This matter would definitely need investigation if a teacher preferred a demonstration platform.

DuFrain[94] further discounts the platform issue of demonstrating in a sitting position because it is the position the students need to learn. Looking toward the future she says:

> Possibly at some future time, the idea of the high table for typewriting while standing may result in a modified desk for typewriting students in the schools and typists in the offices. A psychologist suggests that one way to relieve a typist's fatigue is to have the typist work part of the time while seated and part of the time while standing. The future typist's desk may be one which could readily be converted from a desk of standard height to a high table like the demonstration stand. Thus the teacher's demonstration stand, invented only to aid the teacher while demonstrating, may give us a clue to a new practice for the classroom and office.

Actually, the demonstration platform is a worthy device and a recognized method of typewriting demonstration. The choice between an upright demonstration stand, a table-top model, or a demonstration platform depends upon the classroom situation, amount of funds available, and the preference of the teacher. The many variables in any school would restrict the setting of standards for this piece of equipment.

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[94] DuFrain, op. cit., p. 38.

CHAIRS

Earlier in the study it was mentioned that there would be no attempt to design chairs since it was very difficult for a school shop to manufacture them. There has been considerable research done by educational and governmental organizations, however, and it is possible to draw a selected list of standards from some of these studies.

Adjustable Chairs. Before taking up the matter of standards of chair construction there should be a decision made with regard to the adjustable type of office chair. Many writers and educational authorities recommend the use of adjustable chairs and the matter cannot be overlooked. Some of the factors in favor of adjustable chairs are:

1. The student can, if he will take the time, adjust the chair to his own needs. Proper instruction in the use of the adjustments on the chair might lead to improved student posture during typewriting classes.
2. Since only one style of chair need be bought, this uniformity will lead to diminishing repair problems.
3. The uniformity might lead to improvement in the appearance of the room.
4. There would be no need for shuffling of furniture during school hours except in the event of broken parts.

Some of the factors against the adjustable chairs are:

1. Adjustable chairs are usually very expensive.
2. Repairs are more frequent on adjustable chairs than on non-adjustable chairs.
3. Students will often play with the chair adjustments during school hours as well as during the class session.

Straight Chairs. If it is necessary to use straight chairs instead of

adjustable chairs, certain standards must be established so that proper judgment can be used when providing equipment for the classroom. The following selected standards are listed in order of reference and not necessarily of importance; duplications are omitted. The sources are reliable and, in most cases, criteria have been established by tests.

Gage[95] lists these standards:

1. Balance of chairs is important for safety and comfort.
2. Upholstery should be kept at a minimum consistent with health, comfort, and maintenance.
3. Foam rubber padding is better than hair or felt or other materials.

Perkins and Cocking[96] attack the problem from a slightly different angle and at least one standard might not be applicable in all cases (number 3). The chair:

1. Should be movable.
2. Should be light in weight.
3. Should be stackable.
4. Should fit the user and be comfortable.
5. Should promote health and good posture.
6. Should be finished so as to avoid glare and to reflect light.

Importance of Seating. Leffingwell and Robinson[97] voice the following opinion regarding the importance of the study of seating:

> While the subject of correct seating has received little attention in the past, it is now being gradually recognized as a matter of the highest importance in its demonstrated effect on the quality and quantity of output.

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[95] Gage, Office Standards, Developing Standardization in the Office and Principles of Specific Standardization of Office Equipment, op. cit., p. 19.

[96] Perkins and Cocking, op. cit., pp. 182-184.

[97] Leffingwell and Robinson, op. cit., pp. 182-184.

The above statement is followed with this different, specific suggestion:[98]

> The flat, hard seat is uncomfortable and the round seat of the bent-wood chair compresses the under part of the leg to the great discomfort of the sitter. The best form of seat is what is known as the "saddle seat."

Additional Sources of Information on Seating. The American Association of School Administrators[99] made the drawing of proper seating standards which is shown in Figure 1. In addition to this reference, an interested party could secure authentic information from the following sources, complete reference to which can be found in the bibliography which accompanies the study:

American Council on Education, Specification for Chair Desks.

American Council on Education, Specification for Folding Chairs.

Henry E. Bennett, School Posture and Seating.

United States Government, General Services Administration Federal Supply Service, (any Federal specifications relating to office chairs).

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[98] Loc. cit.

[99] "American School Buildings," op. cit., pp. 250-255.

GIVE THE CHILDREN

FURNITURE

THAT FITS

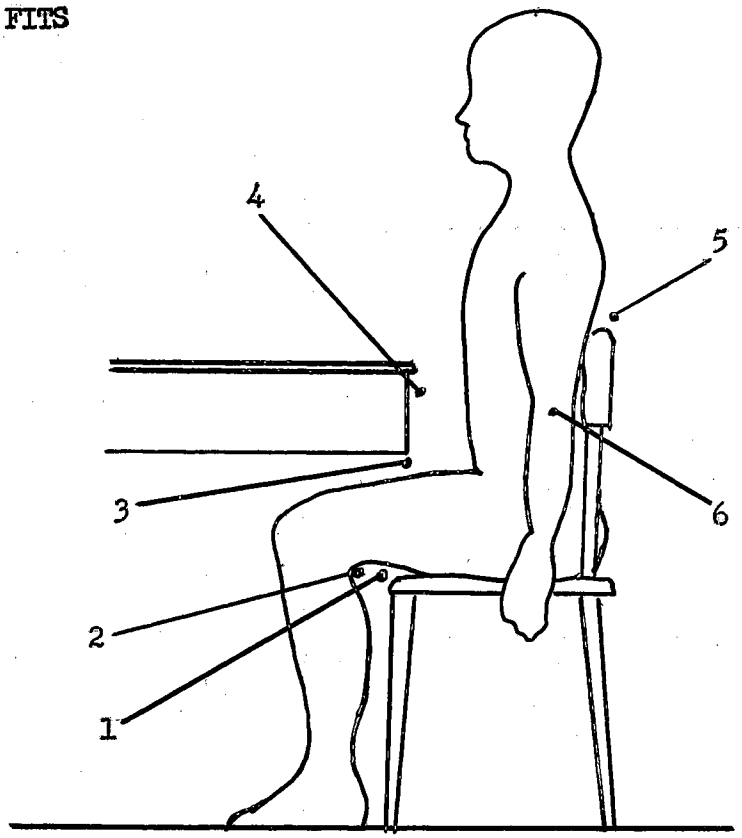

Figure 1

1. No pressure under the knees
2. Free space back of inside angle of knee
3. Room above the thighs
4. Back edge of table overlaps front edge of chair
5. Low chair back, open at bottom; support for hollow of back only
6. Table top higher than elbow when arm is straight

Source: "American School Buildings," Twenty-seventh Yearbook of the American Association of School Administrators Chapter XIV. Washington, D.C.: The National Education Association, 1949. P. 251.

CHAPTER V

FURNITURE AND EQUIPMENT DESIGNS, MATERIAL SPECIFICATIONS

The material in this chapter is divided into eight sections. Seven of the sections contain drawings for particular articles of business education furniture or equipment, material specifications, and comments or interpretations concerning the articles. The other section is devoted to drawings of the detail work necessary to the furniture and equipment, e.g., drawer construction, joints, the adjustable typewriter well, etc.

The original furniture and equipment designs which are included here are based on standards developed by the study. When a design which is the product of another person or persons is included, that design has also met the standards developed by the study, or has been revised to do so.

Attention is again directed to the approach which is a basic part of the study; this approach is to design sound furniture and equipment which can be constructed by school industrial arts shops at low cost and with a minimum amount of equipment. No educational or woodworking principles are sacrificed in order to achieve the low-cost feature.

Adjustable Typewriting Desk, 20" x 46"

Material Specifications

No. of Pieces	Description	Dimensions	Material
1	Desk top	3/4" x 20" x 46"	DF Plywood*
4	Legs	2" x 2" x 28 1/4"	Ponderosa Pine
2	Side top rails	3/4" x 4" x 17 5/8"	do
1	Rear top rail	3/4" x 4" x 43 5/8"	do
1	Front top rail	3/4" x 4" x 43 5/8"	DF Plywood
1	Rear panel	1/4" x 16" x 41"	do
2	Side panels	1/4" x 15" x 16"	do
1	Rear panel rail	3/4" x 2" x 43"	Ponderosa Pine
2	Side panel rails	3/4" x 2" x 17"	do
	1/2" quarter-round moulding	125 linear inches	do
	Typewriter well - Option 1		
1	Typewriter platform	1/2" x 14" x 16 3/8"	DF Plywood
6	Platform slides	1/2" x 1" x 14 1/4"	do
2	Well side panels	3/4" x 4" x 16 1/2"	do
1	Well back panel	3/4" x 4" x 14"	do
	Typewriter well - Option 2		
1	Typewriter platform	1/2" x 14 3/4" x 16 3/8"	DF Plywood
2	Well side panels	3/4" x 4" x 16 1/2"	Solid Oak**
1	Well back panel	3/4" x 4" x 14"	Solid Oak

Additional Interpretation

1. The 29" adjustable typewriting desk illustrated is only one of two heights which need to be made, the other being 30" in height to the top of the desk.

2. Detail drawings show two methods of making the typewriting well, but in each method the typewriter platform is raised or lowered one inch at a time. With two desks of 29" and 30" in height, it will be possible to vary

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*In this, and any other, specification table "DF Plywood" is Douglas Fir Plywood as is described in the study.

**May be any other hard wood.

the typing heights from 27" at the lowest point on the one desk to 30" at the highest point on the other.

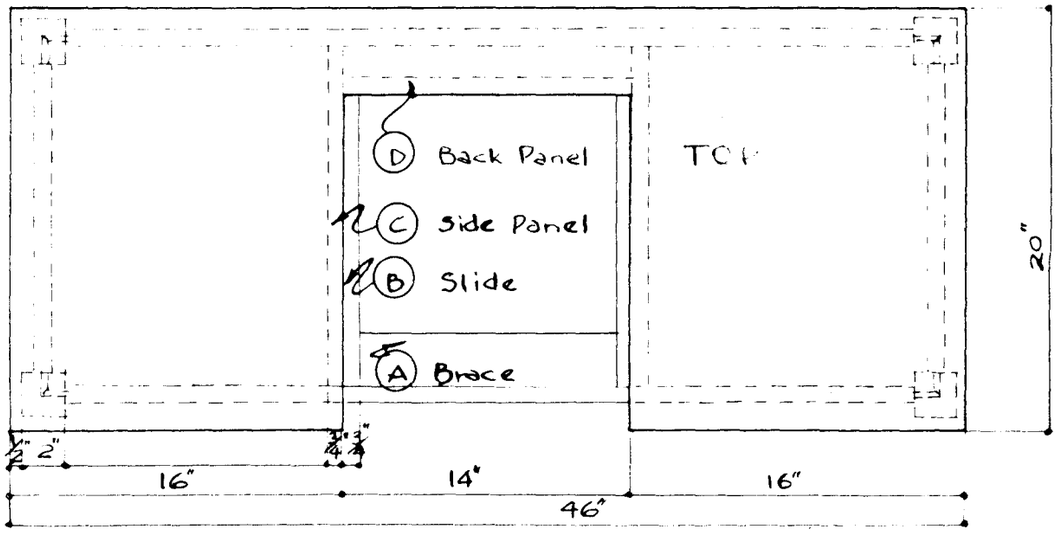
3. The typewriter can be bolted to the sliding platform to help prevent damage which might come if the typewriter fell off the shelf.

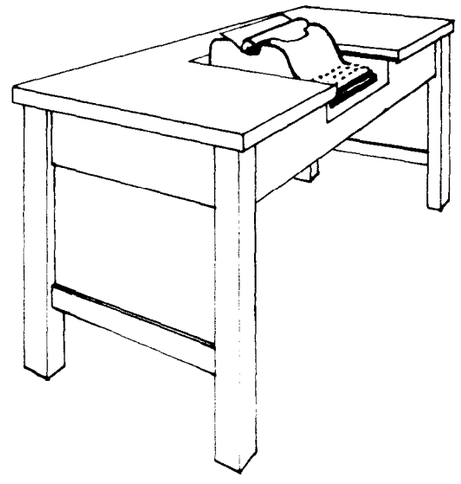
4. No drawers are provided in this model. It is possible to build a simple book shelf or book rack on either side of the desk, below the table top, for storage purposes.

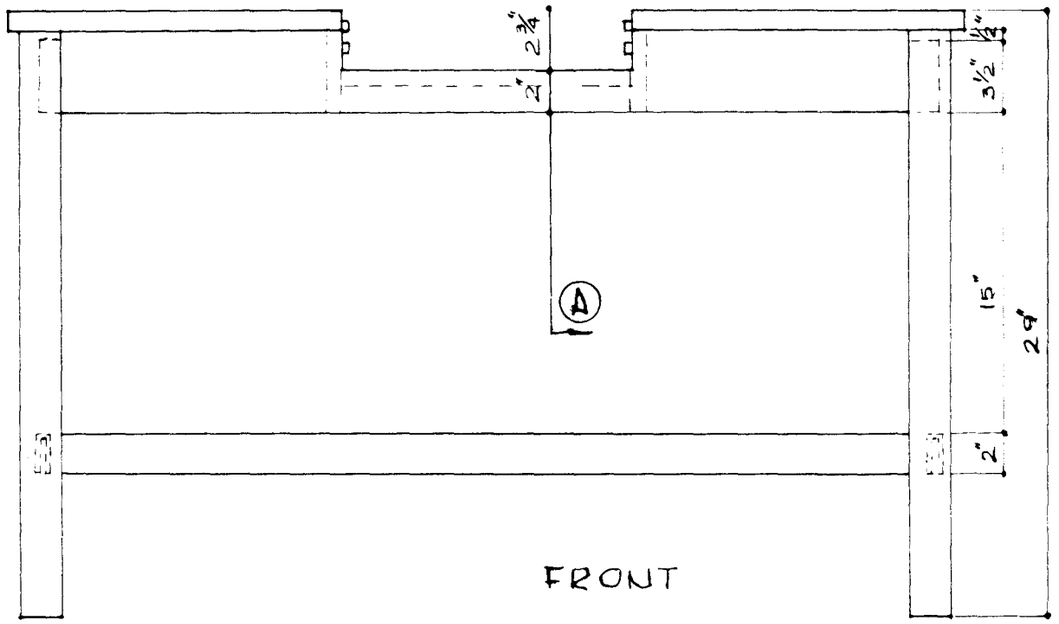
5. On Option "A" of the typewriter well, the slides on which the shelf operates should be dado-jointed into the sides of the typewriter well 3/8" deep. The joint should then be glued and fastened for maximum strength.

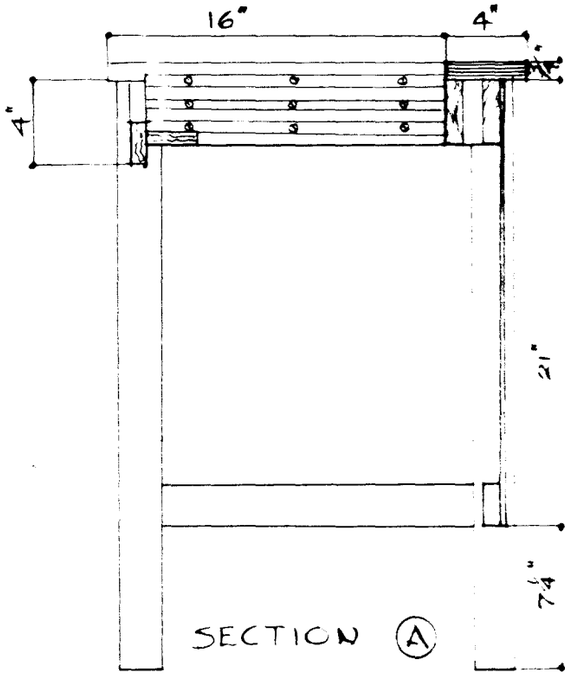
6. The panels could be 12" high instead of the 16" as illustrated. This would mean a savings in material cost and would offer approximately the same amount of protection.

7. A front top rail of 3/4" plywood is recommended because of the added strength plywood will give over the other material used. This additional strength is needed in view of the fact that part of the front rail is cut away to allow for the operation of the typewriter well.









ADJUSTABLE TYPEWRITING DESK #1

scale ⅛"=1"

drawn by J.J.D.

Adjustable Typewriting Desk, 20" x 32"

With 12" Folding Extension

Material Specifications

No. of Pieces	Description	Dimensions	Material
1	Desk top	3/4" x 20" x 32"	DF Plywood
1	Folding shelf	3/4" x 20" x 12"	do
4	Legs	2" x 2" x 28 1/4"	Ponderosa Pine
2	Side top rails	3/4" x 4" x 17 5/8"	do
1	Rear top rail	3/4" x 4" x 29 1/8"	do
1	Front top rail	3/4" x 4" x 29 1/8"	DF Plywood
1	Rear panel	1/4" x 16" x 26 1/2"	do
2	Side panels	1/4" x 16" x 15"	do
1	Rear panel rail	3/4" x 2" x 28 1/2"	Ponderosa Pine
2	Side panel rails	3/4" x 2" x 17"	do
	1/2" quarter-round moulding	210 linear inches	do
	Typewriter well - Option 1		
1	Typewriter platform	1/2" x 14" x 16 3/8"	DF Plywood
6	Platform slides	1/2" x 1" x 14 1/4"	do
2	Well side panels	3/4" x 4" x 16 1/2"	do
1	Well back panel	3/4" x 4" x 14"	do
	Typewriter well - Option 2		
1	Typewriter platform	1/2" x 14 3/4" x 16 3/8"	DF Plywood
2	Well side panels	3/4" x 4" x 16 1/2"	Solid Oak
1	Well back panel	3/4" x 4" x 14"	Solid Oak
	Hardware:		
3	Butt hinges w/screws		
2	Shelf brackets		

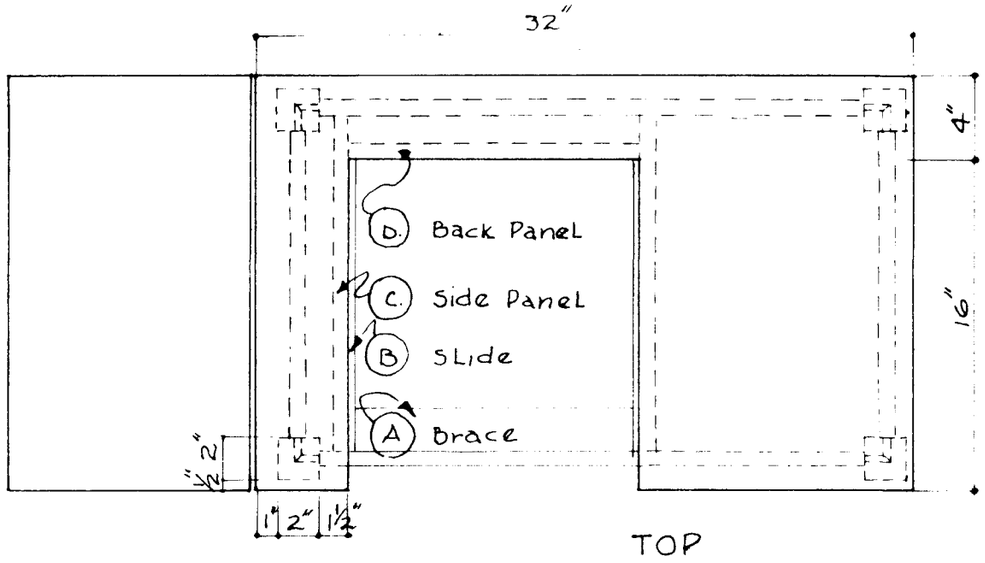
Additional Interpretation

1. The basic construction principles used on this desk are the same as those used on the other adjustable typewriting desk.

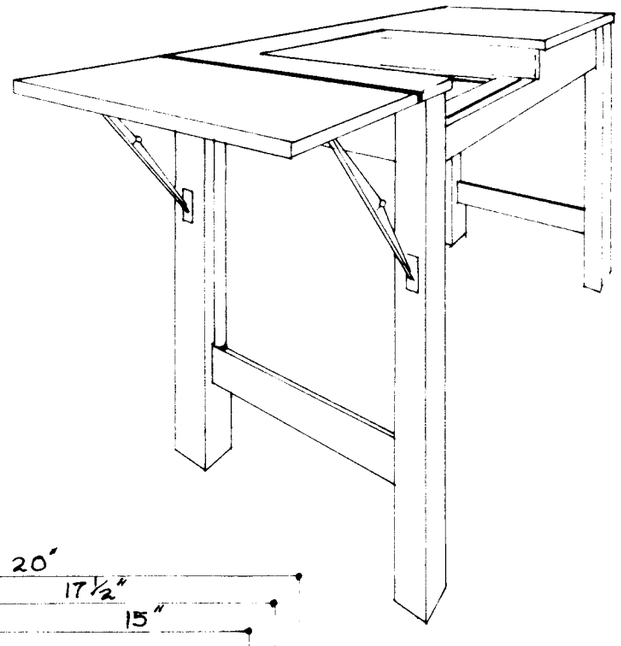
2. One variation in construction is the one-inch overlap of the table top on the left hand side of the desk. This allows room for the folding leaf.

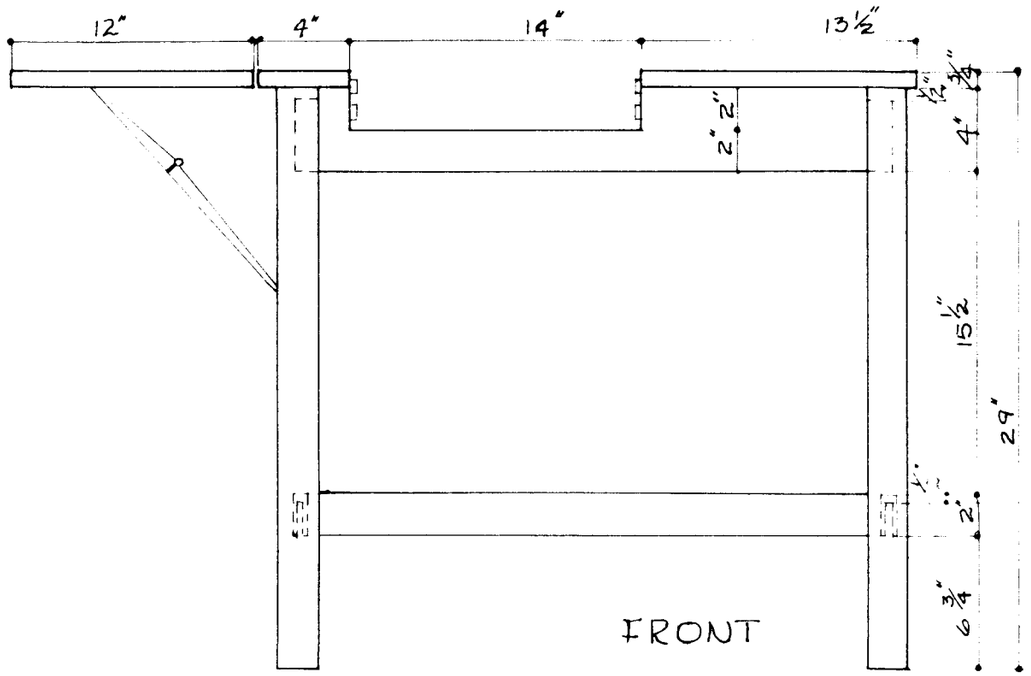
3. Two heights of tables of this type will again provide a four-inch span of adjustability, 27" to 30".

4. A front top rail of 3/4" plywood is again recommended for the added strength which plywood will give to the desk because of the depth of the typewriter well in the front top rail.

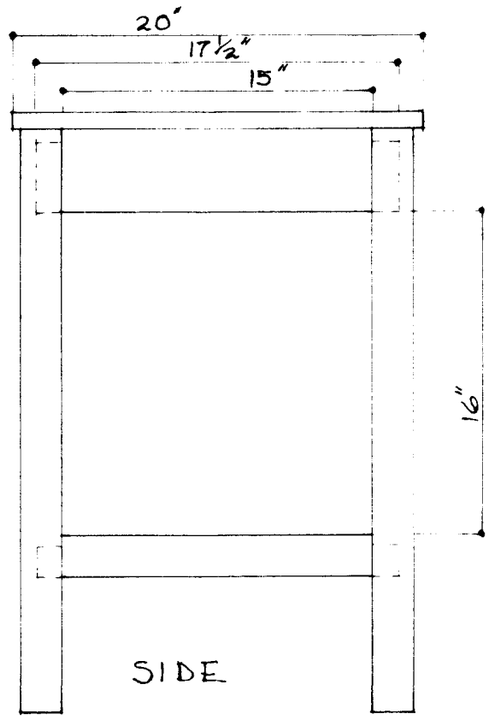


TOP





FRONT



SIDE

ADJUSTABLE TYPEWRITING DESK #2

scale ⅛"=1"

drawn by Joe Bicking

Fixed-Top Typewriting Desk, 20" x 32"

Material Specifications

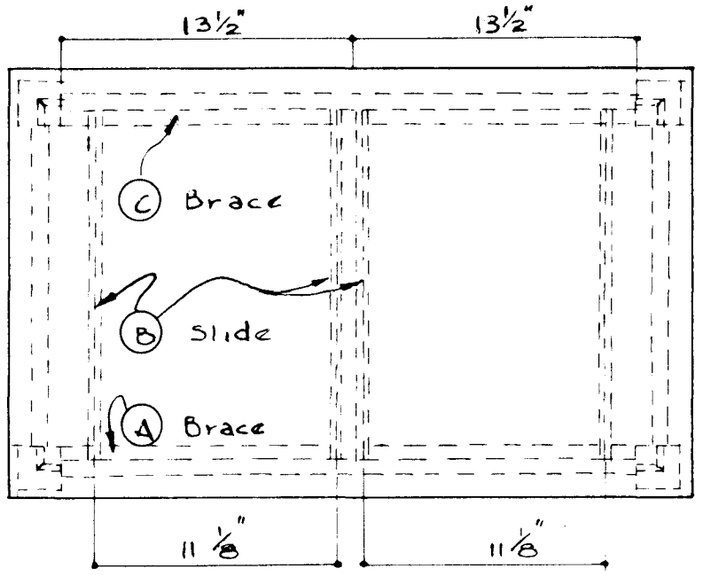
No. of Pieces	Description	Dimensions	Material
1	Desk top	3/4" x 20" x 32"	DF Plywood
4	Legs	2" x 2" x 28 1/4"	Ponderosa Pine
2	Top rails, side	3/4" x 4" x 17 5/8"	do
2	Top rails, front and rear	3/4" x 4" x 29 5/8"	do
1	Rear panel	1/4" x 16" x 27"	DF Plywood
2	Side panels	1/4" x 16" x 15"	do
1	Rear panel rail	3/4" x 2" x 29"	Ponderosa Pine
2	Side panel rails	3/4" x 2" x 17"	do
	1/2" quarter-round moulding for panel sides	210 linear inches	do
	Drawer material specifications		
2	Drawer fronts (outside, lapped)	1/2" x 2 3/4" x 12"	Ponderosa Pine
2	Drawer fronts (inside)	3/4" x 2" x 11"	do
4	Drawer sides	1/2" x 2" x 16 1/2"	do
2	Drawer backs	1/2" x 2" x 10 1/2"	do
2	Drawer bottoms	1/4" x 10 1/2" x 15 1/2"	DF Plywood
4	Drawer rails	1" x 1" x 16 1/2"	do
2	Drawer pulls		Optional

Additional Interpretation

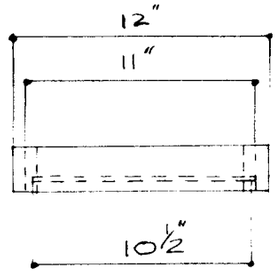
1. Since this desk is non-adjustable, at least four heights will be needed for the normal classroom. Desk heights should be 27", 28", 29", and 30".

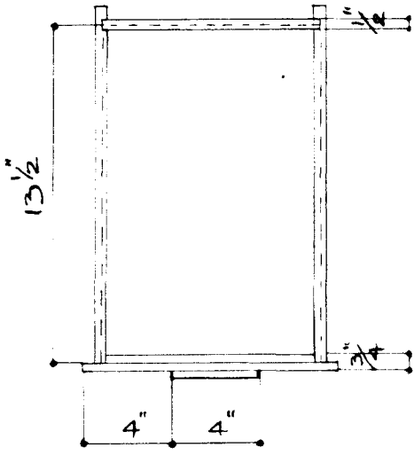
2. The desk is shown with two drawers, but the use of drawers is optional in the construction. Separate detail illustrations show drawer construction, and a section in Chapter VII also deals with this matter.

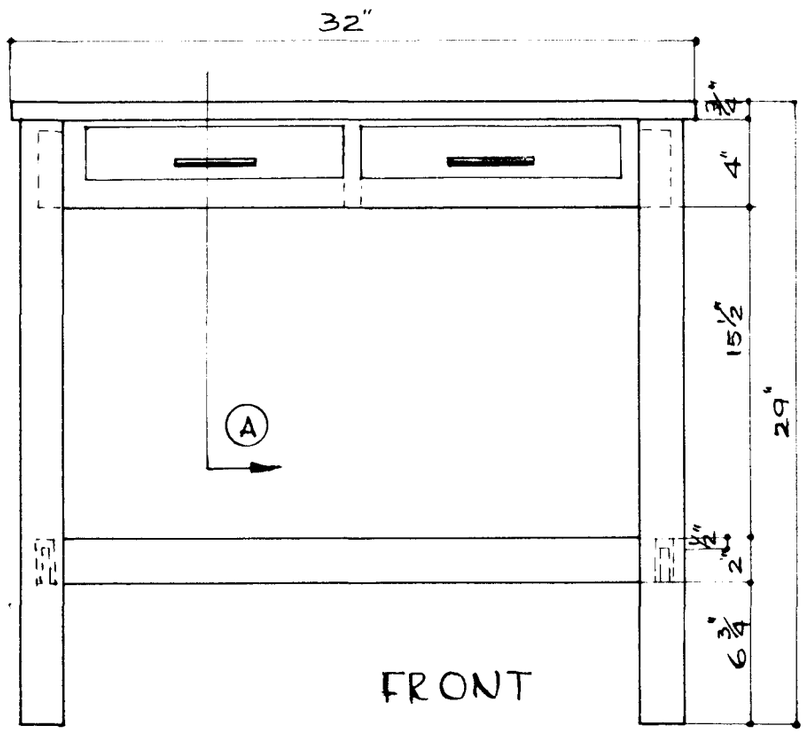
3. This desk may be equipped with a linoleum, plastic, or other type desk top at a later date, if a covering is desired.



TOP







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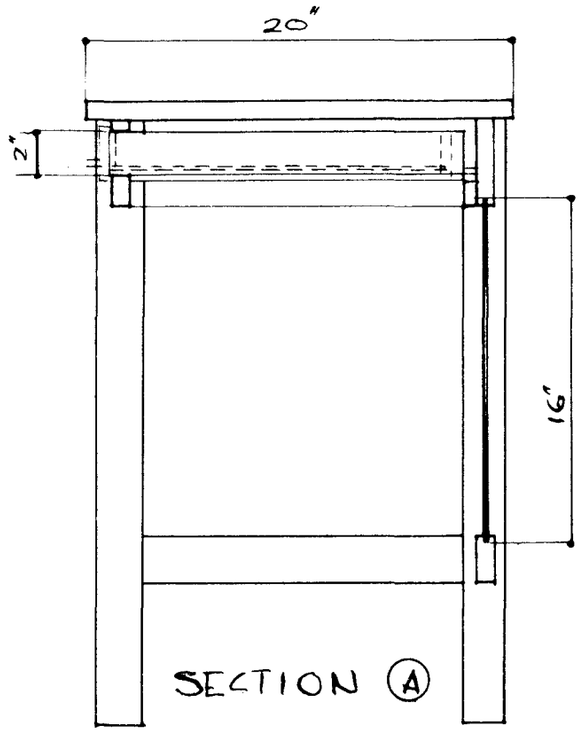


SECTION (A)

FIXED-TOP TYPEWRITING DESK #3

scale ⅛"=1"

drawn by J. J. B.

Combination Subject Desk, 22" x 32"

Material Specifications

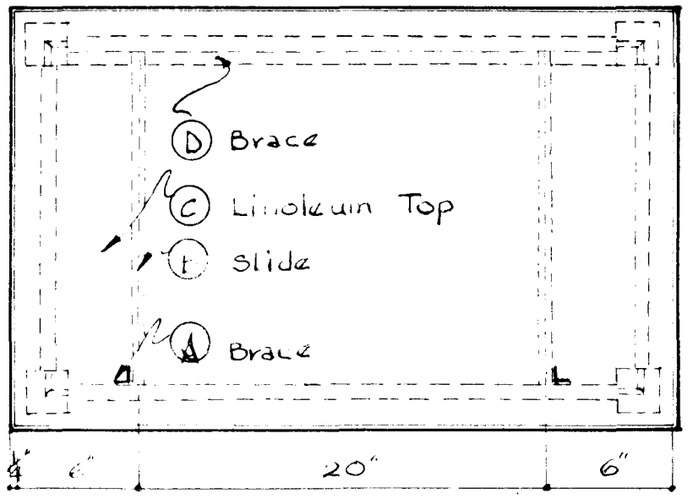
No. of Pieces	Description	Dimensions	Material
1	Linoleum top covering	22" x 32"	
1	Desk top	3/4" x 22" x 32"	DF Plywood
4	Legs	2" x 2" x 28 1/4"	Ponderosa Pine
2	Top rails, side	3/4" x 4" x 19 5/8"	do
2	Top rails, front and rear	3/4" x 4" x 29 5/8"	do
1	Rear panel	1/4" x 16" x 27"	DF Plywood
2	Side panels	1/4" x 16" x 17"	do
1	Rear panel rail	3/4" x 2" x 29"	Ponderosa Pine
2	Rear panel rails	3/4" x 2" x 19"	do
	1/2" quarter-round moulding for panel sides	215 linear inches	do
	1/4" moulding for table top	110 linear inches	do
	Drawer material specifications		
1	Drawer front (outside, lapped)	1/2" x 2 3/4" x 21"	Ponderosa Pine
1	Drawer front (inside)	3/4" x 2" x 20"	do
2	Drawer sides	1/2" x 2" x 18 1/2"	do
1	Drawer end	1/2" x 2" x 19 1/2"	do
1	Drawer bottom	1/4" x 19 1/2" x 17 1/2"	DF Plywood
2	Drawer rails	1" x 1" x 18 1/2"	do
1	Drawer pull		Optional

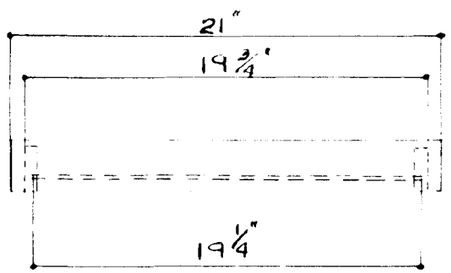
Additional Interpretation

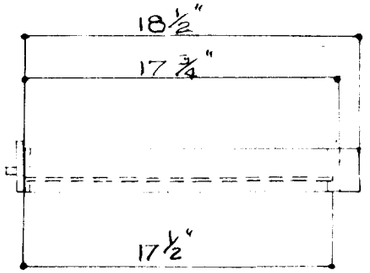
1. All moulding should be glued, nailed, and sanded around edges of desk top. The top edges of the moulding should be rounded, and the corners mitred.

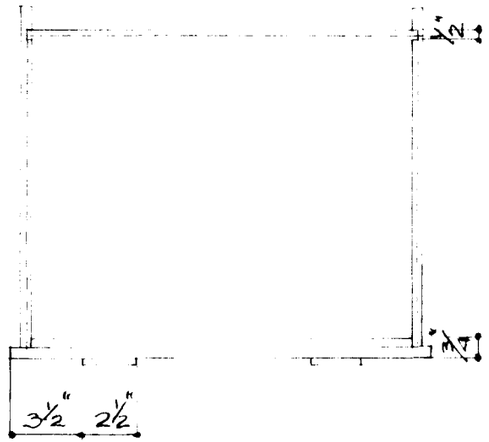
2. The large drawer is optional. Detail drawings illustrate the drawer construction, and Chapter VII has a section dealing with drawers. The drawer was made this size to fit storage needs of the bookkeeping student as discussed in Chapter IV.

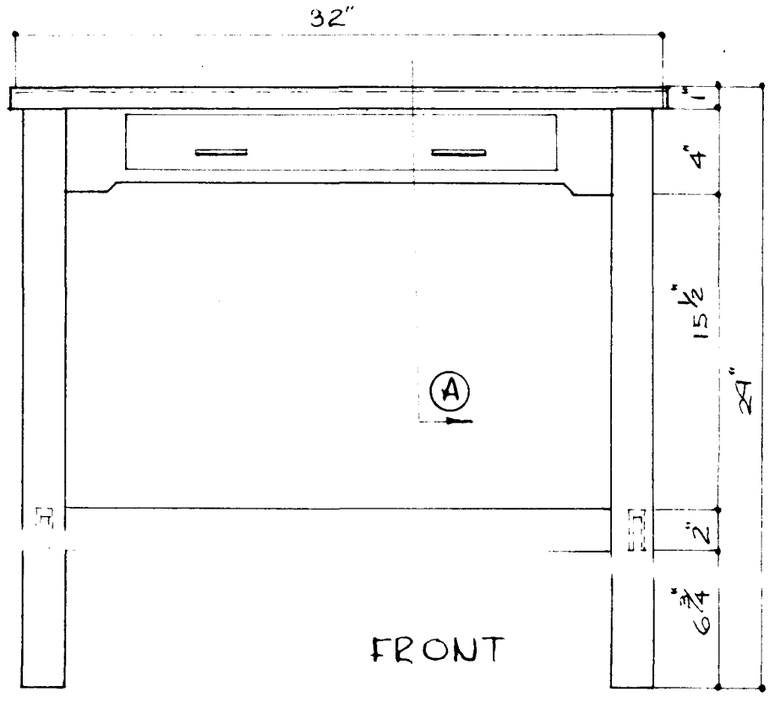
3. A linoleum top is illustrated, but other materials may be used. Linoleum was chosen because it is inexpensive.



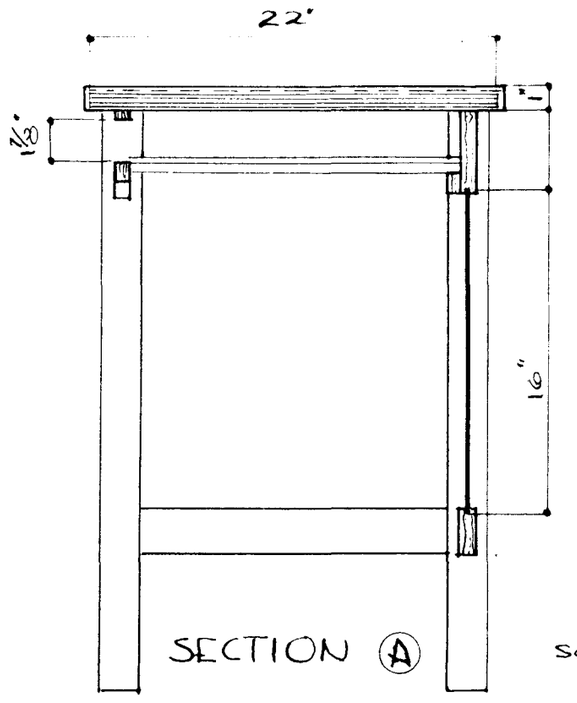








FRONT



SECTION (A)

scale ½" = 1"

COMBINATION DESK for Bookkeeping, Shorthand, and Socio-Business Subjects

drawn by J.J.T.

Computing Machine Desk, 22" x 32"*

Material Specifications

No. of Pieces	Description	Dimensions	Material
1	Linoleum top covering	22" x 32"	
1	Desk top	3/4" x 22" x 32"	DF Plywood
4	Legs	2" x 2" x 28 1/4"	Ponderosa Pine
2	Top rails, side	3/4" x 4" x 19 5/8"	do
1	Top rail, rear	3/4" x 4" x 29 5/8"	do
1	Top rail, front	3/4" x 4" x 29 5/8"	DF Plywood
1	Rear panel	1/4" x 16" x 27"	do
2	Side panels	1/4" x 16" x 17"	do
1	Rear panel rail	3/4" x 2" x 29"	Ponderosa Pine
2	Side panel rails	3/4" x 2" x 19"	do
	1/2" quarter-round moulding for panel sides	215 linear inches	do
	1/4" moulding for table top	150 linear inches	do
	Machine well		
1	Platform (shaped)	3/4" x 18" x 22"	DF Plywood
1	Side panel (shaped)	3/4" x 3 3/4" x 21"	do
1	Rear panel (shaped)	3/4" x 3 3/4" x 7 1/2"	do
	Moulding for machine well (total)	1/4" x 1" x 40"	Ponderosa Pine
	Half-round moulding for outside of machine platform	16 linear inches	do

Additional Interpretation

1. The machine desk has a shaped machine well which requires a great deal of detail work. Made in quantity, however, with templates or jigs, the construction will not be difficult.

2. The machine platform in the well will be set into the side and back pieces by a 3/8" dado joint; glue and fastening devices will be used to hold the joint solid. In addition, glue blocks which are reinforced with screws can be used to give added strength.

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*Adapted from a desk designed by Vernon V. Payne and Floyd W. Kelly.

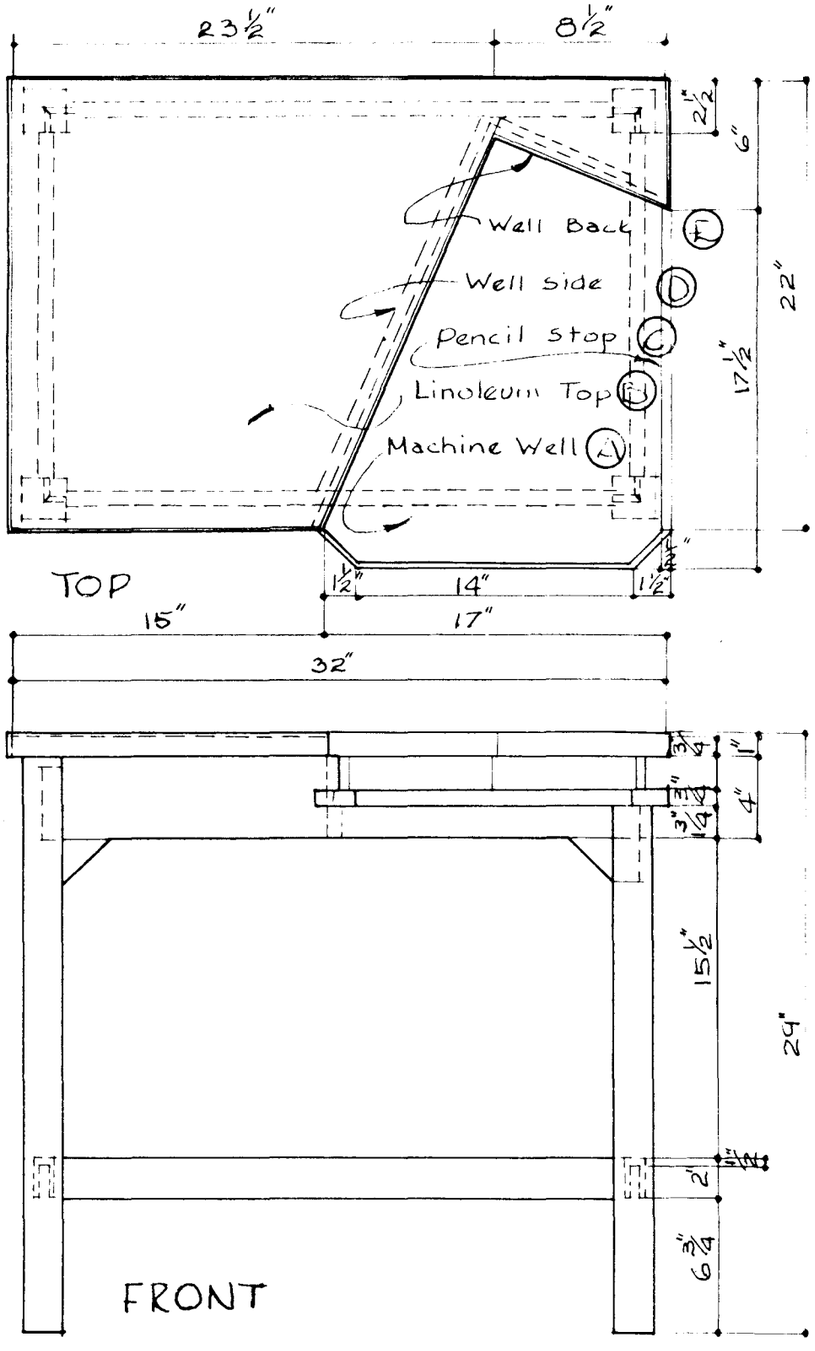
3. A piece of 1/2" half-round (or other) moulding is placed on the open side of the machine platform to help secure the machine.

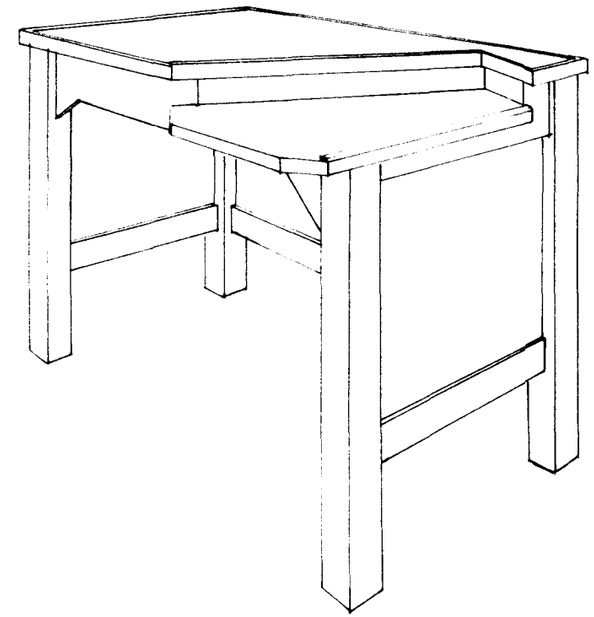
4. A two-inch hole in the rear of the platform is to provide an opening for electric power cords from the machines.

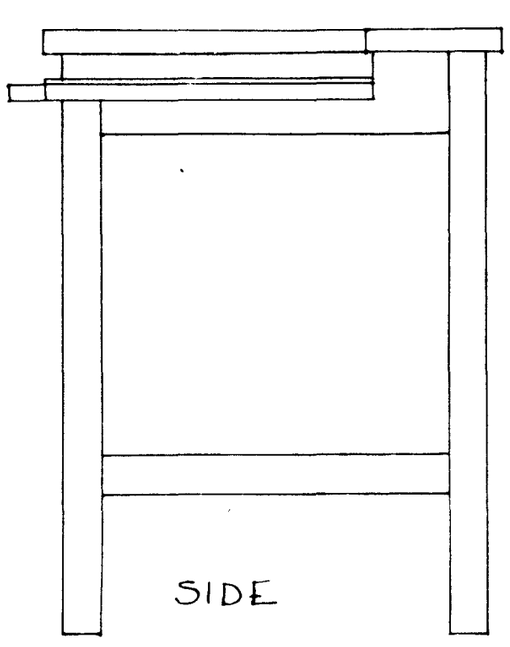
5. The overlap on the front of the platform provides extra space for machines of differing sizes, shapes.

6. It is very important to anchor the side and rear walls of the machine well to the top of the desk and to the front and rear top rails.

7. Linoleum covering is used to provide a cheap, good writing surface. The desk has 1/4" moulding on all sides, including the inside of the machine well. The moulding should be glued, nailed, and sanded; the corners should be mitred.







COMPUTING MACHINE DESK

SCALE ⅛"=1" drawn by J.J.B.

Upright Typewriter Demonstration Stand

Material Specifications

No. of Pieces	Description	Dimensions	Material
4	Sides of demonstration stand	3/4" x 10" x 41 5/8"	Ponderosa Pine
1	Back for stand	1/4" x 19 1/4" x 39"	Masonite or other material
2	Top for stand	3/4" x 10" x 21"	Ponderosa Pine
2	Paper table for stand	3/4" x 10" x 11"	do
10	Shelves for stand	3/4" x 10" x 19 1/4"	do
2	Front and rear panels of base	3/4" x 3" x 18 1/2"	do
4	Base supports	2" x 4" x 18 1/2"	No specifications
2	Knobs for doors		No specifications
4	Casters		Creeper type
4	Cabinet hinges for doors		No specifications
3	Butt hinges for paper table		No specifications
	(one of the following)		
2	Butterfly supports for paper table	3/4" x 2" x 8"	Ponderosa Pine
	or		
1	Arm-type support for paper table	3/4" x 2" x 14 1/2"	do
	or		
1	Folding table-leaf support		Metal

Additional Interpretation

1. This demonstration stand was originally designed for construction from cheap or scrap material. It was thought that either paint or a cheap material for covering could be used, along with the cheap materials, to make a first-class outward appearance. Of course, scrap materials do not have to be used.

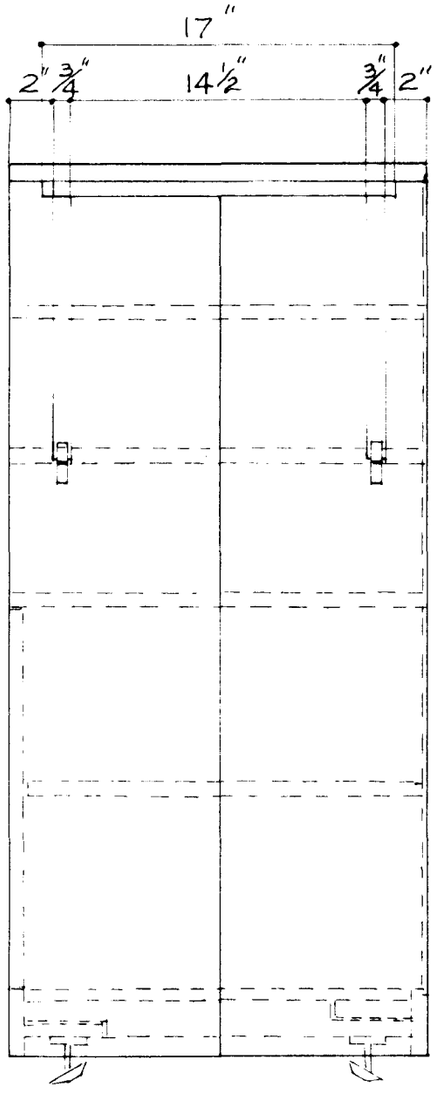
2. Two types of braces for the folding extension are shown. Another type of paper table would be a sliding shelf which would fit under the table top. Still another type would be a folding table-leaf support similar to

that previously shown on the adjustable typewriting desk.

3. The closed storage space is shown without a lock on the doors. This is optional.

4. Creeper (or wobble) casters are shown. These are desired over other types.

5. The inside dimensions allow for storage of such off size items as packages of duplicating stencils, legal size paper, etc.



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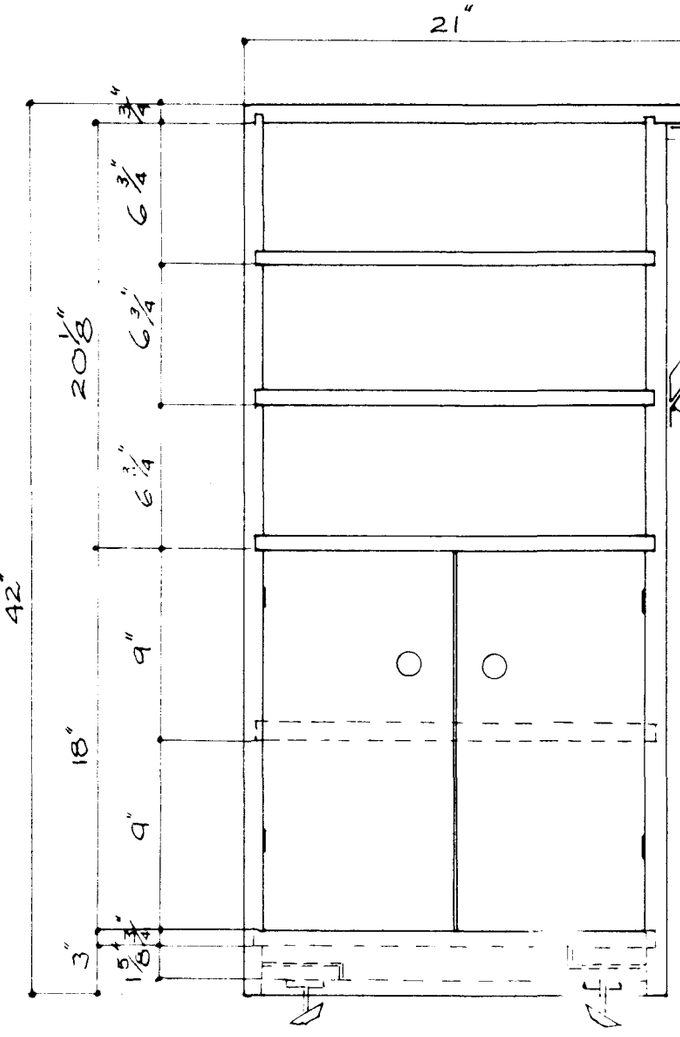

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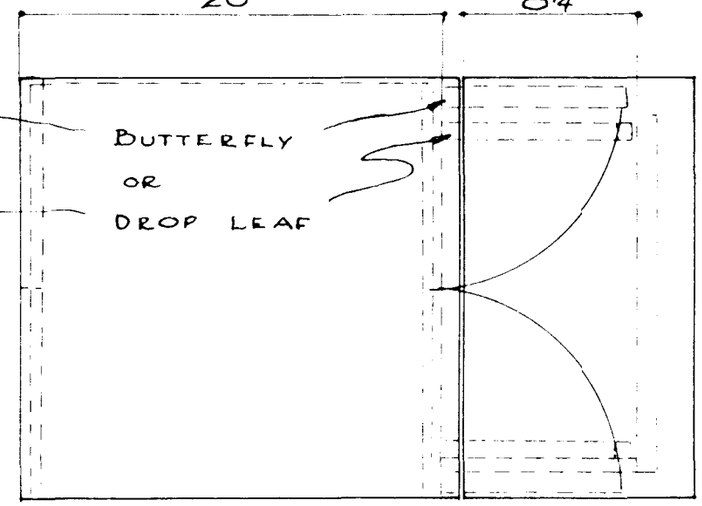

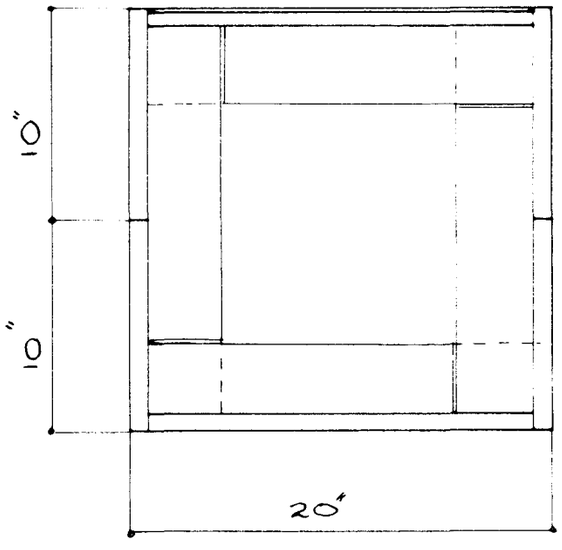

Top

LAP JOINTS USED IN BASE CONSTRUCTION FOR GREATER STRENGTH AND INCREASED GLUING SURFACE

BASE

UPRIGHT TYPEWRITING DEMONSTRATION STAND

SCALE 1/8" = 1" drawn by J.J.B.

Table-Top Typewriting Demonstration Stand (Closed Type)

Material Specifications*

No. of Pieces	Description	Dimensions	Material
1	Top for demonstration stand	3/4" x 17 1/2" x 23 1/2"	Maple
2	Sides to stand	1/4" x 11" x 17 1/4"	Mahogany Plywood
2	Sides to stand	1/4" x 11" x 23 1/4"	do
4	Corner braces	1" x 1" x 11"	Optional
4	Rubber glides	3/4"	—
	Brass screws	1 x 8	—

Additional Interpretation

1. This is a reproduction of the original design submitted by Laddie J. Fedor. It is, in fact, little more than an inverted box.

2. The article from which this design was taken stated that the height of the demonstration stand could be adjusted only by changing the height of the desk on which it is placed.

3. Bracing at the four corners gives the stand stability, provides a solid base for the rubber glides or feet. The rubber feet help fix the demonstration stand and hold it steady.

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*These are the specifications listed by the designer, Laddie J. Fedor.

Table-Top Typewriting Demonstration Stand (With Shelf Space)

Material Specifications

No. of Pieces	Description	Dimensions	Material
1	Top for demonstration stand	3/4" x 17 1/2" x 23 1/2"	DF Plywood
1	Back for stand	1/4" x 11" x 23 1/2"	do
2	Sides for stand	1/4" x 10 3/4" x 17 1/2"	do
2	Shelves for stand	3/4" x 17 1/2" x 23"	do
4	Braces	1" x 1" x 17 3/4"	No specification
4	Rubber glides	3/4"	—

Additional Interpretation

1. The above specifications are for an adaptation of the original idea submitted by Laddie J. Fedor, altered with the purpose of putting some of the waste space to use.

2. Storage space is provided with the use of a bottom and a mid-shelf of 3/4" plywood butted to the sides and held in place with screws and glue. The space at the top is less than that at the bottom.

3. As in the original design by Fedor, the height is adjustable only by changing the height of the desk upon which it is set.

Typewriter Lift Box

Material Specifications

No. of Pieces	Description	Dimensions	Material
1	Top for lift box	3/4" x 12 1/2" x 12 1/2"	DF Plywood
2	Legs or sides for box	3/4" x 2 1/4" x 12 1/2"	do
	Rubber stair-tread material	3/4" x 25"	
	Screws as needed		

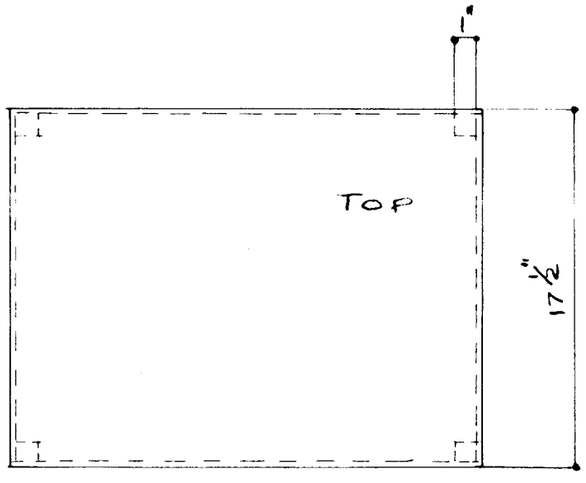
Additional Interpretation

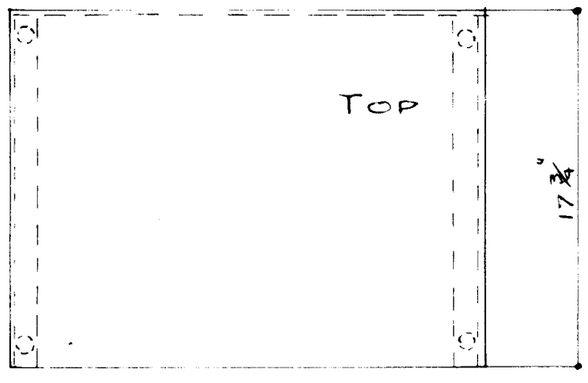
1. This simple lifting device for elevating the typewriter was designed by personnel of the U. S. Government during World War II. Lift boxes of three heights are needed: 2", 3", and 4".

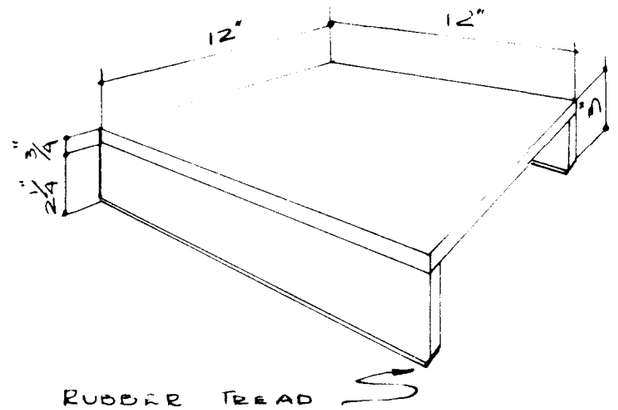
2. Legs--or sides--are butted on the typewriter platform, glued, and held with screws.

3. Rubber stair-treads are placed on the bottoms of the legs to prevent slipping, help deaden the sound.

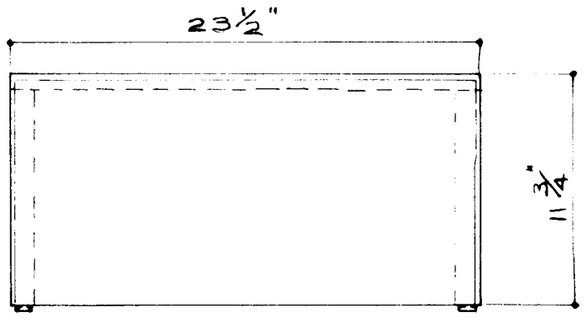
4. The Department of Agriculture suggested soundproof Homosote material for the top although 3/4" plywood is acceptable.







TYPEWRITER LIFT BOX



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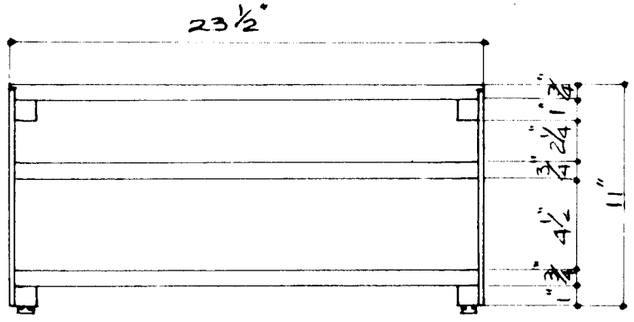

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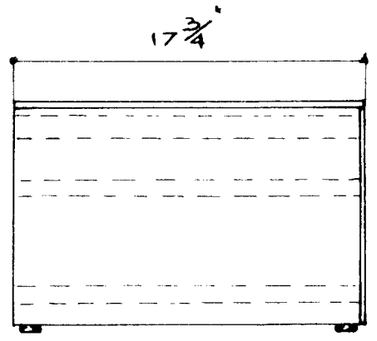
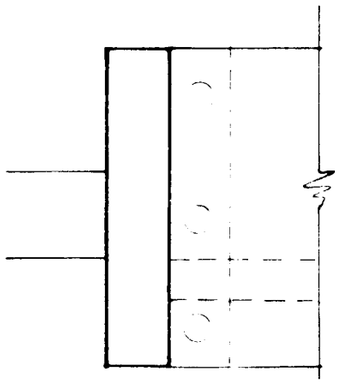


SIDE

*(1) BOX TYPE

*(2) SHELF TYPE

TABLE-TOP TYPEWRITING DEMONSTRATION STAND *(1) and *(2) Scale ⅛" = 1" drawn by J.J.B.



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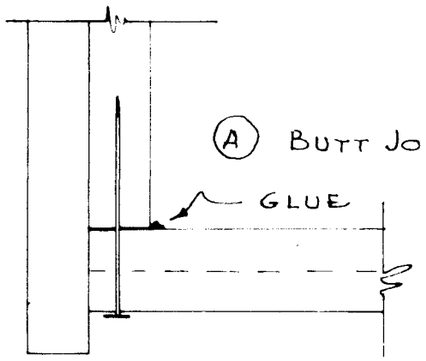
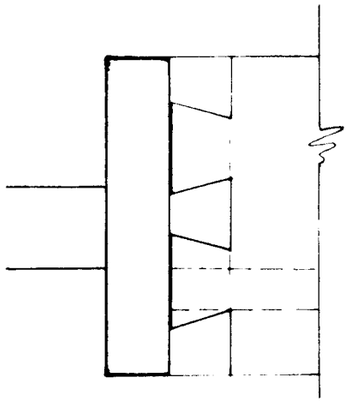
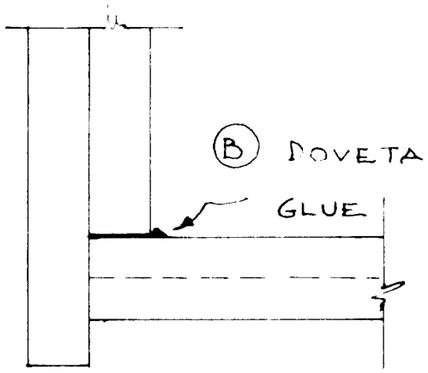


TOP

Ⓐ BUTT JOINT

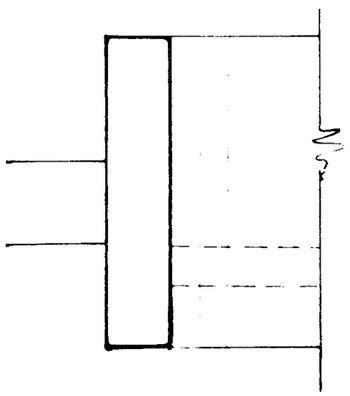
GLUE

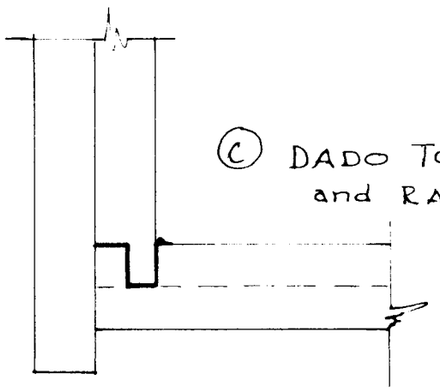




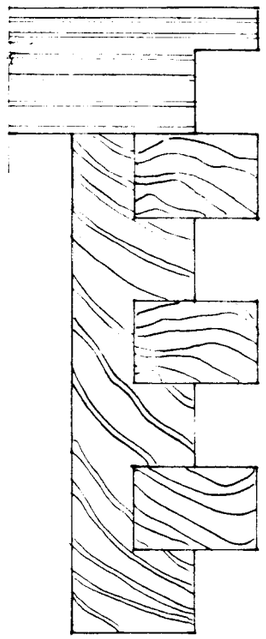
Ⓑ DOVETAIL JOINT

GLUE

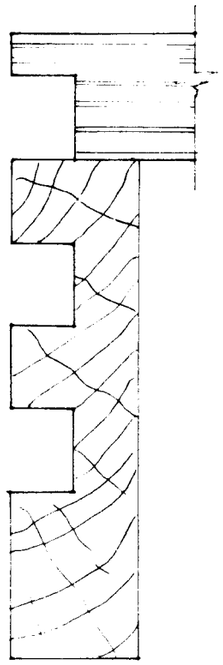




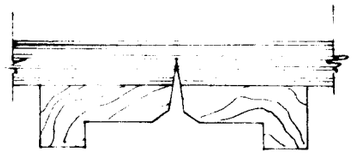
Ⓒ DADO TONGUE and RABBET



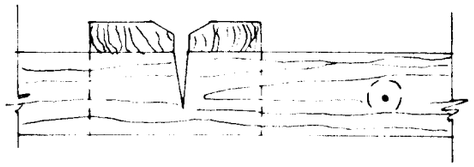
SLIDE B #1



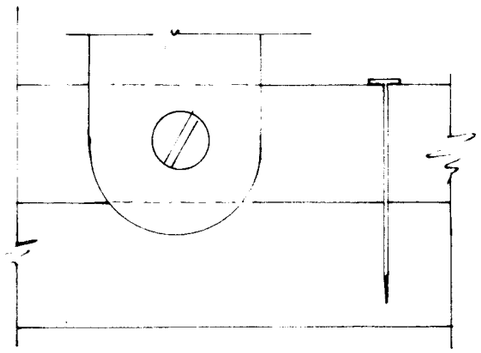
SLIDE B #2
FULL SCALE



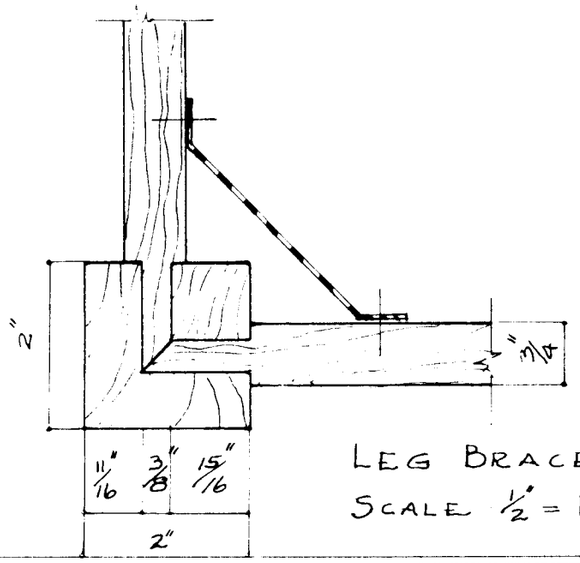
CENTRAL TRACK



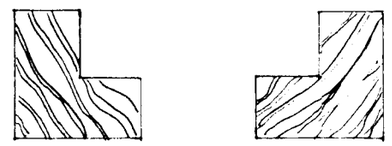
SLIDE B #3 FRONT



SLIDE B #3 TOP
FULL SCALE



LEG BRACE
SCALE 1/2" = 1'



SIDE TRACK B #4
FULL SCALE

FULL SCALE DRAWER JOINT DETAILS -- 2 SHELF SLIDES -- 2 DRAWER SLIDES drawn by J.J.B.

CHAPTER VI

CONSTRUCTION STANDARDS

THE TOOLS

When this study was planned, one of the original purposes was to design furniture which could be built with the tools which are normally found in the industrial arts shop rooms of even the smallest of high schools. Every effort has been made to keep that concept in mind.

Other than common hand woodworking tools such as back saws, planes, squares, and the like, the only special pieces of equipment needed for this construction are:

1. Eight-inch circular table saw with accurate guides which will dado, miter, etc. A tilting arbor is desired.
2. Drill press equipped with mortising attachments.
3. Small 4- to 6-inch jointer.
4. Electric belt sander.

Actually, only the first two items are necessary, but better and faster work can be done with all of the tools, and for any kind of mass production work it is apparent that the jointer and sander would be desirable. The first two of the above-mentioned power tools are necessary for accurate work and interchangeable pieces. It is thought that these four power tools are common to the majority of shops, large or small.

THE TABLE TOP

The Use of Plywood

Use of plywood for the tops of the desks was decided upon after a careful consideration of the appearance of the solid type of desk top when weighed against some of the factors which were in favor of plywood. Actually, appearance was the only major factor in favor of the solid type construction although the surface life of a hardwood desk top is also important.

Some of the advantages of the plywood desk top are:

1. The solid tops require much more hand work
   a. the pieces which make up the top must be jointed, glued, doweled, planed, sanded, squared, filled, etc.
   b. plywood needs only to be cut to the desired size.
2. A solid hardwood desk top is more expensive than the softwood plywood top.
3. Plywood is colloquially called, "pound for pound, the world's strongest material."[1]
4. Plywood has a high resistance to splitting.
5. Plywood has a high resistance to warping.
6. Plywood can be ordered in sizes nearer to actual needs. It is often necessary to accept random lengths in solid wood cuts, thus creating a possibility of waste.

Softwoods and Hardwoods

It is a common fallacy that all furniture should be built from the class of materials usually called "hardwoods." The reference to soft-type woods

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[1] Louis H. Meyer, Plywood, What It Is—What It Does (New York: McGraw-Hill Book Company, Inc., 1947), p. 41.

in plywood means only that the plywood is made from a tree of the conifer family. In a way, this changes our ordinary conception of the terms "hard" and "soft" since some of the conifers are harder than some of the softer hardwoods.[2] Table IV bears out this statement.

Cost of materials is a matter of importance in this study although it should not be the main point of issue. Equally important is durability, the ease with which the material can be worked, color, and availability of materials. Bearing this in mind, Douglas Fir was chosen as the type of plywood to use for the desk top. It has the following factors in its favor:

1. Douglas Fir is a conifer which is available for purchase in almost all parts of the United States, even though it is a product of the Far West.
2. Douglas Fir has an index hardness of more than some of the "hardwoods" e.g., poplar, magnolia, and chestnut, and it has a hardness almost as great as some of the varieties of gum and of sycamore.[3]
3. Because of its volume of production, it is inexpensive.
4. Douglas Fir is easy to work.
5. Douglas Fir is light in color, takes a good finish.

Douglas Fir was chosen for the desk top because it offered a combination of hardness and inexpensiveness without sacrifice of any standards.

Grades of Plywood

It is necessary to define the grades of plywood which can be bought because there are different grades and because construction would vary according to the different grades. It is also of interest that the Douglas

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[2] Ibid., p. 130.

[3] Ibid., p. 220.

TABLE IV

COMPARATIVE STRENGTH OF SELECTED WOODS[a]

Wood	Wt. Per Cu. Ft. (Air-dry) lb.	Comparative Composite Strength Values[b] Bending Strength	Compressive Strength (Endwise)	Stiff-ness	Hard-ness	Shock Resist-ance
Douglas Fir	34	90	107	181	59	81
Ponderosa Pine	28	65	69	112	41	58
Magnolia	33	61	62	126	31	54
Basswood	26	61	62	126	31	34
Birch	43	106	98	174	86	171
Tupelo Gum	35	82	87	127	78	81
Red Gum	34	86	77	134	60	99
Mahogany	46	(No other information listed)				
Maple	44	114	106	178	115	138
White Oak	48	102	96	152	108	127
Walnut	38	111	113	167	88	124
Poplar	28	71	68	135	40	58
Chestnut	30	68	70	112	50	69
Sycamore	34	74	76	129	64	78
Ash	42	110	106	161	108	139

[a] Two types of wood recommended for use in this study, plus hard woods commonly used in furniture construction.

[b] "See United States Department of Agriculture Technical Bulletin 158. Figures represent comparative indexes weighted according to the estimated relative importance of their various components."

Source: Louis H. Meyer, Plywood, What It Is—What It Does. New York: McGraw-Hill Book Company, Inc., 1947. P. 220.

Fir Plywood Association, a non-profit organization, worked with the United States Department of Commerce to set up Commercial Standard CS 45-48 (as amended) for Douglas Fir plywood, thus insuring a high degree of uniformity for the protection of the buyer.[4]

[4] Ibid., pp. 108-109.

First in this process of understanding plywood is that there are two types of Douglas Fir commercial plywood, interior and exterior. These types refer mainly to the moisture resistance of the glues which bond the plies together. The interior type is the type usually used in furniture building; the exterior type for permanent exterior use.

Next are the various grades of interior type plywood. These are as follows, with Table V showing actual plywood marketing specifications:

Grade "A" (Sound) This plywood is sanded and free from all open surface defects.

Grade "B" (Solid) This plywood is sanded and has all surface defects patched.

Grade "C" (Exterior Back) This is plywood which has some surface imperfections. Its serviceability is not impaired.

Grade "D" (Utility Back) Similar to Grade "C" except larger and more numerous imperfections are permitted up to a certain maximum.

The correct understanding of the various grades of plywood is important because in this study two different grades can be used. A-B, Int. (Sound/Solid, Interior) will be used on the typewriting desks. This presents a sound, sanded top for a smooth writing surface; a solid veneer bottom side will not require banding or moulding in order to hide a defect such as would be found in Grade "C" or Grade "D." In the other desks where a linoleum top will be used, C-D, Int. (Sheathing, Interior) is sufficient because the linoleum top and the banding will hide any defects which would appear on the top or the edges of the desk.

TABLE V

PLYWOOD
INTERIOR TYPE GRADES--MINIMUM QUALITY OF VENEERS

Grade	Face	Back	Inner Plies[a]	Additional Limitations
A-A, Int. (Sound 2 sides, Interior)	A (Sound)	A (Sound)	D (Utility)	Sanded two sides
A-B, Int. (Sound/ solid, Interior)	A (Sound)	B (Solid)	D (Utility)	Sanded two sides
A-D, Int. (Sound 1 side, Interior)	A (Sound)	D (Utility)	D (Utility)	Sanded two sides
B-D, Int. (Solid 1 side, Interior)	B (Solid)	D (Utility)	D (Utility)	Sanded two sides
C-D, Int. (Sheathing, Interior)	C (Ext. Back)	D (Utility)	D (Utility)	Unsanded grade. No belt sanding permissible.
B-B, Int. (Concrete form, Interior)	B (Solid)	B (Solid)	C (Ext. Back) (All inner plies)	Edge-sealed and, unless otherwise specified, mill-oiled. Sanded two sides
A-A, Int. (Door panels, Interior)	A (Sound)	A (Sound)	D (Utility)	Sanded two sides

[a] "Except center ply of panels with 5 or more plies."

Source: Louis H. Meyer, Plywood, What It Is--What It Does. New York: McGraw-Hill Book Company, Inc., 1947. P. 111.

Buying Hints

It is often possible to save money on the purchase of plywood, either in the initial cost or through elimination of loss and waste. Some of these hints which have been discovered are:

1. Contractors often use exterior plywood for temporary purposes and would be able to supply used material to the school at a nominal

cost. It is conceivable that slight variations in the standards could be allowed, if necessary, in order to take advantage of this source of supply. Linoleum or plastic tops and banding would cover any marks of use.

2. It is possible to order plywood in sheet sizes other than the size mentioned previously, the 48" x 96" sheet. Usually this requires special order, but a study of the plans included in this study will show that the 48" x 96" sheet would be necessary for some desks whereas a 60" x 96" sheet would be better for other desks. Prices for special orders and special sizes would be a determining factor, but some of the other manufactured sizes which may be secured are widths of 30, 36, and 42 inches and lengths of 72, 84, 108, 120, and 144 inches.

3. On the fixed top desks which have linoleum or plastic writing surfaces, it is possible to use scrap strips of plywood which have been securely fastened together. This, instead of the use of solid pieces, would eliminate some waste since the cross banding process unique to plywood makes it so strong that there would be little, if any, warpage or loss in strength.

4. One other hint of possible savings would be in the use of second-hand flooring which is already grooved for joining together. This type of material, which can usually be bought at a very low cost, is generally seasoned to such an extent that warping is not an important possibility. Further, by using this flooring for the table tops which are to be covered and banded, there will be no loss in appearance.

OTHER WOOD MATERIALS

Ponderosa Pine was selected as the type of wood to be used for the balance of the construction. It furnishes the following characteristics which are of importance to the type of shop construction which is followed in most schools:

1. Ponderosa Pine has generally uniform smooth grain.
2. Ponderosa Pine is light in color which will add to the appearance of the furniture which is to be manufactured; it will blend in with the Douglas Fir plywood top; and it meets the standard of lightness of color which is specified for school furniture.
3. Ponderosa Pine has excellent wood-working properties; is easy to finish.

It is also important to stress the use of Ponderosa Pine over other types of pine. These factors which are found in other types of wood can be guarded against through the use of this specific species:

1. Some pine woods have a tendency to "bleed" sap through small ducts in the wood. This "bleeding" sometimes occurs after the wood has been finished.
2. Some varieties of pine have a great number of small knots dispersed throughout the cuts. If these knots are eliminated entirely, there is a large amount of waste of material; if the knots are not eliminated, there is a loss in appearance, and a possible loss in strength of material.

It is desirable to use a good grade of lumber in the construction of furniture. An inspection of the materials in the lumber yards where the school is located may reveal acceptable random lengths of the correct dimension Ponderosa Pine of a lower grade than would ordinarily be purchased. Grade "B or Better" is the grade recommended for this type of construction,

however. Hunt[5] mentions the fact that at least one source of school lumber supplies will provide leg stock in S4S condition for only five cents added cost per leg. This possibility is worth serious consideration, especially if the local sources of supply cannot provide acceptable material which can be used as is, or at least with a minimum amount of sawing and resurfacing.

WOODWORKING PRINCIPLES

Joints

A study of the drawings of the furniture designs will show that all desk leg joints are the mortise and tenon type. This joint gives a maximum amount of strength to the construction, and with the use of the power tools mentioned in a previous section, at a minimum of effort.

Any good woodworking manual will illustrate proper procedures, so there is no use to go into detail in this study. Only a few of the important principles about the joints are mentioned here to substantiate the designs offered in the study:

Hjorth[6] lists these points:

1. Make a layout for the drill press so that all mortising will be accurate and uniform; parts will be interchangeable.
2. Use (or make) a tenoning jig for a circular saw and cut all rails alike and at the same time to fit the above-made mortised stock.
3. A blind mortise and tenon joint can be strengthened by the use of a dowel pin.

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[5] DeWitt Hunt, A Manual for Hand Woodworking (Revised Edition; Oklahoma City: Harlow Publishing Corporation, 1949), p. 113.

[6] Herman Hjorth, Principles of Woodworking (Milwaukee: The Bruce Publishing Company, 1946), pp. 184-199.

Douglass and Roberts[7] set these standards:

1. Joints should be well-proportioned.
2. The tenon should be not less than 1/2 the thickness of the stock.
3. All joints should fit snugly. The wood surfaces should be close together if the glue is to hold firmly.
4. The wood surfaces should be rough to get the maximum strength from the holding power of the glue.
5. It is necessary to use good glue in joints.

Hunt[8] adds:

1. Always leave as much as 1/2 inch if possible at the top of the leg so the mortise will not weaken it.
2. Working drawings often leave the length of the tenons to the judgment of the workman.
3. It is often not necessary to have shoulders on all four sides of the tenon. When the rail is at the top of the leg, there does not need to be a shoulder on the top of the rail.
4. Tenons should be mitered to fit face to face at the meeting point in the leg.

These are but a few of the accepted standards for making mortise and tenon joints. Of major importance is that the construction follow some accepted standards and that the workman or workmen be allowed certain options.

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[7] J. B. Douglass and R. H. Roberts, Modern Projects In Woodwork (Wichita, Kansas: McCormick-Mathers Company, 1935), p. 14.

[8] Hunt, op. cit., pp. 99 ff.

Panels

In Chapter IV it was mentioned that panels were a necessary standard and that they served two purposes: strength to the construction, and sitting comfort for the feminine students. Both purposes are important.

In the accompanying designs, 16" panels were shown in the drawings. It would be possible to use 12" panels and achieve satisfactory results with a lesser cost; anything less than 12" would probably not be acceptable. 1/4" Ponderosa Pine plywood to match the leg stock is recommended.

The panels are to be rabbeted into the top and bottom rails but not into the legs. This will provide strength to the desk at a minimum of extra work since the rabbeting can be done on the circular table saw. In addition, this operation will help to keep the panel from warping. One-fourth inch quarter-round moulding is to be nailed to the panel and the leg stock to complete this design and provide for the best appearance.

The bottom rails are also to be of Ponderosa Pine and mortise and tenon joints are recommended. All of this can be done with the use of the power tools.

Braces

It is probable that braces are not essential to many of the designs presented here although some bracing can be used, especially where machine wells may weaken the structure. Attention is called to the use of the plywood side and end panels for these wells, and in all cases it is felt that the use of the plywood will provide added strength to the desk.

The suggestion of Hunt with regard to local workman options is repeated

here since this may be a determining factor in the use of braces. Braces made from porous wood are also recommended.[9]

Glue

Since there are a great many types and brands of glues on the market, this study is using the recommendations of the various Federal Supply Service specifications.[10] These standards have been set up and tested by governmental testing laboratories. One section reads:

Section 3.1.3

> Animal Glue, Federal Specification C-G-451. All assembly joints, glue blocks, built-up stock, and lumber core assembly.
>
> Casein Glue, Federal Specification C-G-456. All assembly joints, glue blocks, built-up stock, lumber core assembly, and plywood lamination of drawer bottoms, dust bottoms, and case backs.
>
> Urea-Resin Glue, Federal Specification C-G-496. All assembly joints, glue blocks, built-up stock, lumber core assembly, and plywood lamination.

Either hot or cold glue of a good substance and which meets government specifications is acceptable.

Securing Desk Tops to Rails

Methods of fastening desk tops are varied. It appears that no one method is universally used or approved since one of the Federal Government

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[9] Cheney, op. cit., p. 73.

[10] For example:
General Services Administration, Federal Supply Service, Federal Specification AA-T-108, Tables, Wood, Executive Office, Section 3.1.3 (Washington: Government Printing Office, 4 October 1951), p. 2.

specification pamphlets said only that the desk tops should be secured with screws or suitable metal fasteners.[11]

Hunt[12] illustrates six methods of fastening tops on tables and desks, and since it appears that all are acceptable there is no need to pick one of them as being the best method.

Primers for Douglas Fir Plywood

Unless properly prepared—and this can be said of any wood—Douglas Fir may present finishing difficulties. Certain seasonal cuts are subject to grain raising and a priming coat has been prepared especially for Douglas Fir.

Firzite and Rez are examples of commercial clear resin sealers which are used as priming coats. The use of these special preparations does not entail any additional trouble or expense since they replace any other type of primer, and penetrate into the wood to hold the fibers solid. Finishes can be applied to these primer coats in the same manner as they can be applied to other primers.[13]

Sawing Plywood

Best results in sawing plywood are obtained by scoring the plywood panel with a sharp instrument before cutting is begun. A fine knife mark along the line where the saw will cut the wood will reduce the possibility of chipping along the edges.

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[11] General Services Administration, Federal Supply Service, Federal Specification AA-D-198, op. cit., Section 3.2.3, p. 4.

[12] Hunt op. cit., pp. 130-132.

[13] Meyer, op. cit., pp. 66-67, 134.

This precaution will lessen the hand work involved if the chipped places are to be filled and sanded before finishing work is done. It will also lessen the possibility of clothing snags or tears caused by the chipped edges if they are not to be filled and sanded.

Drawer Construction

There are several types of acceptable drawer construction standards and three types have been shown in the drawings in Chapter V. In addition to those drawings, the following variations are listed:

Drawer bottoms:

1. "Bottoms should be 1/4" set in grooves front and back and reinforced with glue blocks."[14] (It is noted that the bottom is not rabbeted into the drawer sides.)
2. "Bottom is always fitted into grooves in front and sides but extends out under back same distance as sides. Drawer should be put together and glue allowed to set. Then bottom is slipped into place and nailed."[15]

Only two other suggestions with regard to the construction of desk drawers need be mentioned. Douglas and Roberts[16] point out that "it is usually best to make the back of the drawer slightly narrower than the front..." so the drawer will slide more easily without binding. Lapped fronts are recommended by Cheney[17] because of the easier fit and the better resistance to dust seepage.

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[14]General Services Administration, Federal Supply Service, Federal Specification AA-D-198, op. cit., Section 3.2.6, p. 4.

[15]Hunt, op. cit., p. 138.

[16]Douglass and Roberts, op. cit., p. 13.

[17]Cheney, op. cit., p. 17.

LINOLEUM OR PLASTIC TOP COVERINGS

Either linoleum or plastic coverings are acceptable for desk top writing surfaces. The Federal Government lists specifications for linoleum desk tops[18] but does not have any standards for plastic desk top coverings listed.

Various school journals carry advertisements of plastic surfaces which can be purchased either in sheets cut to dimension, or surfaces which can be bonded to the present desk top. In most instances, the life of the desk top would be extended, but the cost of the top would also be greatly increased. There are certain types of plastic surfaces which are almost impossible to mar or scratch, and this is not true of linoleum or wood writing surfaces.

Again, local decision will have to be made, but linoleum surfaces are shown in the drawings since linoleum is the least expensive surface.

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[18] General Services Administration, Federal Supply Service, Federal Specification LLL-L-354, Linoleum: Desk Top (Washington: Government Printing Office, 12 April 1943).

CHAPTER VII

MODIFICATION OF EXISTING FURNITURE AND EQUIPMENT

Certain modifications can be made to existing pieces of furniture to make them meet modern classroom standards. Any discussion in this study of modifications has to be done in a very general way, though, since the design of the old furniture and the needs of the new furniture have to be known before specifics can be stated.

Making Individual Desks From Old Style Desk-Seats

From the old style desks such as the types placed in rows, it is possible to adapt certain makes and styles to provide modern individual desk and chair combinations. This is done by removing the desk box from the frame and installing U-shaped metal tubular legs on either side. Certain brands of this old furniture also have seats which can be dismounted and equipped with tubular metal legs to match the individual desk. If the seat cannot be adapted in this manner, it is necessary to provide some sort of chair.

This particular type of modification is not very expensive and the work can be done in the school shops. For further information and names of manufacturers, see issues of educational periodicals such as The School Executive.[1]

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[1] The School Executive is published monthly at Orange, Connecticut, by the American School Publishing Corporation.

Extending Legs of Present Desks

If individual desks are too low, and this is quite often true in typewriting classrooms which are equipped with the old style "typewriter table," it is possible to raise the desk top height by certain leg extension modifications. Some of these extensions are not practical.

Some schools have attempted to raise the desk heights by placing a frame around the bottom of the desk. With this system, a 1" x 2", 2" x 2", 2" x 3", or 2" x 4" was placed around the bottom of the desk, the legs resting on and fastened to the frame. This did improve the desk in so far as the height was concerned, but the framework had the tendency to eventually assume the characteristics of the rockers on a rocking chair, and a new hazard was created. In addition, janitorial service was made more difficult since the tables had to be moved in order for them to be cleaned under.

In an alternative method devised to help meet the custodial problem mentioned above, extensions were placed only on the sides of the desks. When the extensions were made on the side from leg to leg, the rocking action was made even worse and the danger of the typewriter and desk tipping was increased; when the extensions came out past the legs, the tipping danger was decreased but a new problem, that of students or teachers tripping over the extensions, was added.

Individual leg extensions have been designed and are now available from commercial concerns. One of these is an individual screw-type platform which fits on each leg. This platform can be screwed up or down to adjust the height of the table, but it is not possible to determine easily if the platforms have been extended equally or if the table is level.

Another of the commercial extensions is a metal box-type shoe which fits over the table leg. The shoe is long enough to allow for small wooden

squares to be placed inside and increase the height by as much as four inches, a half-inch or inch at a time, depending upon the number of the blocks which have been used.

Both of these types of leg extensions can be added by the school shop. Names and addresses of suppliers can be found in issues of various education periodicals.

Refinishing Old Desk Tops

In addition to the problem of refinishing desk tops when modifying old desks, the refinishing problem comes up when trying to lighten the color of old, dark desks to meet new color standards, and when smoothing out the writing surface after it has been marred by sharp instruments. Whatever the cause of the refinishing, it is a difficult task.

It was once thought necessary to stain desks a dark color and this stain which is present in the wood of some desks is a refinishing problem which is in addition to surface marks. Scraping off the old finish, patching, and sanding may not be the only refinishing problems.

Pyramided on to this problem of removing stain might be an additional problem of the desk top being finished with a light veneer. Here, scraping and sanding presents a matter of delicacy in order to protect and save the veneer.

The matter of refinishing does present a great number of problems and there are helpful articles and books written on suggested techniques of obtaining best results. Careful study should precede any decision of refinishing, for it might be more costly than the building of new furniture such as that designed in this study.

Plastic desk tops were mentioned in a previous section, but they also

concern this chapter. McLeary[2] mentions a method of refinishing with the use of plastic which gives a "lifetime" desk top. There is no mention of the cost of such a process, but information could be easily secured by interested schools; it is mentioned in the article that this plastic coating is considerably less than the cost of a new, solid plastic desk top.

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[2]McLeary, op. cit., pp. 44-45

CHAPTER VIII

SUMMARY, CONCLUSIONS, AND RECOMMENDATIONS

Summary of Findings

From the findings of this study, standards for business education furniture and equipment have been determined and presented. Suggested designs for the manufacture of furniture and equipment by the schools have also been submitted.

The method by which these standards were determined was a survey of literature related to furniture and equipment for business education classrooms. Factual evidence, represented by research findings, came from studies made by individuals, learned societies, business, and government. Recorded opinions and tried and proven methods from representatives of education, business, and government were also used to help develop the standards.

A summary of the findings include:

1. There has been very little research done by schools and business teachers for the purpose of establishing standards for business education furniture and equipment.
2. Business and industry is considerably ahead of the schools and business teachers in research and experimentation concerning standards for furniture and equipment common to the needs of business education classrooms.
3. There seems to be a very important trend in business offices toward the use of metal office furniture and equipment, but this

trend has not yet reached the schools. At this time there is very little metal school furniture and equipment (as the term was limited in this study) manufactured.

4. Bulletins from the United States Office of Education and other reports and studies show that the ten most popular business education courses, in terms of student enrollments, are: typewriting, bookkeeping, shorthand, introduction to business, business arithmetic, business law, office practice, economic geography, business English, and consumer economics. In view of this information, furniture and equipment needs for business education should be directed toward these ten classes.
5. Desk heights, particularly those desks used for typewriting, are too low for most students if they are less than 28" from the floor to the top of the desk. In the past, 26" and 27" desks and tables were considered satisfactory for business education classrooms.
6. Almost all of the commercial school-type furniture and equipment which was seen or studied about during this study seems to meet the educational standards developed by this study. One possible exception is the standard for desk height which, in the case of some factory-made furniture, is still too low.
7. A few schools have built their own business education furniture and equipment and this has been reported in educational journals. Those who have reported the experience seem to be pleased with the results, and consider school-made furniture and equipment satisfactory.

Conclusions

Conclusions drawn from the study include:

1. It is acknowledged that the lack of research in the area of business education furniture and equipment is a limiting factor to this investigation. Since this may be the first such study to be prepared, however, the fact must be recognized that the study is a starting point which was sorely needed, and the standards listed are a reflection of present recorded research and opinion.
2. The disagreements which were found with regard to various types of business education furniture and equipment seemed to stem from the general overall lack of standards. As was shown by this study, a person could find a few standards in one place and another group of standards in another place, but no one source was found to which a school person could secure information relative to all, or even most, of the various pieces of business education furniture and equipment which are described in this study.
3. Metal business education furniture and equipment are not necessary for school classrooms, despite the trends of business and industry. For one reason, classroom needs are not the same as the overall needs of the business office. For another reason, metal furniture is not generally available to meet classroom requirements. And for a third reason, metal furniture and equipment are generally too expensive for school purchase.
4. There should be at least two types of desks provided for business education classrooms; there should be an adjustable typewriting desk, and one other fixed-top desk provided with a linoleum or plastic writing surface. The choice of the fixed-top desk should be made on the basis of the students' needs, and any deviation

from the choice of these two desks would also be based on the courses offered and the needs of the students.

Typewriting and computing machine courses are the only courses which need special types of desks. It is imperative that individual typewriting desks be given serious consideration since more students in the secondary schools are enrolled in typewriting than in any other business education course. Office machine desks are also recommended when the school has the demand for special courses of this type, and when occupational competency is the objective.

The other courses which are common to the business education department can usually be scheduled throughout the day so that students can use one desk for several different courses.

5. In relation to the importance of having adjustable typewriting desks for typewriting classrooms in order to provide adequate facilities for the large typewriting enrollments, it is noted that another piece of equipment is also essential for the typewriting room. Not one dissenting opinion was found regarding the necessity of having some kind of typewriting demonstration equipment available to the teacher. It must therefore be concluded that typewriting authorities are in almost complete agreement as to the importance of the demonstration technique to the teaching and learning of typewriting skills.

6. Since this study was made with the small high school in mind, it seems that all furniture and equipment should be made with multi-purpose factors taken into consideration. An illustration of this would be the many purposes of the typewriting demonstration stand, other than typewriting demonstration, such as its use as an audio-visual projection stand, a speaker's platform, and space for storage.

7. A thorough study should be made by the parties who will be involved in the planning of business education furniture and equipment for manufacture by the school. Some of the areas which should have close study in order to secure the best possible furniture and equipment are:

    a. Is all of the furniture and equipment to be made at one time or is the manufacturing process to be carried on over a long period? A long-time operation will incur higher labor costs than short-term plans, and it might cause some deviations in materials and workmanship.

    b. Is it necessary that any of the sizes suggested in this study be changed in order to fit the local classroom needs?

    c. What local conditions will change the types of wood to be used:

        (1) local wood growth and availability (local mills).

        (2) location of school in relation to source of wood supply (transportation costs).

        (3) local weather conditions which may affect the use of certain types of wood.

        (4) funds available for the manufacture of the furniture and equipment.

        (5) construction options to be used should be discussed to see if they follow sound educational principles.

8. The furniture and equipment designs which are shown in this study are not revolutionary in any way. Simplicity was an intentional objective, and the designs were made in order to provide the school with the opportunity to secure sound, functional furniture and equipment for a small cost.

9. Since more advanced courses may be offered in some schools, it is possible that desks of a different design would be needed in order to fit the student for work in the employment community served by the school. If this is a factor to be considered, new designs for local use should be made.

Recommendations

The recommendations of the study are:

1. The subject of standards for business education furniture and equipment would be a good topic for special editions of business education periodicals, and for panels at business education conferences and conventions. Attention of this sort would have two far-reaching effects, one to stimulate more thinking with regard to the topic, and the other to create a means of collecting the opinions and experiences of business education teachers concerning furniture and equipment.
2. The opinions of the recognized national leaders in business education with regard to standards for business education furniture and equipment are important and desirable. However, it is possible to secure reliable and helpful information and opinions from business teachers who are neither well-known nor recognized as authorities. It is therefore recommended that more classroom teachers publish their ideas and classroom techniques to help enlarge upon the present knowledge of standards for business education furniture and equipment.
3. The Department of Agriculture research on typewriter desk height, which was previously described by Lamb, was an important study and should be carried out to its successful completion. If the study has been finished, and there is no indication that it has been, such information should be published and made available to business education teachers.
4. Other research, such as that mentioned regarding the Department of Agriculture, should be carried on by organizations and institutions who can afford to bear the cost of the study. Grants might

be made available from some of the various foundations which have been set up to promote research, e.g., Kellog, Ford, and Guggenheim.

5. This study should be followed up by a like study within a few years. The new study could indicate new findings and opinions in this area which would be of benefit to business education students and teachers, new trends, changes in thought.

6. Teacher training institutions which are engaged in the training of business teachers should provide some information to business teachers regarding the standards for business education furniture and equipment commonly used. This would help to prepare the teacher to make sound recommendations and decisions concerning furniture and equipment which is distinctive to business education classrooms. It would, in addition, help the teacher to better understand some physical factors which influence instruction and learning.

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THESIS TITLE: AN INVESTIGATION OF FURNITURE AND EQUIPMENT STANDARDS FOR BUSINESS EDUCATION CLASSROOMS

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The content and form have been checked and approved by the author and thesis adviser. The Graduate School Office assumes no responsibility for errors either in form or content. The copies are sent to the bindery just as they are approved by the author and faculty adviser.

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