A DESIGN FOR DEMONSTRATION EQUIPMENT TO BE USED IN TEACHING LIGHTING AND ADEQUATE WIRING FOR HOMES

by

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CHAPTER I

INTRODUCTION

Those who have become aware of the quantity and quality of light needed for seeing when performing the various activities in the home as well as for retaining the beauty and vitality of home decoration realize that lighting needs and lighting practices are in many instances separated by a wide gulf. This is well expressed in these statements made by people in the lighting industry:

> . . . Most of us . . . have used lighting merely to chase away darkness . . . . Recent surveys indicate that the average American home contains seventeen to eighteen lamp bulbs without a pattern to the lighting or, for that matter, much reason. Proper decoration and utility require sixty or more lamp bulbs and tubes skillfully organized and integrated in a living-decorating plan.
>
> . . . Light conditioning brings a new dimension to living . . . . It enhances the appearance of all your possessions, gives you freedom of movement for both work and play. Light conditioning makes it so much easier for you to see and to do the many things that call for close eye work . . . . Without it, you will not be able to achieve your total plan for living.[1]
>
> . . . Getting people to live with good lighting installations in order to realize for themselves the beneficial results that they will receive as living attributes to everyday living is our great problem. Like many another thing, those who have experienced it would not want to live without it and those who have not had it have no idea of what they are missing.[2]

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[1]E. W. Commery and C. Eugene Stephenson, How To Decorate and Light Your Home (New York: Coward-McCann, Inc., 1955), pp. 29-30.

[2]Kaye A. Leighton, Residential Lighting Specialist, General Electric Company, in a letter, September, 1957. Permission to quote secured.

A similar situation exists in home wiring.

From 1937 to 1954, the national average annual consumption of electrical energy in homes rose from 805 to over 2500 kilowatthours. In some areas the 6000 kilowatthour mark had already been passed, indicating that the rise would probably continue.[3] A prediction for 1970 is that the average electrical power residential customer will use more than 7700 kilowatthours of electricity a year, with some homes approaching 30,000 kilowatthours.[4]

The number of different home appliances on the market increased from about 20 in 1930 to 75 or more in 1955. "Some call for more current on one circuit than all the wiring in most pre-World War II homes was designed to carry."[5] Another factor involved in the use of more electricity was the increased efficiency of appliances with the necessary increases in wattage. Home wiring practice has lagged far behind electrical consumption. Approximately half the homes now existing in the United States were built and wired before 1925 when the average customer used only 400 kilowatthours.[6] Symptoms of the resulting condition are tangles of extension cords, frequent need to replace fuses and reset circuit breakers, unlighted switches, stairways, and

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[3]Residential Wiring Handbook (New York: Industry Committee on Interior Wiring Design, 1954), p. 5.

[4]How To Help Home Owners Live Better Electrically ([n.p.]: [n.n], 1956), p. 8.

[5]"Look What's Happening! in the Home, " The Anaconda Wire, XIV (New York: Anaconda Wire and Cable Company, September, 1955), 8.

[6]How To Help Home Owners Live Better Electrically, op. cit., p. 7.

entrances, and inefficient operation of lights and appliances.[7] According to National Adequate Wiring Bureau statistics, at least 88 per cent of American homes suffer from overloaded wiring.[8]

The obvious need for improved home lighting and wiring led to the conclusion that the teaching of subject matter in these areas would be facilitated by special demonstration equipment. A schedule was used to determine what methods and facilities were used by home economics divisions, schools, or departments in land-grant colleges in teaching lighting and adequate wiring. The results, reported in Chapter II, confirmed the need for and also the lack of availability of such demonstration equipment. On the basis of these facts the decision was made to design demonstration equipment to be used in a classroom in the School of Home Economics of The Woman's College of The University of North Carolina in teaching home lighting and adequate wiring.

The purposes of the study were (1) to review the recommendations for home lighting and adequate wiring and (2) to apply these recommendations to a design for demonstration equipment to be used in teaching lighting and adequate wiring for homes.

Published materials on home lighting and adequate wiring were secured from experiment stations, extension services, commercial companies, and professional societies. These publications and other available literature written since 1945 were reviewed to determine

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[7] Residential Wiring Handbook, op. cit., p. 4.

[8] Improving Your Home's Housepower (New York: National Adequate Wiring Bureau, [n. d.]), p.2.

principles of lighting and adequate wiring, recent developments in the fields, and suggested teaching devices.

The investigator visited the General Electric Lighting Institute at Nela Park in Cleveland, Ohio, to see the demonstration equipment used there, to talk with members of the staff in relation to the equipment, and to attend a basic "Light for Living" course.

The information gathered was used in designing demonstration equipment to illustrate a plan showing adequate wiring for a house using full size wires and to illustrate recommendations for general lighting and lighting for specified activity centers.

CHAPTER II

TEACHING PRACTICES IN LAND-GRANT COLLEGES

To verify the need for a study of demonstration equipment to be used in teaching lighting and adequate wiring for homes, a schedule was sent to the division, school, or department of home economics of the land-grant college in each state and in Alaska to determine what means were being used in colleges for teaching this subject matter. A copy of the schedule appears in the appendix.

A reply was received from each of the forty-nine colleges to which the schedules were sent. The replies indicated that home lighting and adequate wiring were taught as part of the home economics curriculum in thirty-seven of the colleges questioned, were taught to a limited extent in four, and were not taught in seven. One college's reply stated only that they had no laboratory for teaching home lighting and adequate wiring.

In nineteen colleges this subject matter was taught in one course. In others it was taught in more than one: sixteen colleges taught this subject matter in two courses; five, in three courses; one, in five courses; and one, in eight courses. The courses fell largely into these areas: Household Equipment and Related Courses, 36; Housing and Home Planning, 17; and Art, 10 (Table I). With only two exceptions, lighting and/or adequate wiring for homes were taught as a part of a course rather than as a separate course. One of the exceptions was being considered for incorporation into a more inclusive course, "Installed Equipment," to cover water, plumbing, heating, air conditioning, wiring, and lighting. There were several specific indications

TABLE I

COURSES IN WHICH LIGHTING AND ADEQUATE WIRING WERE TAUGHT

Courses	Number of Times Appearing in Replies	
Household Equipment and Related Courses		36
Household Equipment*	26	
Special Equipment Courses (Number not specified; counted as 2)	2	
Home Equipment	1	
Household Appliances	1	
Equipment	1	
Home Service (Advanced Equipment)	1	
Advanced Household Equipment	1	
Household Technology (Equipment and some Household Physics)	1	
Electricity in the Home	1	
Food Equipment	1	
Housing and Home Planning		17
Housing	4	
Home Furnishings	3	
Housing and Home Furnishings	2	
Home Furnishings and Home Planning	2	
Home Planning	1	
House Planning	1	
The House and Its Furnishings	1	
Residence Planning (Agricultural Engineering)	1	
Housing and Equipment	1	
Home Planning and Equipment	1	
Art		10
Interior Design (5 offered by one college)	6	
Home Art (All 3 offered by same college)	3	
Introductory Design	1	
Home Management		5
Home Management (2 offered by one college)	4	
Management of the Home	1	
Lighting		5
Lighting and Cleaning Equipment	2	
Home Lighting and Refrigeration	1	
Home Wiring and Lighting Requirements	1	
Home Lighting	1	
Household Physics		2
Consumer Problems (Lamp Buying)		1
Farm and Home Utilities (Agricultural Engineering)		1

* In some colleges this subject matter was taught in more than one course in Household Equipment. One college offered 3 courses, and one offered 2 courses. One course was taught in the Department of Agricultural Engineering.

that little time was spent on home lighting and adequate wiring. Statements such as the following were made:

One hour occasionally
One week unit
Two week unit
Three week unit
One lecture and one lab.
Taught in Household Equipment, sometimes
One lecture-demonstration included in course
Touched on in home safety unit

In twenty-two of the colleges contacted both lecture-demonstration and laboratory methods of teaching were used, supplemented in one case by field trips (not designated) and in another by class committees. The lecture-demonstration method was used by eleven of the colleges; another used lecture only; and still another used the laboratory for demonstration purposes. In fourteen cases no indication was given as to what method of teaching was used.

Thirty-one replies stated that full-scale equipment was used in teaching, one qualified by "limited," and another by "when it can be obtained." Only once was mentioned a piece of full-scale wiring demonstration equipment, an REA wiring demonstration board. Full-scale lighting equipment appeared more often in such comments as:

Lighting
Lamps
Selection of lamps and shades
Quality of light studied through use of light meter
Lighting with illustrative equipment

In no instance was the use mentioned of actual illustrations of installed room lighting, as valance, cornice, bracket, cove, or soffit.

In one of the thirteen colleges using small-scale equipment a four by six-foot demonstration panel showing the three types of circuits was used. The fact that this panel was considered small-scale while the

REA demonstration board, which was probably of similar construction, was considered large-scale indicates the probability of difference of opinion in placing equipment in these categories. The other three items mentioned under small-scale equipment fell into the grouping of floor plans and blueprints used for planning house wiring.

While home lighting and adequate wiring were taught to some extent in 41 of the 49 colleges, in only 2 was there access to a special lighting and wiring laboratory (Table II). One of these laboratories was at the State 4-H Club Camp fifty miles from the campus, and each class spent two or three days there. The second was an Agricultural Engineering laboratory.

Three schedules gave evidence of plans for immediate improvement in teaching lighting and adequate wiring for homes. In one college new facilities were being planned, in another an advanced Household Equipment course in which lighting would be taught more effectively was being planned, and in the third their new building provided a Household Equipment laboratory which they hoped to use in teaching this subject matter.

Interest in the results of the survey was expressed by several of the teachers who wrote the replies, one stating:

> We would be most appreciative if the results of your study could be made available to us. I do believe that this has been a somewhat neglected area . . . in many schools and has not received adequate emphasis. I am happy that in your planning you are taking this into account.

This indicated that the study might prove useful not only to the School of Home Economics of the Woman's College, but also to other schools.

TABLE II

FACILITIES USED IN TEACHING LIGHTING AND ADEQUATE WIRING

Facilities	Number of Colleges in which Used
Household Equipment Laboratory One school used a laboratory especially designed for these courses, and another stated that they had a laboratory in their new building and hoped to use it in teaching.	35
Home Furnishings Laboratory In one school a laboratory was used for a small project in placement. In another a combination Home Furnishings-Sewing laboratory was used.	11
Utility Company Laboratory*	6
Home Management House	4
Related Arts Laboratory	2
Special Lighting and Wiring Laboratory	2
Household Equipment Classroom	1
Home Management Laboratory	1
Lecture Room	1
Physics Laboratory	1
Field Trips to Homes Being Constructed	1
Field Trip (not designated)	1

* In two additional cases utility company personnel went to colleges to give demonstrations.

CHAPTER III

REVIEW OF LITERATURE

Publications of the General Electric Company were used as principal sources of information on home lighting.* This company was also found to be outstanding in the designing of residential lighting demonstration equipment. Recommendations found in these publications and some of the demonstration units were used as a basis for designing demonstration equipment for teaching home lighting (Chapter V).

Several sources were used in preparation for designing demonstration equipment for teaching adequate wiring for homes (Chapter IV).* Many publications stated that their recommendations were based on the National Electrical Code's minimum provisions for safety. These publications supplemented the basic requirements with further recommendations for adequacy, as stated in the purpose of the Residential Wiring Handbook, "to provide design standards, compliance with which will result in an efficient, convenient, and useful home wiring system that will help avoid electrical obsolescense."[10] Unusual design or unusual construction may make it impossible to follow exactly some recommendations. Those for specific usages should be adjusted to the particular home under study.[11]

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[10] Residential Wiring Handbook (New York: Industry Committee on Interior Wiring Design, 1954), p. 5.

[11] Ibid., p. 10.

*An effort was made to trace statements in commercial and professional society publications to their original sources, but the investigator was unable to do so.

Service Entrance

A full supply of electricity is made available by the power supplier, but the extent of use is determined by the adequacy of the interior wiring.[12] The service entrance is the focal point of electrical adequacy, limiting the total energy which may be used.[13] It consists of all wiring from the point where the service drop of the utility company ends to the point inside the house where the branch circuits begin. This includes the insulators on the outside of the house, the cable or conduit running down the side and into the house, the meter, the service switch, the branch circuit fuses or circuit breakers, and the ground connection.[14]

If only two wires are installed, only 115-120 volts are available. A three-wire installation, recommended for all services, provides either 115-120 or 230-240 volts, necessary for large appliances such as ranges and water heaters.[15]

A service equipment rating of at least 100 amperes was recommended for homes up to 3000 square feet in floor area, using service conductors of not less than number 2 wire, American Wire Gauge.[16, 17]

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[12] Residential Wiring Handbook, op. cit., p. 3.

[13] How To Help Home Owners Live Better Electrically ([n.p.]: [n.n.], 1956), p. 25.

[14] H. P. Richter, Wiring Simplified (Minneapolis: Park Publishing Company, 1954), p. 44.

[15] Ibid.

[16] Residential Wiring Handbook, op. cit., p. 30.

[17] In the American Wire Gauge numbering system, the higher the number, the smaller the wire. For example, a number 14 AWG wire is smaller than a number 12 AWG wire.

lf range, water heater, high speed dryer, or central air conditioning were used along with the usual small appliances, a 150-ampere service with number 1/0 AWG wires was recommended. To provide capacity for electric heating or for additional circuits for future use, the recommendation was for a 200-ampere service with number 3/0 AWG wires.[18]

Because of the many major uses of electricity in or near the kitchen, it was recommended that electric service equipment be located on or near a kitchen wall to minimize length of runs and installation and wiring costs.[19]

Protective Devices

Some means must be provided for disconnecting the home wiring from the power lines and for providing protection against overloading circuits. Protective devices may be either fuses or circuit breakers. The trend has been toward circuit breakers since they require simply resetting rather than replacing in the event of an overload. They also automatically provide time-lag features which permit temporary overloads,[20] and are safer to use since there is no danger of electric shock and no opportunity for bridging with a penny or similar object after a fuse has blown.

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[18] *Simplified Electric Wiring Handbook* ([n. p.] : Sears, Roebuck and Company, 1957), p. 10.

[19] *Residential Wiring Handbook*, loc. cit.

[20] Richter, *op. cit.*, p. 45.

Circuits

If all lights and appliances in a home were protected by a single fuse or circuit breaker, a blown fuse or a tripped breaker would result in complete darkness and a total lack of electric power. In such an instance all the wires would have to be of a very low gauge to correlate with the amperage of the protective device, and this would result in a clumsy and expensive installation.[21] Therefore, wires of higher gauge, called branch circuits, carry electricity as needed through the walls, ceilings, and floors of the house to the lights, convenience outlets, and individual electrical equipment. Each branch circuit is protected by a fuse or/a circuit breaker, and when the circuit becomes overloaded, the protective device cuts off the current. When the circuit is overloaded, but not sufficiently to cut off the current, electricity cannot be distributed to all appliances on the circuit at full pressure, or voltage. Wires of too high gauge and/or circuits too long may also result in this reduction of voltage, called voltage drop.[22] The recommended allowable maximum voltage drops for the efficient use of lights and appliances are: feeder circuits, 1 per cent; branch circuits 2 per cent; branch circuits direct from main control center to equipment, 2½ per cent, except for the circuit supplying the range, 1 per cent.[23]

The minimum size of conductors that can be used for any circuit is the size having carrying capacity equal to the rating or setting of

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[21] Ibid., pp. 34-35.

[22] Improving Your Home's Housepower (New York: National Adequate Wiring Bureau, [n.d.]), p. 6.

[23] A. Carl Bredahl, Westinghouse Home Wiring Handbook (Pittsburgh: Westinghouse Electric Corporation, 1945), p. 64.

the device protecting the circuit. When conductors of lower guage are used to prevent excessive voltage drop, this change in conductor size does not demand an increase in the capacity of the protective device.[24] The minimum size wire permitted for safety in house circuits by the National Electrical Code is number 14 AWG, but the minimum size being generally recommended today for all homes is number 12 AWG.[25] This is a requirement in some localities.[26]

The three types of branch circuits required for adequate wiring are general purpose, appliance, and individual-equipment circuits.

General purpose circuits supply all lighting outlets throughout the house and all convenience outlets except those in the kitchen, dining room or dining areas, breakfast room or nook, and laundry or laundry areas. Also recommended are separate branch circuits for lighting and for convenience outlets in living rooms and bedrooms. They are provided on the basis of one 20-ampere circuit for not more than each 500 square feet, or one 15-ampere circuit for not more than each 375 square feet of floor area, with the outlets supplied being equally divided among the circuits.

For small household appliances, the use of 3-wire circuits is an economical means for dividing the load, providing greater capacity at individual outlet locations, lessening voltage drop in the circuit, and providing greater flexibility in the use of appliances. At least one 3-wire, 115/230-volt, 20-ampere appliance circuit equipped with

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[24] Ibid., p. 31.

[25] Simplified Electric Wiring Handbook, op. cit., p. 10.

[26] Richter, op. cit., p. 10.

split-wired receptacles is required for adequacy to serve convenience outlets in the kitchen, breakfast or dining area, extending to the laundry area to serve any convenience outlets not otherwise required to be served by individual-equipment circuits. For most effective use, the upper half of all receptacles should be connected to the same side of the circuit. Three-wire circuits with split-wired receptacles are also recommended for serving convenience outlets in living rooms and bedrooms, and in the garage primarily for a workbench.

Individual-equipment circuits are required for any pieces of major electrical equipment installed, such as the range, automatic washer, clothes dryer, fuel-fired heating equipment, dishwasher and waste disposer, and water heater. In some instances, one circuit may serve two devices which are not used at the same time, as attic fan and bathroom heater. For future adequacy, spare circuit equipment should be provided for at least two 20-ampere, 2-wire, 115-volt circuits in addition to the initial installation.

For larger homes it is strongly recommended that consideration be given to the installation of branch circuit protective equipment, served by appropriate feeders, at several strategic locations within the house, rather than at a single location.[27]

Outlets

Convenience outlets should be sufficient in number and located so that an extension cord is never needed, even when furniture is

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[27] Residential Wiring Handbook, op. cit., p. 28-29.

rearranged.[28] They should be located near the ends of wall space rather than at the center.[29] Generally, convenience outlets should be placed approximately twelve inches above the floor line, and so that no point along the floor line in any usable wall space is more than six feet from an outlet in that space. The following specific recommendations are made: dining or breakfast areas, at table locations, just above table height; bedrooms, on each side and within six feet of the center line of each probable bed location; bathroom, near the mirror, three to five feet above the floor; and in the kitchen, one outlet for the refrigerator and one for each four linear feet of work-surface frontage with at least one outlet to serve each work surface approximately forty-four inches above the floor line.[30]

Lighting outlets for permanent installations are recommended for general illumination in the home.[31]

Additional requirements for convenience outlets, lighting provisions, and special purpose outlets are given in the Residential Wiring Handbook.[32]

Controls

Switches cut off or restore the flow of electricity to lights

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[28] Richter, op. cit., p. 9.

[29] Residential Wiring Handbook, op. cit., p. 8.

[30] Ibid., pp. 11-23.

[31] Ibid., p. 8.

[32] Ibid., pp. 11-23.

and appliances without disconnecting them from the outlets.[33] "An adequately wired home has wall switches so located that you can enter by the front door or back, go from basement to attic, without ever being in darkness and still not leaving lights burning behind you."[34]

The switch used for controlling a light from one point is known as a single-pole switch. If a light is to be controlled from two different places, a 3-way switch is used, and from more than two places, a 3-way switch at the point nearest the source, another at the point nearest the light, and 4-way switches at each other point.[35]

Wall switches should usually be located at the latch side of doors or at the traffic side of arches, approximately forty-eight inches above the floor line, and within the room or area to which the control is applied. Some exceptions are: the control of exterior lights from indoors; the control of stairway lights from adjoining areas, when stairs are closed off by a door; and control of lights from the access space adjoining infrequently used areas, as storage areas.[36] Door switches or wall switches are preferred rather than pull switches for controlling closet lights.[37]

How To Help Home Owners Live Better Electrically states that in

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[33] Facts About Electric Wiring for the Home (New York: National Adequate Wiring Bureau, [n.d.]), p. 1.

[34] Richter, op. cit., p. 9.

[35] Ibid., p. 40.

[36] Residential Wiring Handbook, op. cit., p. 8.

[37] How To Help Home Owners Live Better Electrically, op. cit., p. 35.

selecting control equipment, either conventional line-voltage switching or low-voltage remote control switching may be chosen. The low-voltage wiring system isolates all switches from 115-volt circuits, thereby improving the safety rating of the system. It permits long runs of inexpensive wiring, encouraging the use of remote control switching, and since it allows any number of switches to be used on each control circuit, it makes multi-point control economically practical. The small, inexpensive wires used with this system can be easily installed, and new switches can be added and existing ones moved with a minimum of cutting and patching. The unit cost of this type of control decreases as the number of units in the system increases, making it well suited for extensive installations. Low voltage control is ideal for house modernization jobs where existing wiring is operated at line voltage.[38]

Dimmer controls enable home owners to regulate intensity of light in local areas, as living rooms, dining rooms, master bedrooms, or porches.[39] This type of lighting level variation may be desirable in rooms used for activities requiring such contrasting levels as that required for reading and sewing, and that for conversation and television.

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[38] How To Help Home Owners Live Better Electrically, op. cit., pp. 35-38.

[39] Ibid., pp. 38-39.

CHAPTER IV

PLAN FOR ADEQUATE HOME WIRING DEMONSTRATION UNIT

The wiring plan for a home illustrated in this section was devised to demonstrate the capacity of service entrance and the number and type of circuits needed for adequacy for present electrical usage and for future expansion.

The primary source of recommendations for lighting was See Your Home in a New Light,[40] and for wiring, the Residential Wiring Handbook.[41]

Floor Plan

The floor plan used was an adaptation of that of the 1957 Sweetbriar, a prefabricated house design by National Homes Corporation.[42] The house was planned incorporating preferences expressed by homemakers from all areas of the United States at the Women's Congress on Housing held in Washington, D. C. in 1956. Since it was a small house with a total area of 1167 square feet (exclusive of garage and terrace) it was believed to illustrate well the fact that any house, regardless of size or cost, could have adequate wiring.

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[40] See Your Home in a New Light (3rd. ed.; Cleveland, Ohio: General Electric Company, [n.d.]).

[41] Residential Wiring Handbook (New York: Industry Committee on Interior Wiring Design, 1954).

[42] Permission to use the adaptation of the 1957 Sweetbriar plan secured from National Homes Corporation, Lafayette, Indiana.

The floor plan is shown with outlets and switches drawn in with the circuit plan given on an overlay sheet (Figure 1). In subsequent drawings parts of the circuit plan are given to show more clearly the circuit arrangement.

Service Entrance

A 200-ampere, 120/240-volt, 3-wire service entrance of number 3/0 AWG wire was provided since all major appliances, including range, water heater, and central air conditioning and heating were electric, and since additional capacity for future use should be allowed.[43]

Circuits

The length of circuits was determined by using the recommended allowable maximum voltage drop of one per cent for the range circuit and two per cent for other branch circuits.[44] The length of run in feet in relation to the load in amperes and the wire size was taken from Tables D, F, and G of the Farmstead Wiring Handbook.[45]

Circuits 1, 2, and 3 were planned for lighting only, based on the recommendation for three circuits with 20-ampere fuses or circuit breakers for a 1200 square foot house with three bedrooms and one and one-half baths (Figure 2).[46] These circuits were rated at 20 amperes

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[43] Better Homes and Gardens, "Housepower in the Home" ([n.p.] : Meredith Publishing Company, 1957), p. 27; and Simplified Electric Wiring Handbook ([n.p.] : Sears, Roebuck and Company, 1956), p. 10.

[44] A. Carl Bredahl, Westinghouse Home Wiring Handbook (Pittsburgh: Westinghouse Electric Corporation, 1945), p. 92.

[45] Farmstead Wiring Handbook (New York: Industry Committee on Interior Wiring Design, 1955), pp. 40, 42, 43.

[46] See Your Home in a New Light, op. cit., p. 39.

○	LIGHTING OUTLET	◉	SPECIAL-PURPOSE OUTLET	*	HEATING AND COOLING SYSTEMS, ALTERNATE SYSTEMS GIVEN
$○_{PS}$	LIGHTING OUTLET WITH PULL SWITCH	W.D	COMBINATION WASHER-DRYER	S	SWITCH
	CONTINUOUS WIREWAY FOR FLUORESCENT LIGHTING	B.H	BATHROOM HEATER	S_3	THREE-WAY SWITCH
⊖	DUPLEX CONVENIENCE OUTLET	W.H	WATER HEATER	S_4	FOUR-WAY SWITCH
$⊖_3$	TRIPLEX CONVENIENCE OUTLET	I	IRONER	S_D	AUTOMATIC DOOR SWITCH
◉	DUPLEX CONVENIENCE OUTLET, SPLIT-WIRED	R.F.F	COMBINATION REFRIGERATOR-FOOD FREEZER	MS	MASTER CONTROL PANEL FOR REMOTE CONTROL OF LIGHTING
$⊖_{WP}$	WEATHERPROOF CONVENIENCE OUTLET	D.W	DISHWASHER	----	CONNECTS OUTLETS WITH SWITCHES
$⊖_R$	RANGE OUTLET	F.D	FOOD DISPOSER	═══	CIRCUITS
Ⓕ	VENTILATING FAN	W.B	WORK BENCH	▬	CIRCUIT BREAKER PANEL

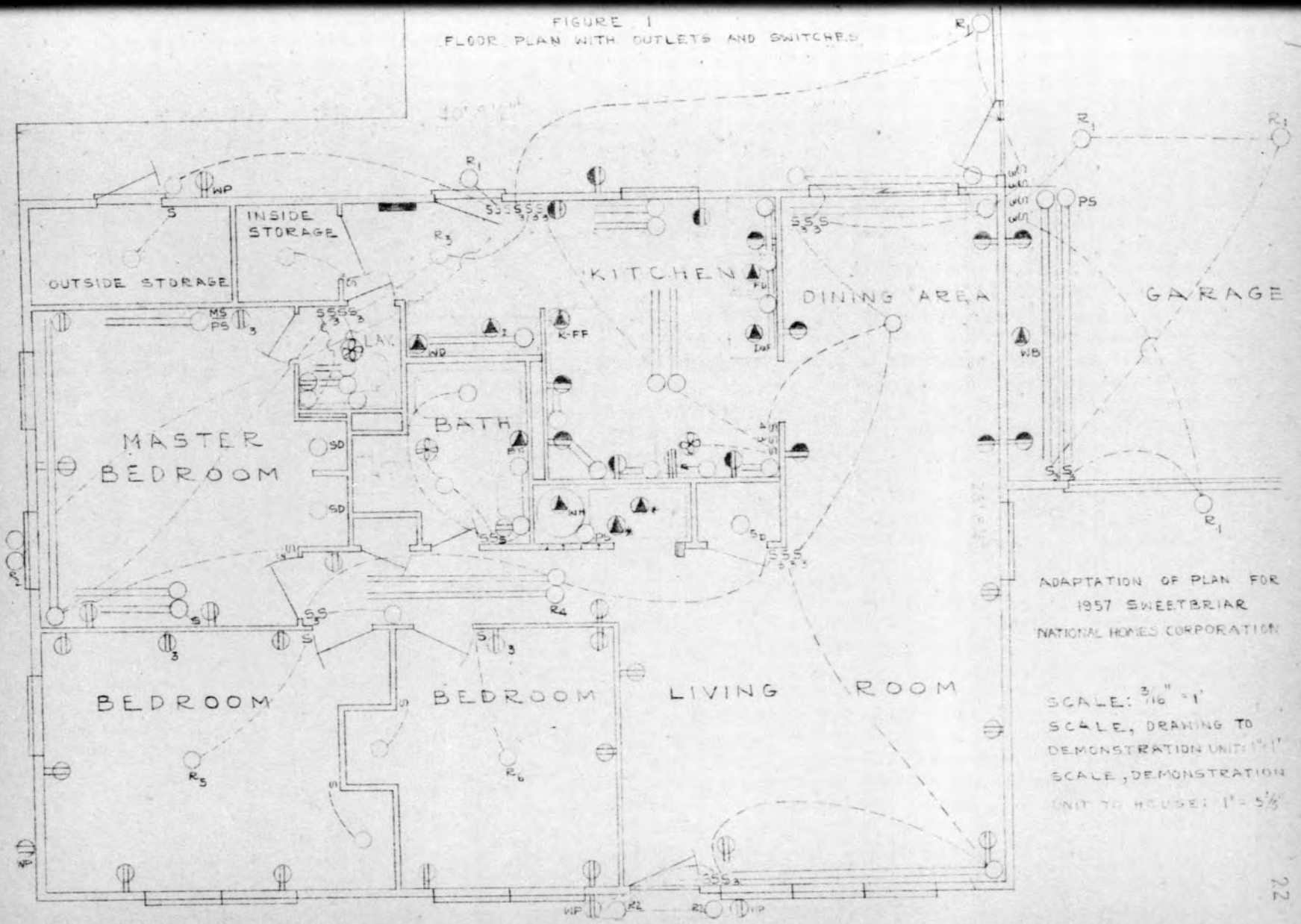
FIGURE 1
FLOOR PLAN WITH OUTLETS AND SWITCHES

FIGURE 1 OVERLAY CIRCUIT PLAN

ADAPTATION OF PLAN F
1957 SWEETBRIAR
NATIONAL HOMES CORPORATI

SCALE: 3/16" = 1'
SCALE, DRAWING TO
DEMONSTRATION UNIT
SCALE, DEMONSTRATI
UNIT TO HOUSE 1/8" =

FIGURE 1
FLOOR PLAN WITH OUTLETS AND SWITCHES

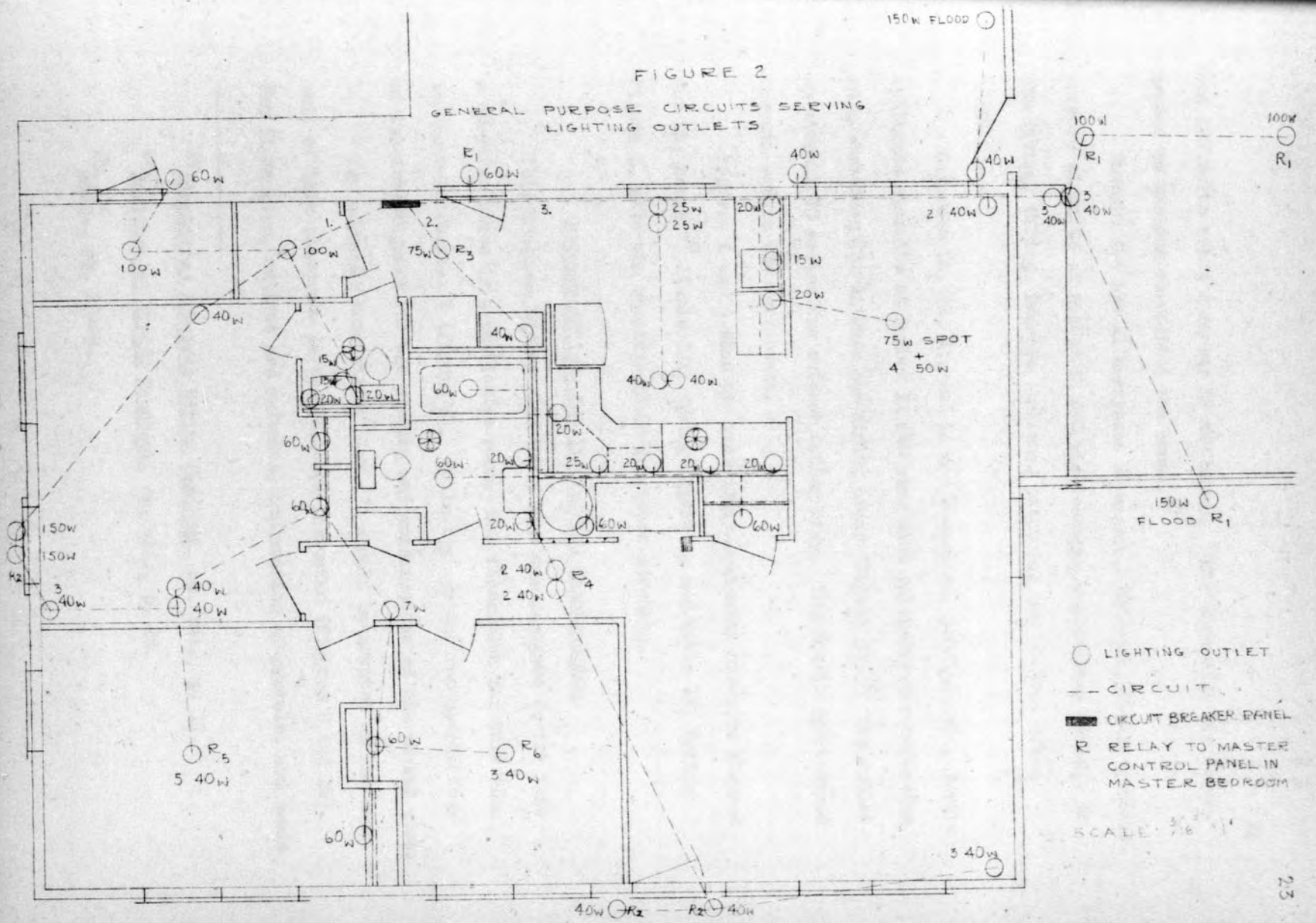


ADAPTATION OF PLAN FOR
1957 SWEETBRIAR
NATIONAL HOMES CORPORATION

SCALE: 3/16" = 1'
SCALE, DRAWING TO DEMONSTRATION UNIT: 1" = 1'
SCALE, DEMONSTRATION UNIT TO HOUSE: 1" = 5 1/3'

FIGURE 2

GENERAL PURPOSE CIRCUITS SERVING LIGHTING OUTLETS



and 120 volts using 2 number 12 AWG wires. This wire size was recommended as minimum throughout the house.[47]

Numbers 4-9 and 11 designate 20-ampere, 120-volt, 2-wire general-purpose circuits of number 12 AWG wire serving convenience outlets in the living, dining, bedroom, hallway, bathroom, and outdoor areas (Figure 3).

Circuits 10, 12, 13, and 14 are 20-ampere, 120/240-volt, 3-wire appliance circuits of number 12 AWG wire with split-wired receptacles as recommended for kitchen and dining areas (Figure 3).[48] One outlet on circuit 13 serves the outdoor eating area. The fourth split-wired circuit serves the work bench.

Figures 4 and 5 show the individual-equipment circuits planned for the house.[49] Table III, facing Figure 4, and Table IV, facing Figure 5, give the specifications for these circuits.

Recommendations for Placing and Construction

This adequate wiring plan for a home was designed to fit into a specific place in a particular room. The floor plan for this room is shown in Chapter V (Figure 8). Following are the recommendations of the investigator for the placing and construction of the wiring plan.

The adequate home wiring plan (J) should be mounted on the west wall of this classroom in the position indicated (Figures 8 and 12). The floor plan, outlets and switches, explanation of symbols, and scale

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[47] Simplified Electric Wiring Handbook, op. cit., p. 11.

[48] Residential Wiring Handbook, op. cit., p. 28.

[49] Ibid., pp. 28-29.

FIGURE 3

APPLIANCE CIRCUITS AND GENERAL PURPOSE CIRCUITS SERVING CONVENIENCE OUTLETS

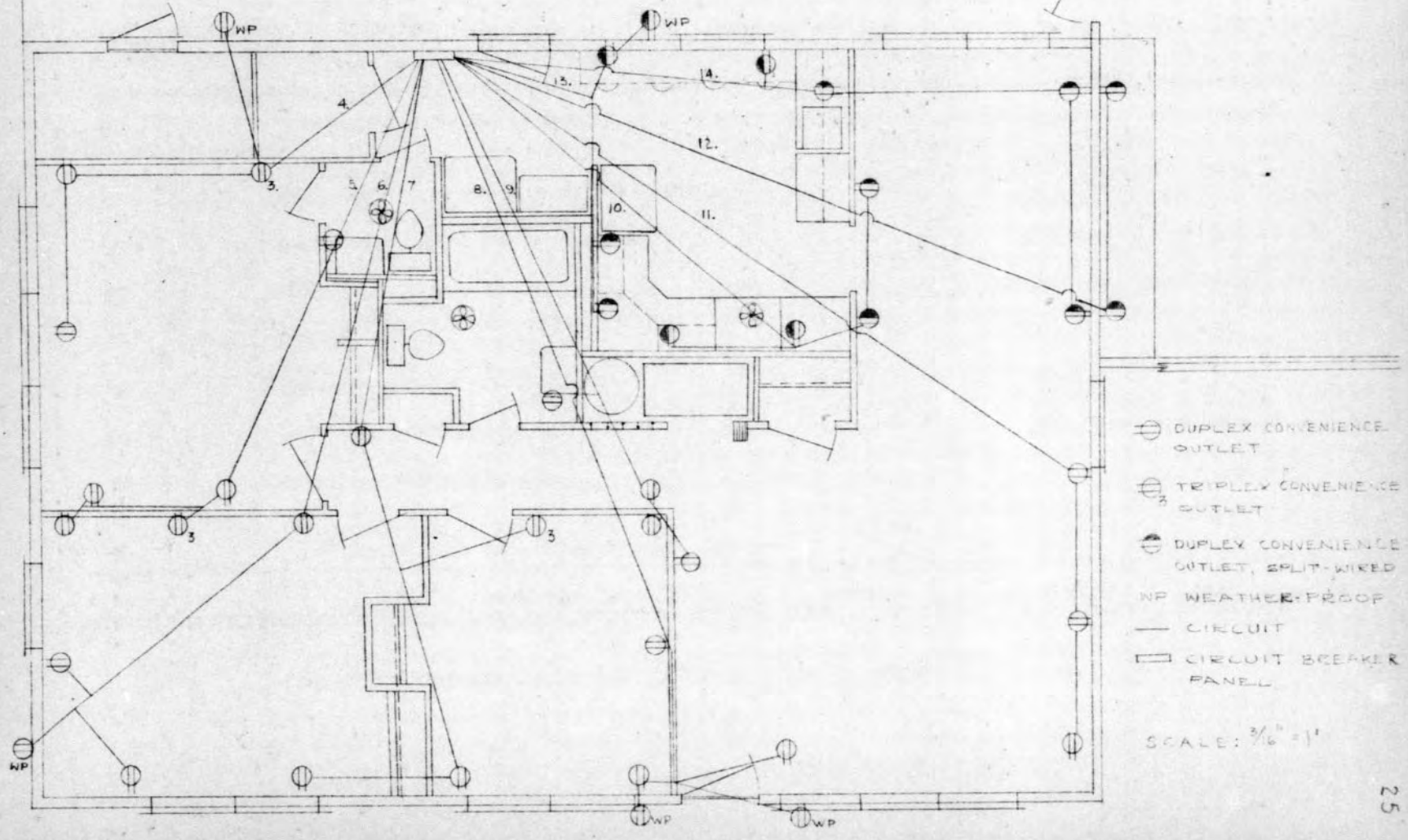


TABLE III

SPECIFICATIONS FOR INDIVIDUAL-EQUIPMENT CIRCUITS SERVING APPLIANCES

Circuit number	Equipment Served	Amperage	Voltage	Wire Size (AWG)
15	Ventilating fans (one in each bathroom; one over range in kitchen)[1]	20	120	12
16	Combination washer-dryer[2]	40	120/240	8*
17	Built-in bathroom heater[2]	20	120	12
18	Water heater (quick recovery)[3]	30	240	10
19	Ironer[1]	20	120	12
20	Range[2]	50	120/240	6*
21	Combination refrigerator-freezer[4]	20	120	12
22	Work bench (for tools requiring higher voltage)[5]	20	240	12
23	Dishwasher and food disposer[2]	20	120/240	12*

1. Improving Your Home's Housepower (New York: National Adequate Wiring Bureau, [n.d.]).
2. Residential Wiring Handbook (New York: Industry Committee on Interior Wiring Design, 1954), pp.28-29.
3. Specification Sheet G - 33 - CL (Chicago: Hotpoint Company, 1958), p. 6.
4. Specification Sheet F - 42 - CL (Chicago: Hotpoint Company, 1956), p. 2.
5. Better Homes and Gardens, "Housepower in the Home" ([n.p.] : Meredith Publishing Company, 1957), p. 21.

* These appliances, operating on 120/240 volts, require three wires.

FIGURE 4

INDIVIDUAL-EQUIPMENT CIRCUITS SERVING APPLIANCES

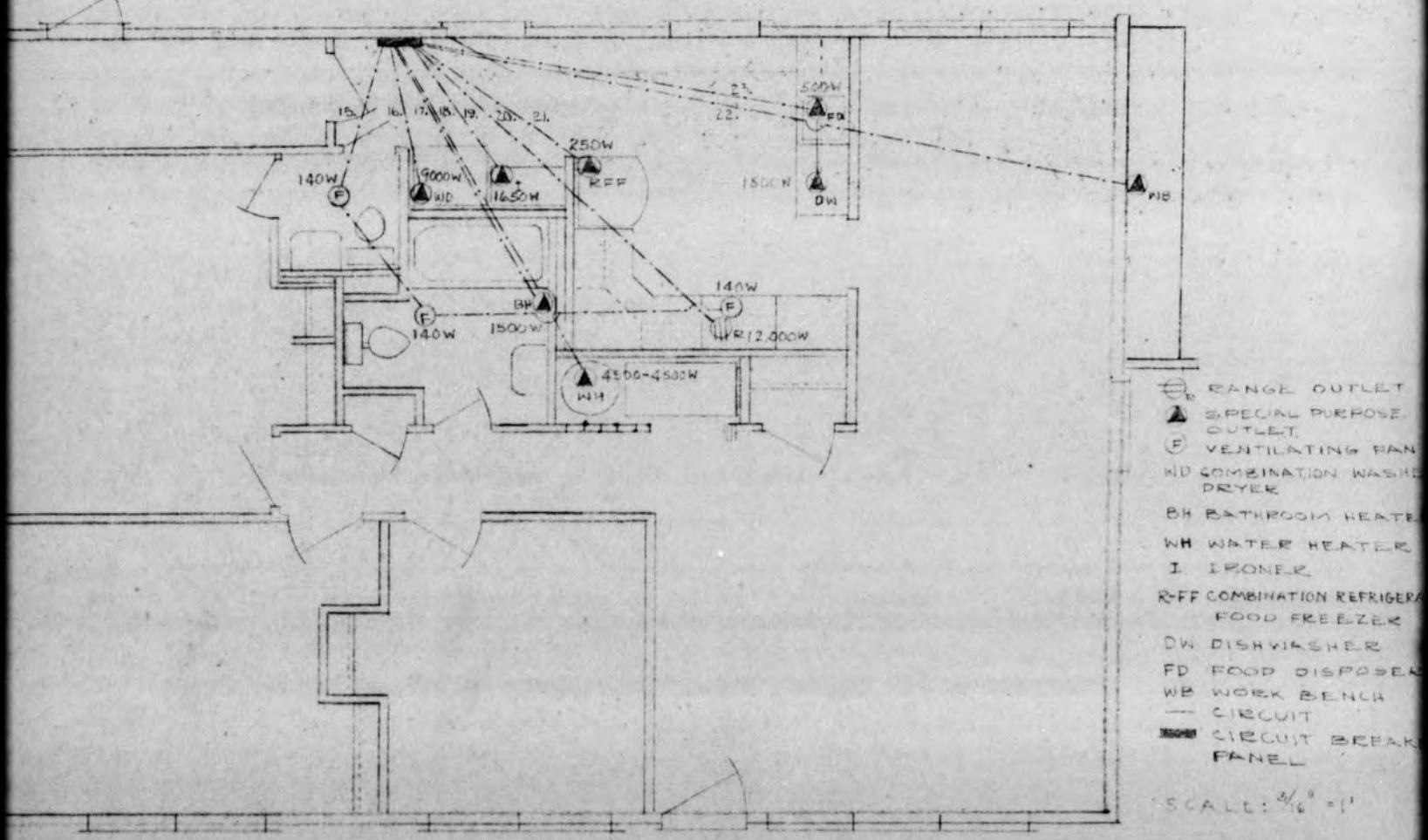


TABLE IV

SPECIFICATIONS FOR INDIVIDUAL-EQUIPMENT CIRCUITS SERVING HEATING AND COOLING SYSTEMS

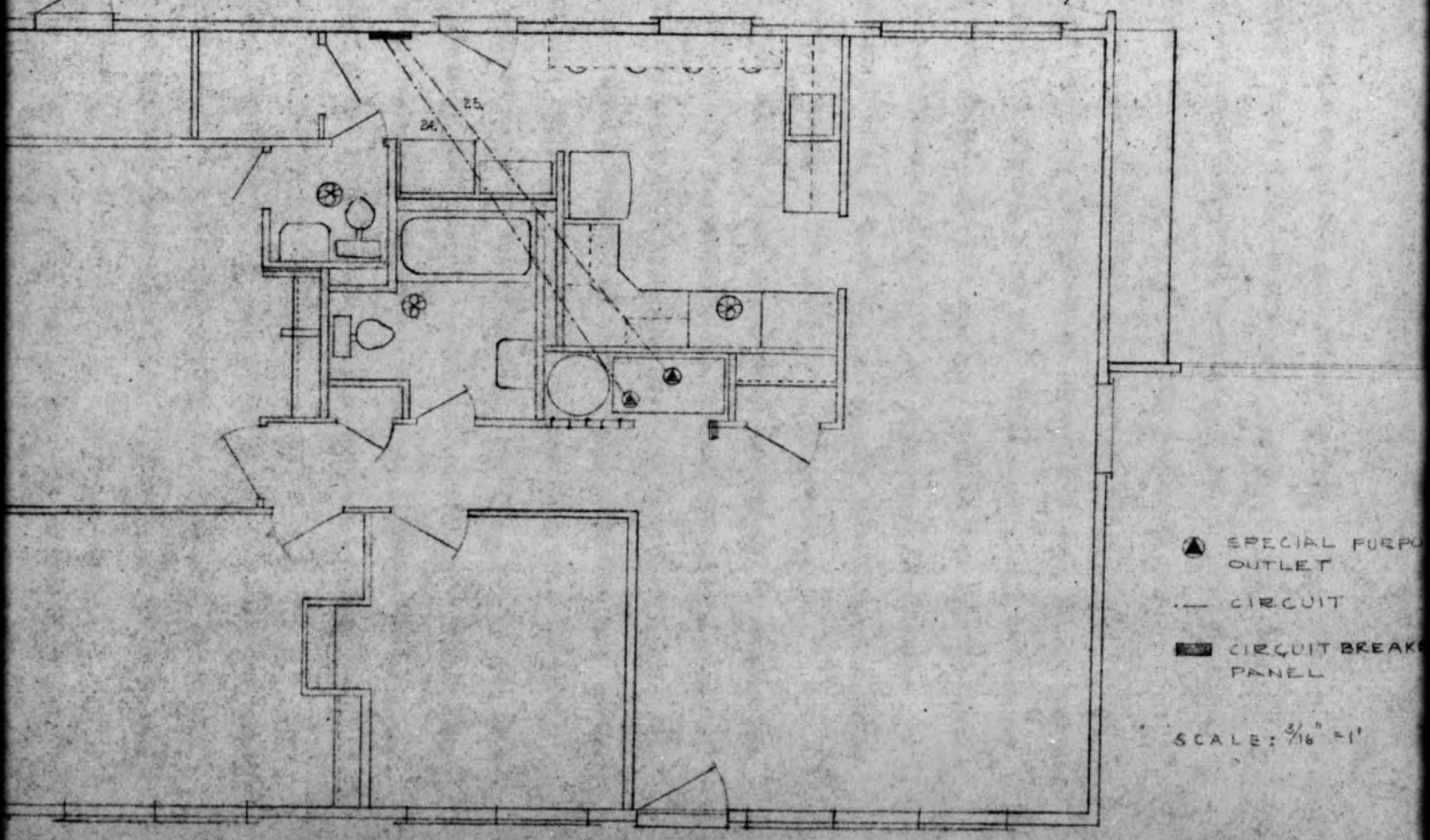
Circuit number	Equipment Served	Amperage	Voltage	Wire Size (AWG)
	Alternate A*			
24	Resistance heaters (cut in for supplementary heating)	60	240	6
25	Heat Pump	60	240	6
	Alternate B**			
24	Central air conditioning system	40	240	8
25	Fuel-fired furnace	20	120	12

* Product Utilization Data WT 44 C1, 2 and WT 64 C1 (Bloomfield, New Jersey: Weathertron Department, General Electric Company, 1957), p. 8.

** Residential Wiring Handbook (New York: Industry Committee on Interior Wiring Design, 1954), pp. 28-29.

FIGURE 5

INDIVIDUAL EQUIPMENT CIRCUITS FOR HEATING AND COOLING SYSTEMS



(Figure 1) should be painted on hardboard or some similar type of rigid, durable board which would resist warping and which could be painted. The background should be painted light gray and the plan black so that the unit may be used in television programs.

Actual wires of the sizes previously specified should be used to show their entrance into the house through the meter (F) and circuit breaker panel (G) (Figures 8 and 12). These wires should be enclosed in transparent plastic cable or conduit. They should enter the house at the service entrance indicated on the drawings. The circuits should be actual wires of sizes also previously specified and attached to the board according to the plans given (Figures 2-5).

At each outlet a small incandescent lamp should be attached to the wire so that when a circuit is switched on, all outlets on the circuit will be lighted. White lamps should be used for lighting outlets, green lamps for convenience outlets, blue lamps for split-receptacle appliance outlets, and red lamps for special-purpose outlets. If small colored lamps are not available, white lamps may be dyed with opaline lamp color, which may be commercially obtained.[50] Alternating current of low voltage should provide power for lighting the lamps. The circuits should be individually controlled from a master panel located at the front of the classroom.

The wiring demonstration unit should be housed in a wooden frame 8 inches wide at the top, 4 inches wide at the other three sides, and of sufficient thickness to be substantial (Figures 6 and 7). The wiring

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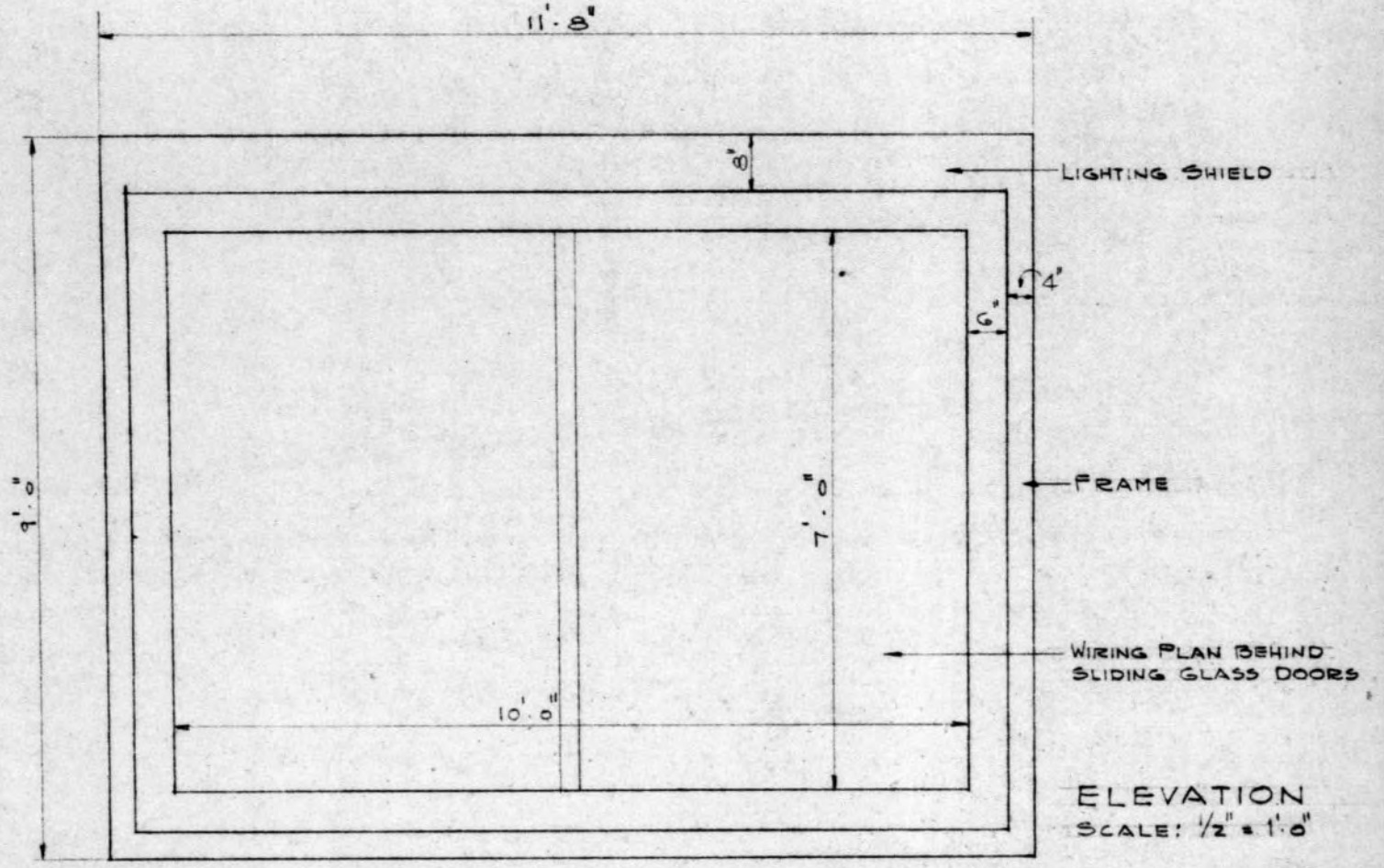
[50] Lamp color is available from Roscoe Laboratories, 29 Moore Street, Brooklyn 6, New York.

FIGURE 6

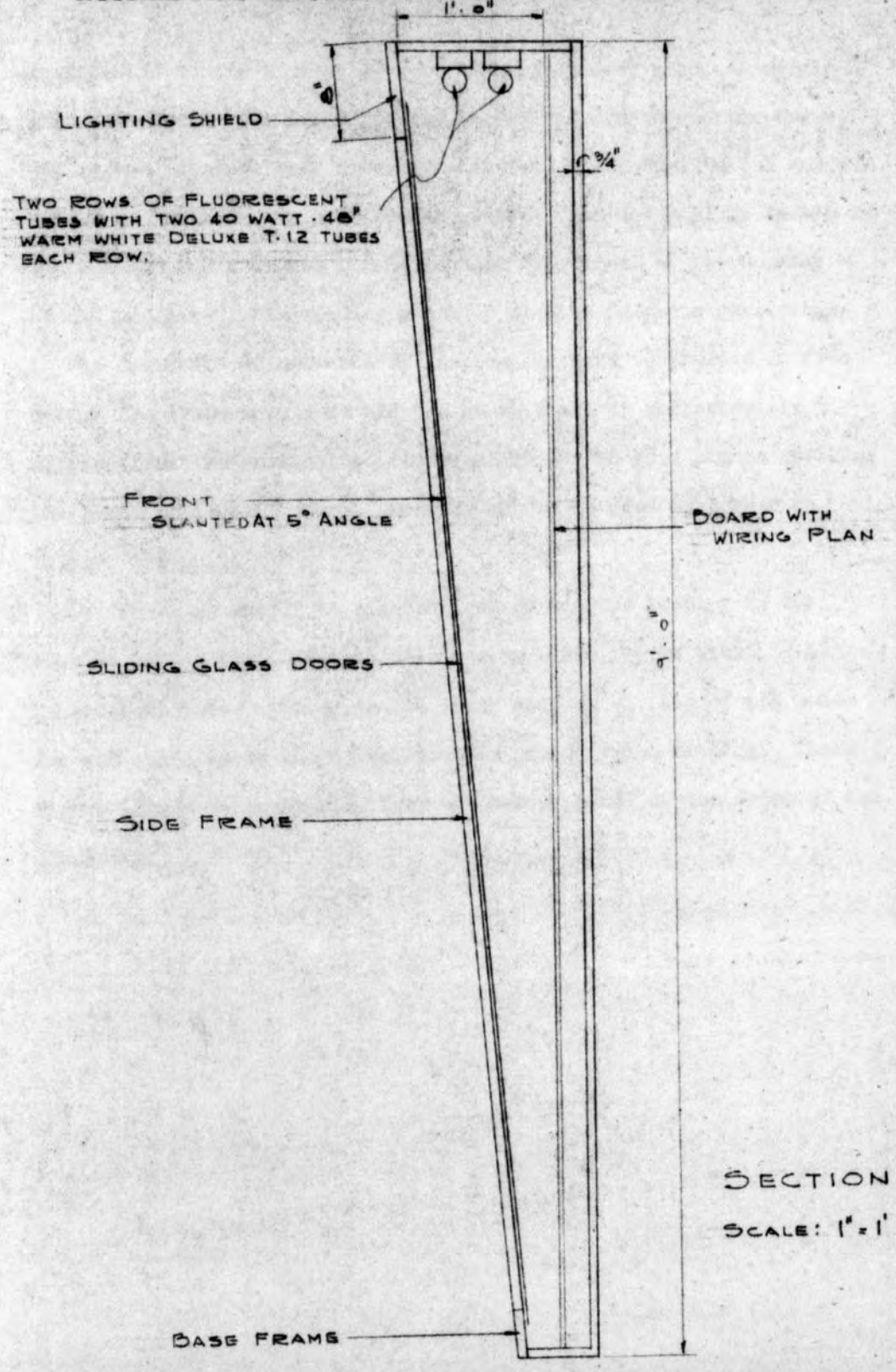
HOUSING FOR ADEQUATE HOME WIRING DEMONSTRATION UNIT



ELEVATION
SCALE: 1/2" = 1'-0"

FIGURE 7

HOUSING FOR ADEQUATE HOME WIRING DEMONSTRATION UNIT



design will occupy a space 10 feet wide and 7 feet high. A margin of 6 inches should be allowed between the wiring design and the frame, making the outside frame dimensions 11 feet 8 inches in width and 9 feet in height. The unit should project from the wall 16 inches at the top and 6 3/4 inches at the bottom. The front of the housing should be fitted with sliding glass or plastic doors to give access to the board for adjustments or lamp changes and to protect it from dust./ The doors should lock. The front should be slanted at an angle of approximately 5 degrees from the vertical to reduce glare due to room lights striking the glass or plastic doors. Bracing should be used as needed to support the unit.

The plan should be lighted from inside the housing by two rows of two 40-watt, 48-inch deluxe warm white, rapid start, T-12 fluorescent tubes mounted on the lower side of the top of the housing and shielded by the 8 inch section of top front framing. These lights should be controlled from the master panel at the front of the classroom.

CHAPTER V

PLAN FOR DEMONSTRATION EQUIPMENT TO BE USED IN TEACHING HOME LIGHTING AND FOR ARRANGEMENT OF HOME LIGHTING AND ADEQUATE WIRING DEMONSTRATION EQUIPMENT IN A CLASSROOM

The principal source used in planning demonstration equipment to be used in teaching home lighting was See Your Home in a New Light, a publication of the General Electric Company.[51] The recipes for living-seeing activities given in this booklet have been, according to Commery and Stephenson:

> . . . carefully tested against good visual planning conditions. They represent the minimum of lighting performance in keeping with today's decorating practices, while utilizing the simplest equipment at the lowest price. Thoughtfully applied to your home, these recipes will give you answers to your lighting problems compatible with the standards set up by the Residential Lighting Committee of the Illuminating Engineering Society.[52]

"All light-conditioning recipes are based upon an essential number of lumens . . . . Lumens are, in effect, units for measuring light delivered by bulbs and tubes."[53] The G-E Lumen Counter contains "the information needed to plan a properly lighted room or home, using the General Electric Lumen Count Method as a guide." The folder

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[51] See Your Home in a New Light (3rd. ed.; Cleveland, Ohio: General Electric Company, [n.d.]).

[52] E. W. Commery and C. Eugene Stephenson, How To Decorate and Light Your Home (New York: Coward-McCann, Inc., 1955), p. 211.

[53] Lighting Fixture Guide ([n.p.] : General Electric Company, [n.d.]), p. 19.

"includes tables of recommended minimum lumens for each type of room, and the initial lumen output of each bulb and tube popularly used for residential lighting."[54]

Classroom Use

The classroom for which the demonstration equipment was planned is and will continue to be used for teaching subjects other than home lighting and wiring. For this reason the basic classroom arrangement should remain unchanged and a lighting level suitable for recitation and study should be provided.

Classroom Seating

The amount of usable student seating space will be approximately 178 square feet, allowing a three foot clearance on all sides of the room after the planned equipment has been placed around the walls. The dimensions of the seated human figure with minimum clearances, as given in Architectural Graphic Standards, are 3 feet 1 inch in depth and 2 feet 3 inches in width. These dimensions would allow twenty-six students to be seated in the room. An increase in width allowance for the seated figure to 2 feet 6 inches would allow more elbow room, which is recommended, but would decrease to twenty-three the number of students who could be seated.[55]

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[54]"Introduction of New G-E Lumen Count Method," Hi Lights, VII ([n.p.] : General Electric Company, Fall, 1957), 13.

[55]C. H. Ramsey and H. R. Sleeper, Architectural Graphic Standards (New York: John Wiley and Sons, Inc., 1947), p. 293.

For good visibility in all directions, the investigator recommends the installation of swivel tablet-arm chairs, but was unable to locate such chairs on the market. They might be similar to Pedestal Tablet-Arm Chair Number 472 of the American Seating Company. This chair has cradle-form plywood seat and back, a plywood or plastic-surface sloped tablet-arm, and an optional under-seat book rack. It is mounted on an oval steel pedestal. This chair, however, does not swivel.[56]

Light Reflectance

Light reflectance, the proportion of light reflected from a surface to the light falling on it, should be considered in choosing wall, ceiling, and floor surface finishes for the classroom.[57] Light reflectance values are important in lighting design calculations. They affect visual comfort, utilization of light, and room atmosphere. For visual comfort, "brightness ratios between task and background not greater than three to one are usually recommended." The light reflectance factor is involved in the efficiency of every lighting system since some or all of the light generated by the source is reflected from the walls, ceiling, and/or floor before it reaches the activity plane. Interior finishes of high reflectance are desirable for most rooms for a feeling of cheerfulness and efficiency.[58]

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[56] *American School and University*, Volume 26 (New York: American School Publishing Corporation, 1954-55), p. D c/1.

[57] *See Your Home in a New Light*, op. cit., p. 3.

[58] *Light and Interior Finishes* (Cleveland, Ohio: General Electric Company, [n.d.]), pp. 1-4.

The Illuminating Engineering Society recommends reflectance ranges for office, school, and industrial applications and for home applications. On the basis of these, the investigator recommends reflectance ranges suitable for both school and home use since the classroom is to be used in teaching home lighting as well as for instruction. The range of reflectance values for each area allows flexibility in choice according to the types of visual tasks carried on in the room. The recommendations are as follows:

	Recommended by IES[59]		Recommended by investigator as suitable for school and home
	Office, school, and industrial	Home	
Ceilings	80-85%	65-80%	80-85%
Walls	50-60%*	35-55%	55-60%
Floors	15-30%	15-30%	15-30%
Trim colors	30-40%		30-40%
Furniture or machines	30-40%		30-40%
Desks and bench tops	30-50%		30-50%

* 60-70% permissible in schools when entire room is finished in light tones.

The plan for this classroom includes the installation of a suspended luminous ceiling, the specifications for which would require a glossy, high-reflectance true ceiling.[60] The floor of the room already has a light finish which is within the recommended range. A neutral color with a reflectance value of fifty-five to sixty per cent is suggested for walls and woodwork.

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[59] Ibid.

[60] Committee on Residence Lighting of the Illuminating Engineering Society, Recommended Practice for Residence Lighting (New York: Illuminating Engineering Society, 1953), p. 31.

Fluorescent Tubes

Deluxe warm white tubes, designed for the residential interior,[61] are suggested for use throughout the classroom where fluorescent lighting is planned to produce the best color effect in most instances.

> All light changes color: to mar . . . or to compliment. When the lighting is from deluxe tubes, all colors are then seen in a new and full beauty.
>
> Warm deluxe tubes . . . create a warm atmosphere and blend without conflict with the light from candles and incandescent bulbs. All warm tones are enhanced: woods, especially mahogany, maple, and walnut; fabrics and wall papers; complexions of people, appearance of foods.
>
> Cool deluxe tubes are for interiors predominating in the cool colors (blues-greens) or when it is desirable to create a cool atmosphere for effect or for psychological comfort in a warm climate.[62]

Only one example of deluxe cool white lighting was included in the plan for the classroom: a row of deluxe cool white tubes was used in a cornice installation along with a row of deluxe warm white tubes. The two rows should be controlled separately to show the difference between the cool and the warm light.

Suspended Ceiling

A suspended ceiling, with the major part luminous, is recommended for the classroom.

The suspended ceiling is shown in four sections to designate differences in luminous and opaque areas and in ceiling height (Figure 8, Overlay). Sections 1 and 2 are luminous; sections 3 and 4 are opaque.

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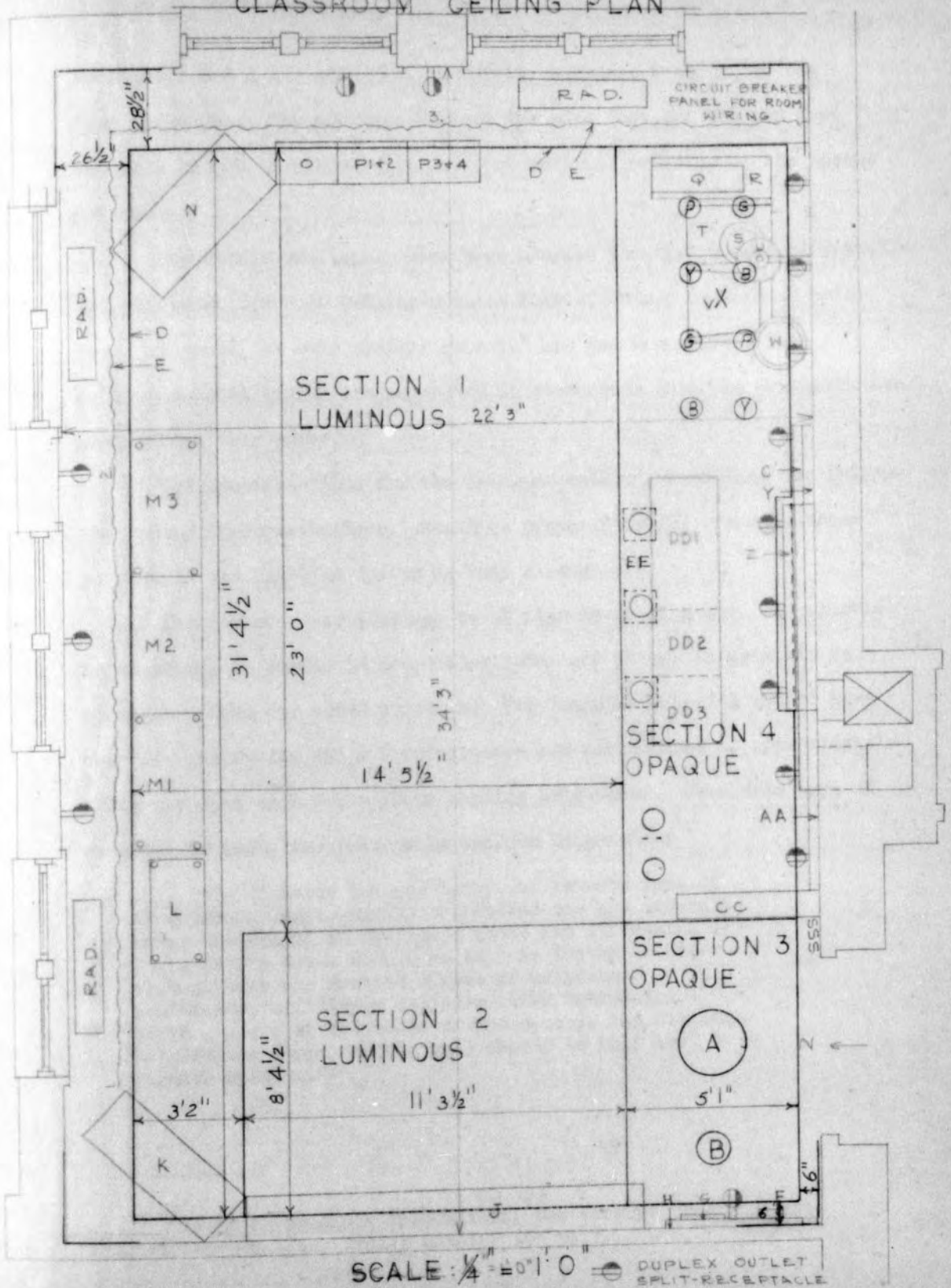
[61] *See Your Home in a New Light*, op. cit., p. 38.

[62] *Wall Lighting Guide* (Cleveland, Ohio: General Electric Company, [n.d.]), p. 8.

FIGURE 8 OVERLAY
CLASSROOM CEILING PLAN

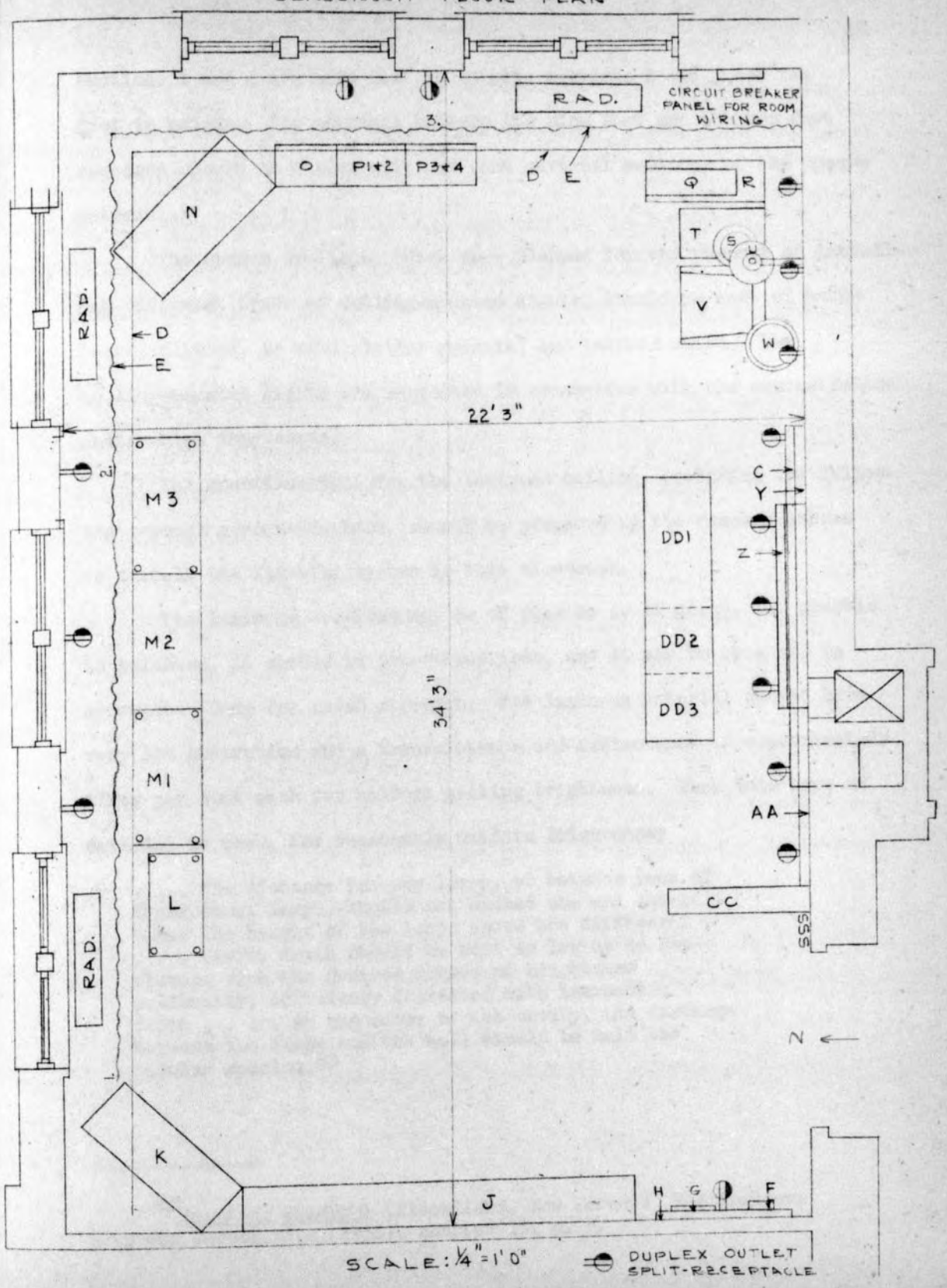


SCALE: ¼" = 0"1'0"

DUPLEX OUTLET
SPLIT-RECEPTACLE

FIGURE 8

CLASSROOM FLOOR PLAN



Sections 1 and 4 are nine feet in height; sections 2 and 3 are ten feet in height. The openings between the nine foot and the ten foot sections should be closed with one foot vertical sections of the opaque material.

The opaque sections, which were planned for the purpose of installing different types of ceiling-mounted lights, should be made of hardboard, plywood, or some similar material and painted white. The ceiling-mounted lights are suggested in connection with the demonstration units which they serve.

The specifications for the luminous ceiling, including the following general recommendations, should be prepared by the company chosen to install the lighting system in this classroom.

The luminous sections may be of plastic or of glass. If plastic is selected, it should be non-combustible, and it may be obtained in corrugated form for added strength. The luminous material should have very low absorption and a transmittance and reflectance of approximately fifty per cent each for uniform ceiling brightness. When this type of material is used, for reasonably uniform brightness:

> . . . the distance between lamps, or between rows of fluorescent lamps, should not exceed one and one-half times the height of the lamps above the diffuser . . . . Cavity depth should be kept as low as is consistent with the desired degree of brightness uniformity; efficiency decreased with increasing depth . . . . At the sides of the cavity, the distance between the lamps and the wall should be half the regular spacing.[63]

---

[63] Lighting Handbook (Bloomfield, New Jersey: Westinghouse Electric Corporation, 1956), chapter 11, p. 7.

Flurescent tubes, which generate less heat and operate more economically than incandescent lamps, should be used in the luminous ceiling installation.

Three lighting levels are suggested for the classroom. The first, 30 footcandles, is recommended by the Illuminating Engineering Society on desks and chalkboards in classrooms.[64] There is a general question as to whether this recommendation should be raised. The investigator recommends a second level, approximately 70 footcandles, and a third level, approximately 100 footcandles, which would allow the students using the classroom to compare the degree of comfort and efficiency derived from three levels.

The suspended luminous ceiling would of necessity be installed below the true ceiling to provide sufficient space for the fluorescent tubes. The reduction in ceiling height to a height approaching that of ceilings usually found in homes would be desirable since this classroom will be used in teaching home lighting. In a room as large as this one, a ceiling nine to ten feet from the floor would be in good proportion to the other dimensions and would afford a greater degree of psychological comfort than would a lower height.

The suspended ceiling was planned to extend within no less than six inches from any wall. This is in accord with the latest thought on the subject, which indicates that some space should be left open between the luminous ceiling and the walls for a feeling of greater

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[64] Ibid., chapter 5, p. 5.

spaciousness in the room. This is suggested despite the fact that an enclosed cavity would result in fewer maintenance problems since less dust could enter the cavity.[65]

The luminous ceiling should be constructed in such a way as to allow convenient access to the cavity for replacing lamps and for cleaning.

All surfaces above the luminous ceiling should be painted white for efficiency and also to reduce shadows of any obstructions. Obstructions in the cavity should be kept to a minimum.[66]

The luminous ceiling lighting should be controlled by switches just inside the entrance and to the right of a person entering the room.

The choice of a luminous ceiling for the classroom was strengthened by statements in editorials in the American School and University.

> The best type of artificial lighting is still a controversial issue. It is agreed, however, that indirect light, regardless of source, is most desirable for classrooms. In old school building where high ceilings exist, one good solution is the installation of a plastic ceiling at a nine to ten-foot level with light sources between old and new ceilings.[67]

An application of luminous ceilings in a new building was reported from the De Anza High School in El Sabrante, California. Studies were made

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[65] Ibid., chapter 11, p. 7.

[66] Ibid.

[67] Carl N. Porter and Shirley and David Aldrich, "Modernizing That Old Elementary School Building," American School and University, XXVI (New York: American School Publishing Corporation, 1954-55), 177-8.

of the comparative cost and effectiveness offluorescent lighting with skylights, incandescent lighting with skylights, and luminous ceilings with no skylights. The studies indicated a lower construction cost, a favorable total annual operation cost, and low expected maintenance costs for the luminous ceilings.

> The luminous ceiling as applied here provides high lighting efficiency and has numerous advantages from the point of view of general adaptability. The construction utilizes a corrugated plastic sheeting which is suspended from the roof structure on a steel track and conceals all structural members within the lighting chamber, thereby providing a clean sleek-looking ceiling for the room. Fluorescent lighting is concealed behind the plastic, the result being an evenly distributed light which reduces glare and shadow.
>
> Accoustical members are built into the track which supports the plastic sheeting, combining the light and sound conditioning in one installation. The use of the luminous ceiling throughout the classroom and laboratory areas is a fresh solution, providing an entire ceiling which lights up with the equivalent of soft daylight.
>
> With this decision made, we could feel that we had a lighting system of guaranteed constancy at all times of the day and year.[68]

The luminous ceiling is equally applicable to homes, as indicated in this statement by Peet and Thye:

> Emphasis at present is directed toward raising the level of the overall illumination in a room to such an extent that local lighting will no longer cause spotty areas of light against a somewhat dim background. Luminous ceilings solve this problem in a very satisfactory manner.[69]

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[68] John Carl Warnecke, "The De Anza Design: An American Heritage Defined," American School and University, XXVI (New York: American School Publishing Corporation, 1954-55), 253-62.

[69] Louise Jenison Peet and Lenore Sater Thye, Household Equipment (4th ed.; New York: John Wiley and Sons, Inc., 1955), p. 407.

Ceiling Fixtures

Examples of close-to-ceiling fixtures are suggested for the opaque ceiling panel over the entrance to the room (Figure 8, Overlay, Section 3). One fixture (A) should illustrate the qualities of good design given below. This fixture should be an example of a center fixture in an average sized room (125 to 225 square feet) and should contain four 50-watt lamps or, preferably, five 40-watt lamps with a shield at least 17 inches in diameter.[70] Another fixture (B), with the same number and type of lamps in the same positions but with the shield too small and too close to the lamps, would show the contrast in attractiveness and in visual comfort between a well-designed and a poorly-designed unit. These fixtures should be separately controlled from the master panel at the front of the classroom.

The usefulness of a lighting fixture is determined by its ability to control and distribute light. There should be adequate shielding which detracts neither from the design of the fixture nor from the quality and quantity of light. The shield should be sufficiently large to conceal the lamps from view in any direction. A translucent shield should be slightly curved at the outer edge and approximately three-fourths inch, or more, from any lamp to prevent unpleasant bright spots. It should be of a material that is highly diffusing but not unnecessarily dense. Flashed opal, ceramic-enameled glass, or some plastics may be generally used; etched crystal, and configurated and frosted glass are suitable only for fluorescent lamps and very low-wattage incandescent lamps.

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[70] *See Your Home in a New Light*, op. cit., p. 28.

A shallow shield for close-to-ceiling mounting may be used with incandescent lamps horizontally placed in multiple sockets to provide a spread of light over a wide area.[71]

Wall Lighting

Wall lighting can increase the apparent size of a room and increase the beauty and interest of wall designs and colors. Wall lighting generally used in homes may be in three forms:

(1) A valance gives upward and downward light and is wall-mounted over windows and draperies or over the entire length of a wall for general lighting.

(2) A bracket gives upward and downward light and is mounted on interior walls for such purposes as highlighting an area or providing functional lighting for an activity center.

(3) A cornice gives only downward light and is ceiling-mounted over windows and draperies or over the entire length of a wall for general lighting.[72]

Two of the three types of wall lighting are recommended for use in the classroom. Valance lighting was omitted since its use was prohibited by the plan for the luminous ceiling. Valance lighting is mounted at least ten inches below the ceiling, usually over windows. It must be open both at the top and at the bottom of the faceboard. The use of the suspended luminous ceiling, which was planned to extend below the tops of the windows, would make it impossible to mount a lighting unit ten

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[71] Ibid., p. 5.

[72] Wall Lighting Guide, op. cit., pp. 2-3.

inches below the ceiling without having windows visible above it. The investigator recommends that valance lighting be illustrated in some other location, as in a home management house.

A wall-bracket (C) 10 feet 9 inches in length is recommended to light the chalkboard (Figures 8 and 9). The bracket faceboard should be 6 inches in depth and mounted 6 inches from the wall, with its lower edge at the level of the upper edge of the chalkboard frame, or 7 feet 1 inch from the floor (Figure 10). The channel should be mounted on the wall centered behind the faceboard (to equalize upward and downward light[73]) with the center of the tubes 3 inches from the wall.[74]

Lighted cornices (D) are recommended for the window walls, to be mounted over draperies (E) (Figures 8, 11, and 12). Since the suspended ceiling makes it impossible to mount the cornices directly on the true ceiling of this classroom, they should be supported from the true ceiling and/or the wall and mounted flush with the edge of the luminous ceiling, being fitted tightly against this edge to prevent light leaks over the faceboard.

The cornice over the north wall (Figure 11) should be constructed so that the faceboard is placed 6 inches from the draperies and the channel is placed with the tube centered 4 inches from the draperies (Figure 10). The faceboard should be 9 inches in depth, and painted white on the inside and the wall color on the outside.[75]

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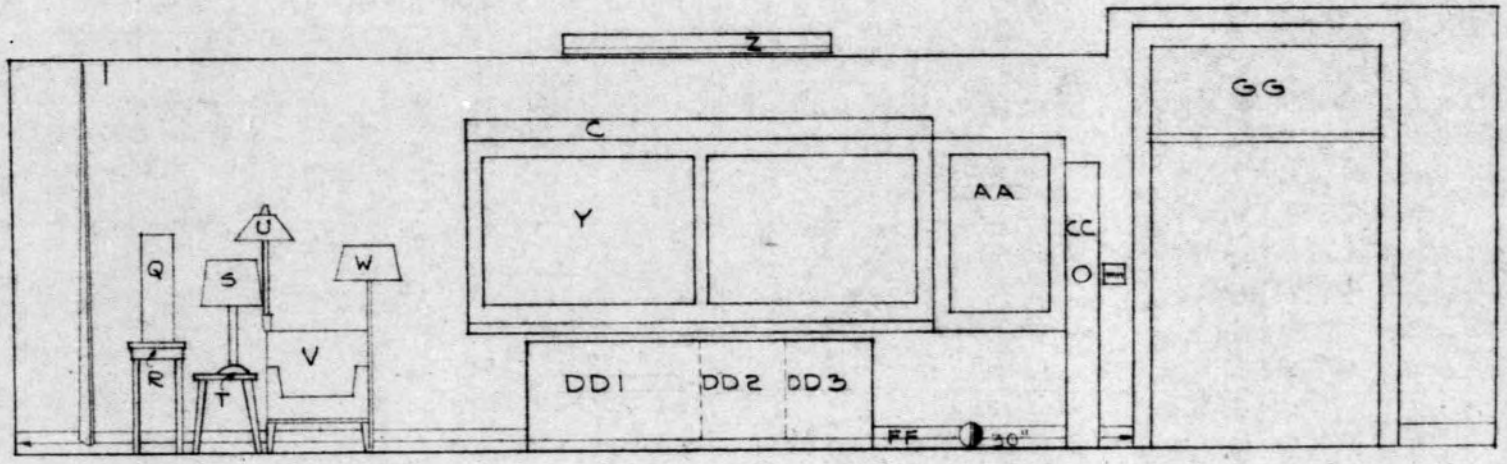
[73] Ibid., p. 3.

[74] See Your Home in a New Light, op. cit., p. 17.

[75] Specifications given for cornice installations are: width of faceboard, 6 inches minimum; distance between wall and faceboard, 6 inches minimum; distance between wall and tube center, 3½ to 4 inches. See Your Home in a New Light, op. cit., p. 19.

FIGURE 9

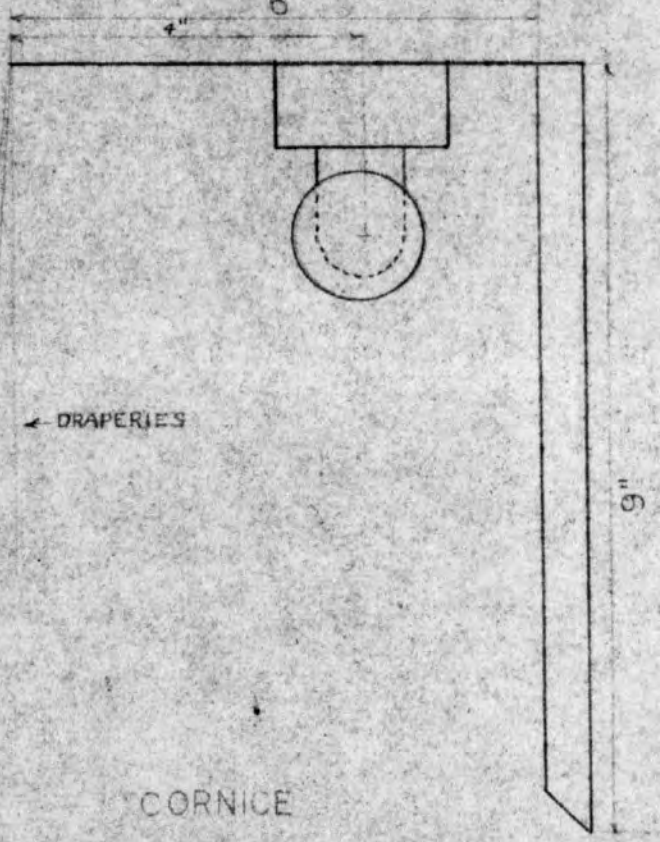
SOUTH WALL ELEVATION



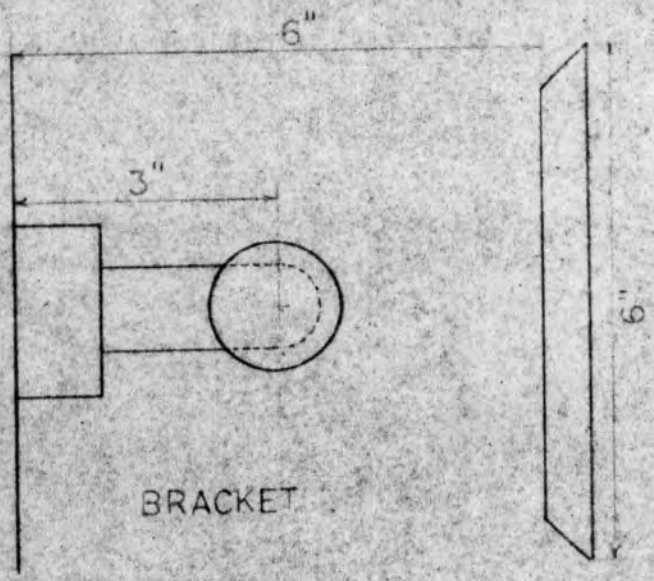
SCALE: 1/4" = 1'-0"

30" MULTI-OUTLET ASSEMBLY
DUPLEX OUTLET EVERY 30"

FIGURE 10
WALL LIGHTING DETAILS



CORNICE

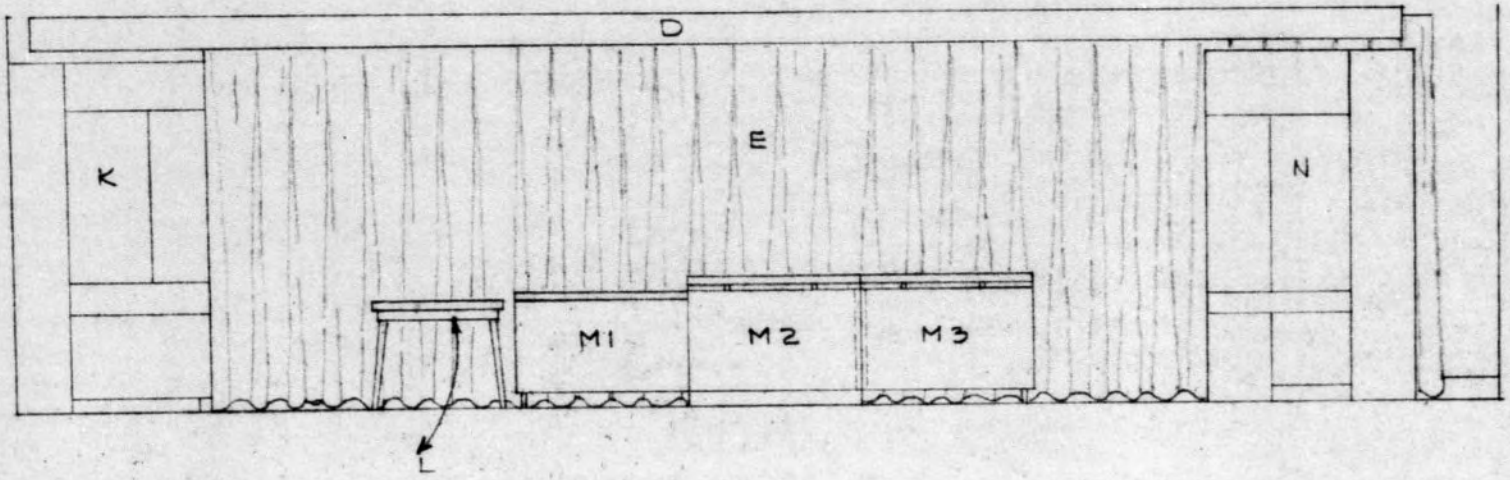


BRACKET

SECTION
SCALE ½ SIZE

FIGURE 11

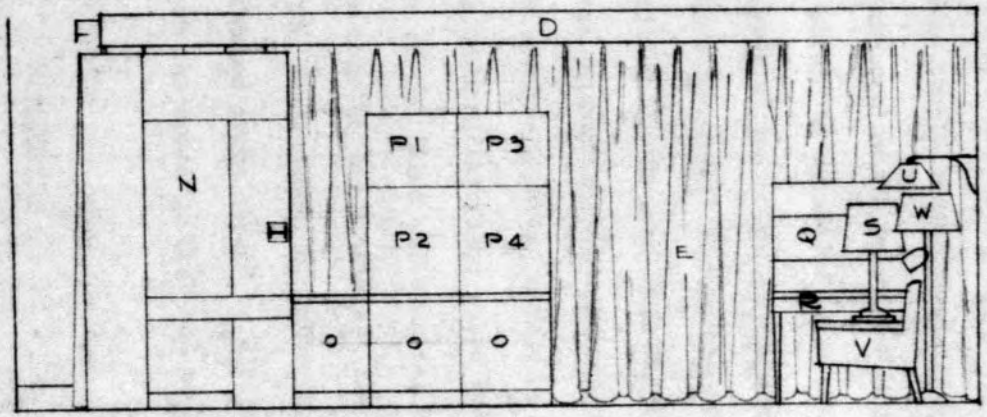
NORTH WALL ELEVATION



SCALE: 1/4" = 1'-0"

FIGURE 12

EAST WALL ELEVATION



SCALE: 1/4" = 1'-0"

The cornice over the east wall (Figure 12) was planned to illustrate the difference between deluxe warm white and deluxe cool white fluorescent lighting. It should be constructed the same as the cornice over the north wall, except that an additional 2 inches should be allowed between the channels and the draperies so that a second row of channels may be mounted behind the first row. Deluxe cool white tubes should be used in the second row. The two rows should be separately controlled so that the effects of the different types of light may be compared. They should have dimmer controls to illustrate variation in the level of light from a source for different activities in the same room and to allow observation of combinations of different proportions of warm and cool deluxe light.

The bracket and the cornice lighting should be controlled from the master panel. In both types of lighting, white sockets should be placed at the extreme ends of the baked white enamel channels so that the T-12 tubes may be as close together as possible. The channels should be fitted end to end, using the least number of tubes to fit the length of the installation. Any unlamped space should be divided equally at the ends of the faceboard, with the space at each end no more than 9 inches in length.[76]

Draperies

Draperies (E) are recommended for the window walls to soften the appearance of the room, to darken the room for lighting demonstrations, and to obscure the black-out shades used to darken the room for the use of projection equipment (Figures 11 and 12). The draperies should have

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[76] Ibid., p. 16.

approximately the same light reflectance value as the wall finish. Any type of drapery heading may be used provided hooks are attached at the top of the fabric and headings draw evenly so that no part of the fabric falls in front of the tubes to obstruct light.[77] However, box or cartridge pleats would lie flatter than French pleats. The pull-cords should be located at points 1, 2, and 3 (Figure 8). To save time in opening and closing and to minimize access problems, two sets of pull-cords should be located at points 2 and 3 for control of draperies on both sides of these points.

The draperies should extend the full length of the east wall and along the north wall to the permanent equipment in the west corner. They should be mounted 18 inches from the walls to clear the radiators by 6 inches. The cornice support should be constructed so that the draperies may also be mounted on it.

Wiring Demonstration Equipment

The wiring demonstration equipment was planned for the west wall of the classroom (Figures 8 and 13). The unit showing a wiring plan for a home (J, described in Chapter IV) is centered on this wall. The meter (F) and the circuit breaker panel (G) are on the south side of this unit, centered 4 feet 8 inches from the floor. This height, at the eye level of a slightly shorter than average woman, was felt to be suitable because it would be easier for a tall person to see an object at a lower level than for a short person to see an object above her eye level.

The meter was included in the plan to show the place of a meter in a wiring system and to provide opportunity for reading a meter in operation. The use of low-voltage current and of small lamps instead of

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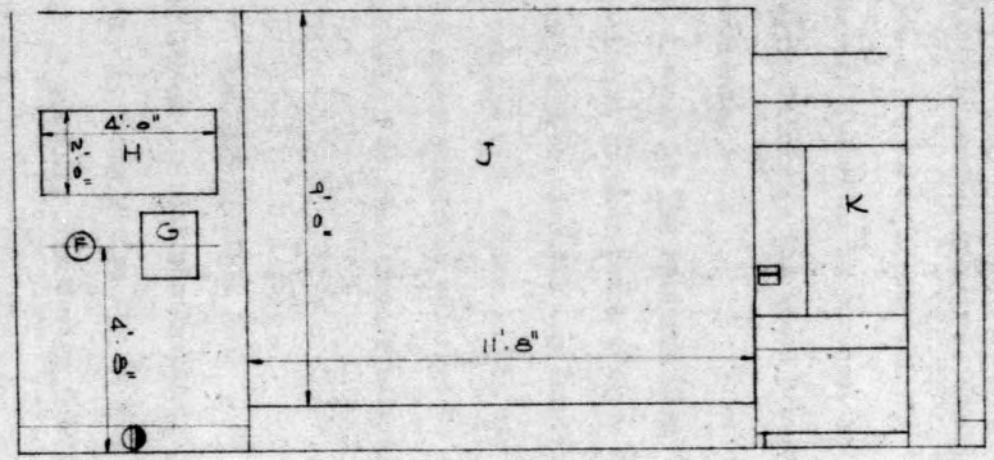
[77] Wall Lighting Guide, op. cit., p. 7.

FIGURE 13

WEST WALL ELEVATION



SCALE: 1/4" = 1'-0"

DUPLEX OUTLET
SPLIT-RECEPTACLE

actual equipment on the circuits would cause the meter to show a use of current insignificant in proportion to that consumed in a home.

The circuit breaker panel was planned to illustrate the following protective equipment: a 200-ampere main circuit breaker for disconnecting the entire wiring system, circuit breakers of appropriate ratings for each of the twenty-five specified circuits, and three additional 20-ampere circuit breakers for extra circuits to supply current for future needs.[78] Grouping the circuit breakers according to purpose, as all those protecting lighting circuits, and using labels in the space provided would demonstrate a panel planned for convenience.

A reproduction of a chart in The Anaconda Wire (H) is mounted just above the meter and the circuit breaker panel (Figure 8). It illustrates how wires of too high gauge and/or circuits too long result in excessive voltage drop, which affects the time factor in the use of heating appliances (Figure 14).[79] The chart should be enlarged to approximately 2 feet by 4 feet, painted on hardboard or some similar material, and framed under glass.

Bathroom Lavatory Unit

In the north-west corner, a bathroom lavatory unit (Figures 8, 11, and 13, K) illustrates the lighting recipe for shaving or make-up at the bathroom mirror (Figures 15 and 16). The design follows closely a General

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[78] Residential Wiring Handbook, (New York: Industry Committee on Interion Wiring Design, 1954), p. 29.

[79] "Branch Circuits," The Anaconda Wire, XIV (New York: Anaconda Wire and Cable Company, September, 1955), 4.

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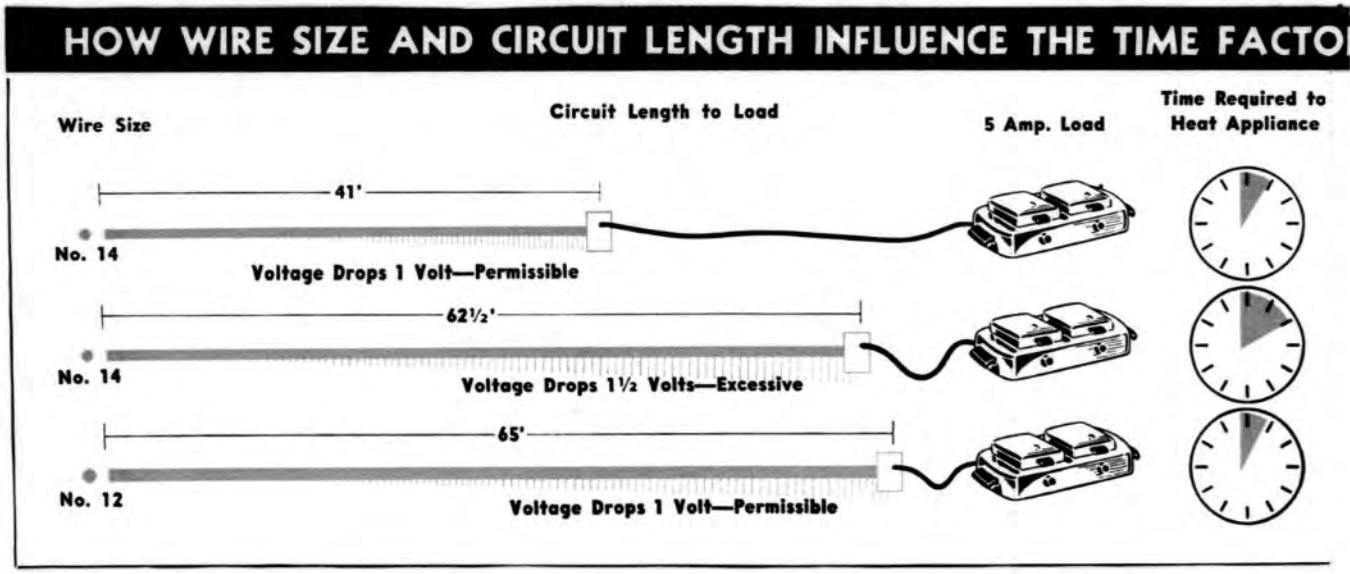
[79] "Branch Circuits," The Anaconda Wire, XIV (New York: Anaconda Wire and Cable Company, September, 1955), 4.

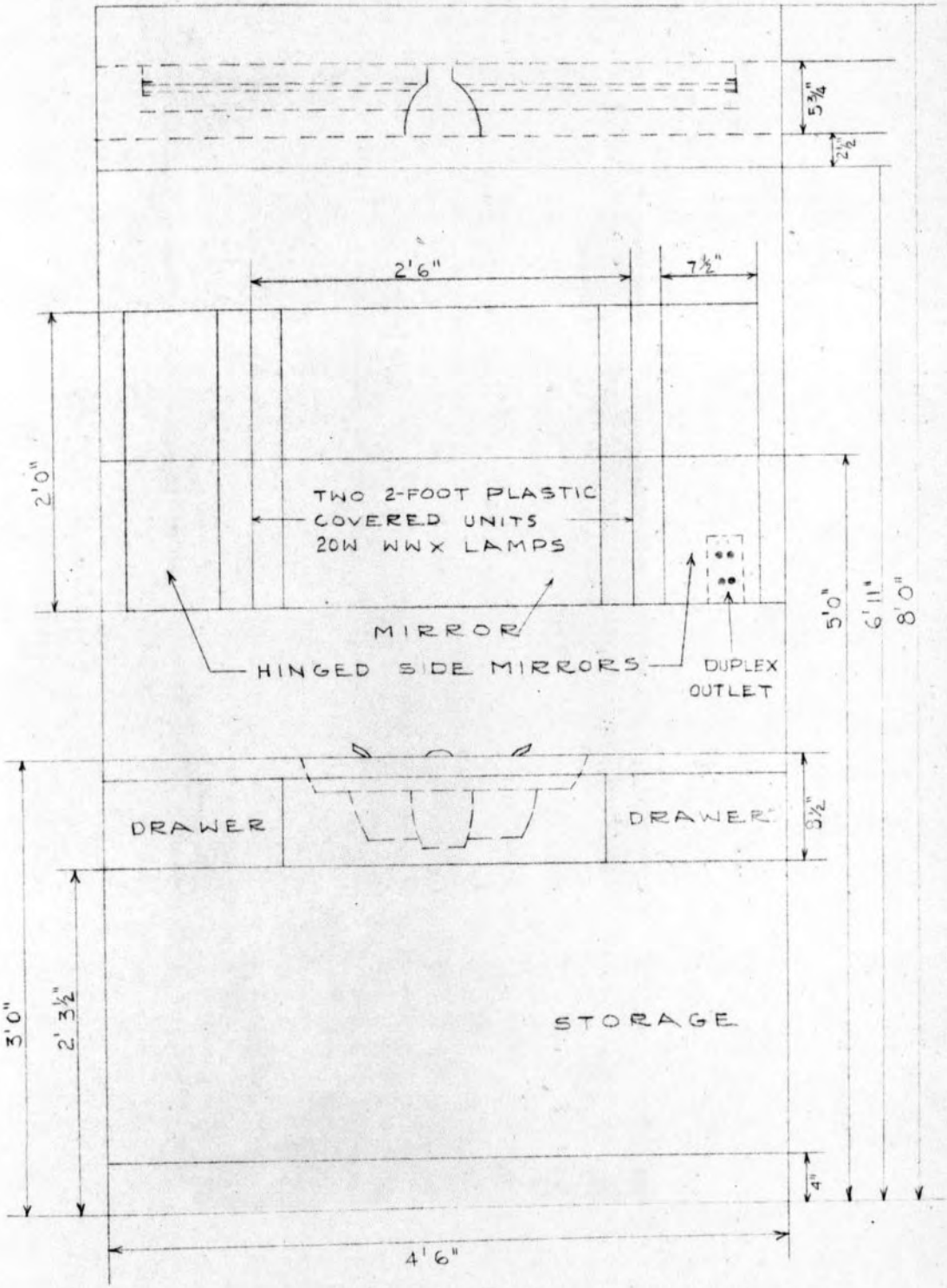
FIGURE 14



* "Branch Circuits," The Anaconda Wire, XIV (New York: Anaconda Wire and Cable Company, September, 1955), 4.

FIGURE 15

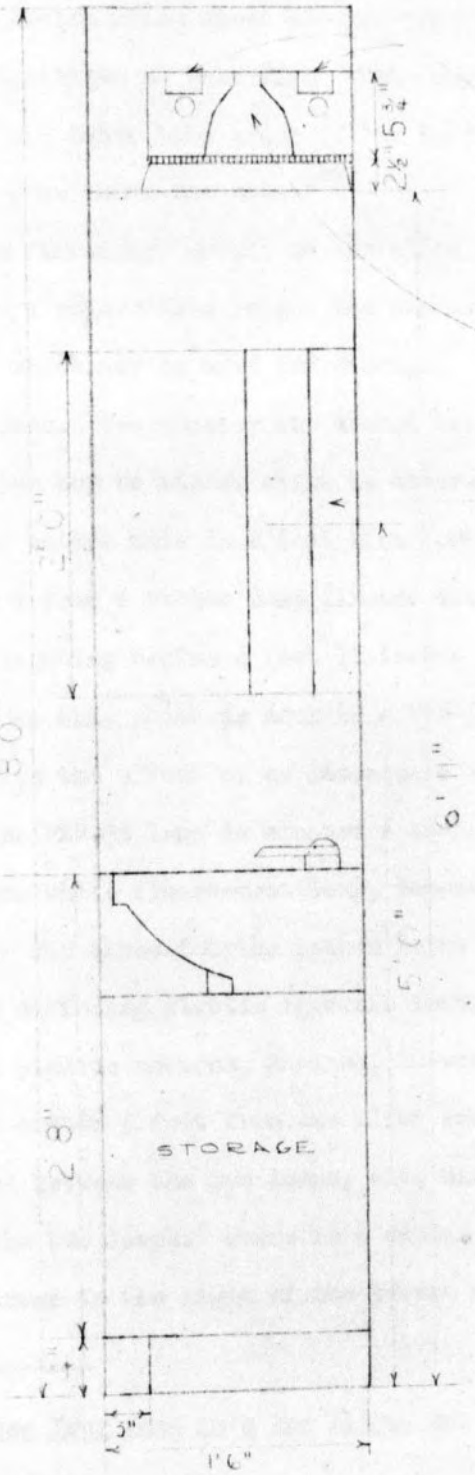
BATHROOM LAVATORY UNIT



ELEVATION

SCALE: 1" = 1'0"

FIGURE 16
BATHROOM LAVATORY UNIT



SECTION
SCALE: 1" = 1'0"

Electric specification sheet showing the plan of the unit installed in the Lighting Institute at Nela Park. This application provides "ample light on top of the head, both sides of the face, and (by reflection from the washbowl) even under the chin."[80]

The lavatory should be installed 3 feet from the floor, which is considered a comfortable height for the average person,[81] and enclosed in a cabinet which may be used for storage. Toe space is 4 inches high and 3 inches deep. The counter top around the lavatory and the wall surface from counter top to mirror might be covered with laminated plastic.

The entire unit is 8 feet high (outside dimension), 4 feet 6 inches wide, and 1 foot 6 inches deep (inside dimensions). The shielding for the overhead lighting begins 6 feet 11 inches from the floor. At a level 8¼ inches above this point is mounted a PAR-38 incandescent lamp which demonstrates the effect of an inadequate single overhead source. On each side of the PAR-38 lamp is mounted a 48-inch, 40-watt, rapid start, T-12 deluxe warm white fluorescent lamp, demonstrating adequate overhead lighting. Five and three-fourths inches below the mounting surface there is a half-inch diffusing plastic eggcrate louver. To light the sides of the face, two plastic covered, 24-inch, 20-watt deluxe warm white lamps are placed on center 5 feet from the floor and 2 feet 6 inches apart. A mirror is mounted between the two lamps, with hinged 7½-inch mirror extensions outside the two lamps. There is a duplex convenience outlet behind the hinged mirror to the right of the person using the unit.

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[80] See Your Home in a New Light, op. cit., p. 33.

[81] Your Farmhouse, Planning the Bathroom (Washington: United States Department of Agriculture, October, 1952), p. 5.

Lighting in this unit should be locally controlled.

Units for Use and Storage of Projection Equipment

Along the north wall, a series of units (L and M) were planned primarily for use and storage of projection equipment (Figures 8 and 11).

The investigator recommends the purchase of a projection lightmeter which would allow the entire group using the classroom at a given time to see projected on the screen the readings of the lightmeter taken during demonstrations. Also recommended is the purchase of a set of thirty-two Kodachrome 2 by 2-inch colored slides of the lighting recipes given in See Your Home in a New Light.[82]

The table on lock-type rollers (L) may be rolled into a position convenient for projection and the surface used for the operation of slide, filmstrip, or moving picture projectors, or for a projection lightmeter. It may also serve as a portable work or demonstration surface elsewhere in the room. The dimensions of the table are 2 feet 6 inches in height, 3 feet in length, and 1 foot 6 inches in width.

The first cabinet section (M1) was planned as a base for the opaque projector, which normally would be left on top of this unit. The cabinet should be mounted on lock-type rollers so that it may be rolled into projection position. The space inside the cabinet might be used for storage of projectors other than the opaque projector and for slides, filmstrips,

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[82] Projection lightmeter is available from the General Electric Company, Large Lamp Division, Application Engineering, Nela Park, Cleveland 12, Ohio. Cost: approximately $90.00.

Slides are available from the General Electric Company, Large Lamp Division, Department 480-ST, Nela Park, Cleveland 12, Ohio. Cost: $12.50.

and films which would be shown in this room. The outside dimensions of the cabinet are 2 feet 8 inches in height, 4 feet in length, and 2 feet in width.

The second cabinet (M2) should be stationary. It might house a rolling metal filing cabinet which could be used for storage of such materials as those used in the opaque projector. The dimensions of this cabinet are 3 feet in height, 4 feet in length, and 2 feet in width. It should be wired for connection to a wall convenience outlet, allowing a general purpose circuit to serve an outlet strip on the front of this unit.

The adjoining sides of M2 and M3 should be recessed 1½ inches each as shown by the dotted lines (Figures 8 and 11). This would allow space for connecting the wiring for an outlet strip on the front of M3 with the circuit serving M2. The outlet strips on the fronts of these cabinets would be more convenient for use with projection equipment than wall outlets behind the draperies. The electrical connection between the two separate cabinets would illustrate the principle of pre-wiring interior walls, such as movable storage walls, for connection to circuits in exterior walls.

The third cabinet (M3) might be used for storage of materials used with the desk-dressing table-machine sewing unit (N). Mounted on lock-type rollers, it might be disconnected from M2 and moved for convenient access to the adjoining unit. The dimensions of this unit are the same as those of M2, 3 feet in height, 4 feet in length, and 2 feet in width.

Desk-Dressing Table-Machine Sewing Unit

For the north-west corner (Figures 8, 11, and 12), a desk-dressing table-machine sewing unit (N) is recommended to illustrate lighting for

desk work, make-up when seated at a dressing table, and machine sewing (Figures 17 and 18).

The design for this unit is an adaptation of centers in the General Electric Lighting Institute at Nela Park and in the Living Center of the Shenandoah Valley Electric Cooperative, Incorporated, Dayton, Virginia. The unit is 8 feet in height (outside dimension), 4 feet 6 inches in width, and 2 feet in depth (inside dimensions). It should have a natural oak finish except for the inside wall surfaces above the desk top. These walls should have a light gray flat-painted finish, so that the unit may be used in television programs.

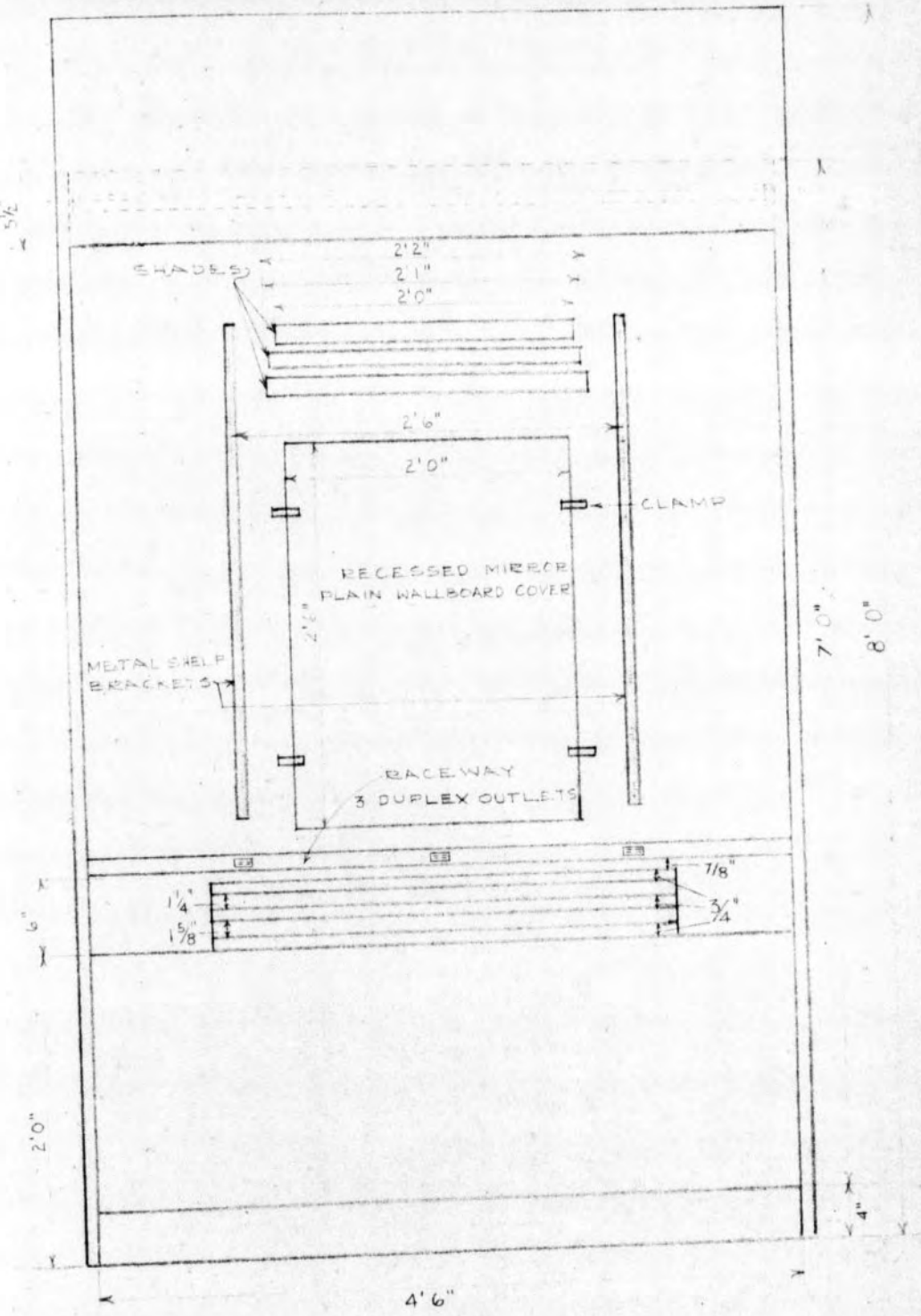
The ceiling of the unit is 7 feet from the floor. Extending downward $5\frac{1}{2}$ inches at the front of this ceiling is a wooden shield which conceals from view an installation containing one side-mounted and one standard-mounted 48-inch, 40-watt, rapid start, T-12 deluxe warm white fluorescent lamp. A sheet metal shield over the lamp channel is bent 45 degrees to direct the light downward. These ceiling-mounted lamps, which should be locally controlled, afford opportunity to observe the effect of overhead light for activities at the unit.

On the back wall of the unit above the desk top, which is 2 feet 6 inches from the floor, metal shelf brackets on center 2 feet 6 inches apart allow experimentation with height placement of wall lamps.

The investigator recommends the purchase of two wall lamps and a table lamp for desk work. In selecting the lamps these specifications from the General Electric lighting recipes should be followed:

Wall lamps for desk work. A pair of wall lamps, each with a 100-watt bulb, a 6-inch plastic diffuser bowl or a flat plastic diffusing disc below the bulb, a socket position 2 inches below the shade,

FIGURE 17
DESK-DRESSING TABLE-MACHINE SEWING UNIT

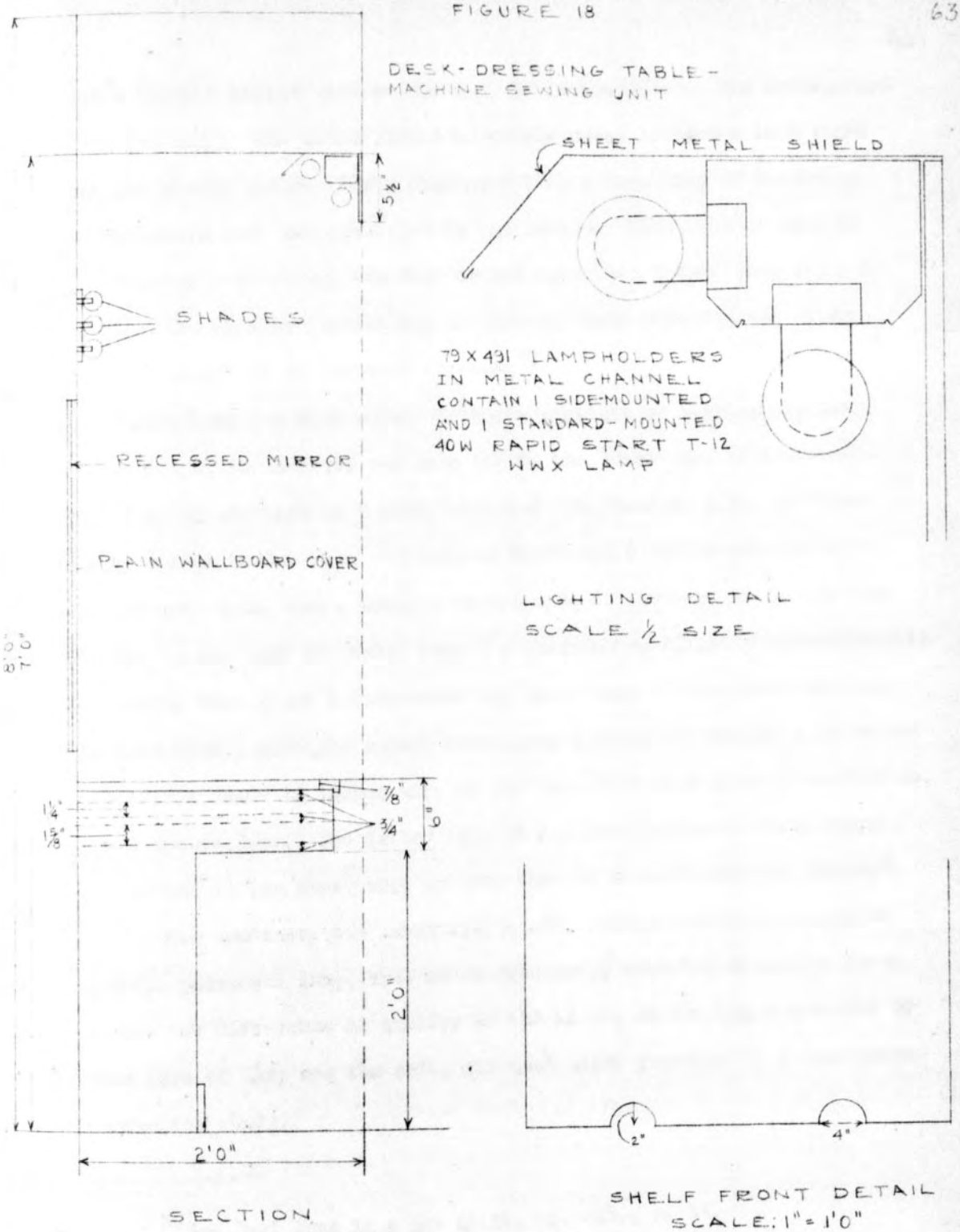


ELEVATION

SCALE 1" = 1'0"

FIGURE 18

DESK-DRESSING TABLE-
MACHINE SEWING UNIT



LIGHTING DETAIL
SCALE ½ SIZE

SECTION
SCALE: 1" = 1'0"

SHELF FRONT DETAIL
SCALE: 1" = 1'0"

and a shade 6 inches wide at the top, 10 inches wide at the bottom, and 7 inches deep. The shade should be fairly dense or opaque in a light but not strong color. For a desk more than 2 feet deep an extending or swing-arm lamp was specified in the recipe. This type of lamp is recommended even though the desk is not more than 2 feet deep since it would allow greater flexibility in varying shade position and determining the effect on the work surface.[83]

Table lamp for desk work. Either a straight or a swing-arm lamp measuring 15 inches from the desk top to the lower edge of the shade. The lamp should have an 8-inch Certified Lamp Makers' glass diffuser or an 8-inch bowl-shaped white glass diffuser, a 50/150-watt or a 30/230-watt bulb, and a shade 8 inches wide at the top, 16 inches wide at the bottom, and 10 inches deep. A louvered or slightly curved plastic diffusing disc about 1 inch above the lower edge of the shade may also be used with a multiple socket containing a total of 180 watts in bulbs and with a shade 14 inches wide at the top, 16 inches wide at the bottom, and 6 inches deep. The latter type of application should be shielded at the top if the upper edge is less than 58 inches above the floor.[84]

For contrast, the investigator also recommends the purchase of a metal gooseneck lamp, such as is frequently used for study, to demonstrate the difference in quality of the harsh, direct light provided by this type of lamp and the soft, diffused light provided by a lamp recommended for study.

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[83] See Your Home in a New Light, op. cit., p. 15.

[84] Ibid., p. 14.

An outlet strip with three duplex outlets should be placed on the back wall just above the desk top to serve the demonstration lamps.

For best results in desk work adjacent walls and desk tops should have a light finish. Very dark or bright colors would result in a distracting contrast between background and reading and writing materials.[85] To illustrate the differences in light reflectance and in visual comfort, three roll shades are suggested to vary the wall finish. One should be a dark color, one a bright color, and the third a light color in a rough texture. The shades should be mounted one above the other. The lower one should be 2 feet 2 inches wide, the next one 2 feet 1 inch wide, and the upper-most shade 2 feet wide so that each may be lowered behind the others and lie flat against the wall. These shades might be supplemented by others of various finishes and designs, stored nearby for convenient use.

To show the effect of different desk top finishes, at least three boards should be used for placing on top of the desk. Each side of each board should have a different finish and these should be included: light colored laminated plastic finish, bright colored flat-painted finish, dark (walnut or mahogany) dull finish, dark high-gloss finish, medium value dull finish, and medium value high-gloss finish. Two openings were planned in the 6-inch front of the desk (the space usually used for a drawer) for storage of the boards. The upper opening is 1¼ inches high, the lower one 1 5/8 inches high, and both are 3 feet wide and extend the full depth of the desk. Half-circle indentations above and below the openings were planned to allow easy grasping of the boards.

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[85] Ibid.

Two lamps should be purchased to illustrate lighting for make-up when seated at a dressing table. They should be selected according to the following specifications as suggested in the General Electric lighting recipe for this activity:

A pair of table lamps with white or ivory translucent shades, the shade centers being 15 inches above the 30-inch table top to distribute light evenly to both sides of the face at face height. The preferred type of shade would be attached to the lamp by means of a harp, though a clip-on shade may be used. The minimum shade dimensions are top diameter 7 inches, bottom diameter 9 inches, and depth 7 inches. The bulb may be a 30/100-watt three-lite or a 100-watt white, and the top of the bulb should be at least 2 inches below the upper edge of the shade.[86]

Additional lamp shades for use with the dressing table lamps are recommended: lined shades or very dense plastic shades to show that sufficient light does not pass through them to the sides of the face; green or blue translucent shades to show distortion of colors; and pink shades to show that make-up applied under becoming light may not give the desired appearance in daylight or under other types of artificial light.

For dressing table use, a mirror 2 feet wide, 2 feet 6 inches high, placed 3 inches above the desk top, should be recessed in the wall of the unit, with a plain wallboard cover to fit over the mirror flush with the wall surface. The cover should have the same finish as the unit wall and should be held in place by painted clamps. This would allow the mirror to be covered when the unit was being used to demonstrate desk work or machine sewing.

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[86] Ibid., p. 32.

For machine sewing, a wall lamp is recommended to illustrate one method of lighting the work area at the sewing machine. The lamp should conform to the following General Electric recipe specifications:

A wall lamp with an 8-inch Certified Lamp Makers' glass diffuser and a 50/150-watt bulb, an 8-inch bowl-shaped white glass diffuser and a 50/150-watt bulb, or a 50/150-watt, R-40 white Indirect Bulb in a wide harp. The shade should be 8 inches wide at the top, 13 inches wide at the bottom, and 8 inches deep.[87]

It is recommended that a portable sewing machine or a mock-up of wood with a sewing machine light attached at the normal position be provided to illustrate the need for more light on the needle than can be supplied by the tiny bulb of the sewing machine light and general room lighting.

Also recommended is the purchase of a comfortable desk chair for use with all activities at this unit.

East Wall Storage Unit

For the east wall adjoining the corner unit (N), a storage unit (O) 6 feet long, 1 foot 2 inches wide, and 2 feet 6 inches high is recommended (Figures 8 and 12). This unit provides storage space for some of the materials used with the desk-dressing table-machine sewing unit.

Demonstration Kits

The investigator recommends the purchase of the following General Electric Lighting Institute Demonstration Kits (P) to be mounted on the storage unit (O) (Figures 8 and 12):

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[87] Ibid., p. 13.

(P1) Kit Number DK-2, Filament Lamps, Residential. Contains 6 medium, 1 Three-lite medium, and 1 Three-lite mogul sockets, individually switched, for demonstration and comparison of residential incandescent lamps. Lamps not included. Dimensions: 25 inches wide, 20 inches high, 8 inches deep. Cost: $50.00.

(P2) Kit Number DK-12, Lighting Materials. Fluorescent light-box on swivel demonstrates appearance, shielding or diffusing properties of 2-foot square samples of plastic, glass, and metal. Separate case with ten samples included. Dimensions: 25 inches wide, 30 inches high, 12 inches deep. Cost: $160.00.

(P3) Kit Number DK-14, Quantity and Quality. Demonstrates Science of Seeing principles: factors of size, contrast, time, and brightness; diffuse versus directional light; shadows, highlights, sparkle, texture, reflected brightness. Dimensions: 25 inches wide, 20 inches high, 12 inches deep. Cost: $105.00.

(P4) Kit Number DK-15, Color of Light. Demonstrates white and four Coloramic filament lamps; daylight, cool white, deluxe cool white, and deluxe warm white fluorescent lamps; primary colors of light; black light. Colored pictures and materials included. Dimensions: 25 inches wide, 30 inches high, 14 inches deep. Cost: $120.00.

All kits have interlocking aluminum rails on their upper and lower surfaces for stable stacking in any arrangement. The installation of two additional sets of the rails is recommended for the top of the storage unit so that the kits may be locked in place on the unit as well as on each other.

The kits recommended for purchase are completely wired. Each has a nine-foot cord and plug permanently attached and stored in a recessed

pocket on the back, and a flush-mounted convenience outlet to permit connecting one kit to the next.[88]

Reading Area

For the south-east corner, a reading area which may also be used for hand sewing is recommended (Figures 8, 9, and 12). This area includes a lighted shelf unit (Q) on a table (R), a table lamp (S) on a table (T), a wall lamp (U), a lounge chair (V), and a floor lamp (W). This arrangement would provide opportunity for experimentation with lamp height and placement for the specified activities. Wooden blocks should be provided for varying lamp heights.

The lighted shelf unit (Q), designed according to the plan for the Sewing Center Shelf Light at the General Electric Lighting Institute, Nela Park, would illustrate a type of decorative lighting (Figure 19). Two master panel controlled 24-inch, 20-watt, T-12 deluxe warm white lamps mounted in a sheet metal box in the lower part of the unit would light decorative arrangements on both shelves by passing through the diffusing sandblasted glass lower shelf and the clear glass upper shelf. The lower shelf should be removable to allow access for changing tubes. Metal shelf support strips on the inside back of the unit would allow variation in upper shelf height. The inside dimensions of the entire unit are 2 feet 5 3/4 inches in height, 2 feet 9 inches in width, and 8½ inches in depth. The lower section containing the fluorescent tubes is 8 3/4 inches in height, with the shelf space occupying the remaining 1 foot 9 inches.

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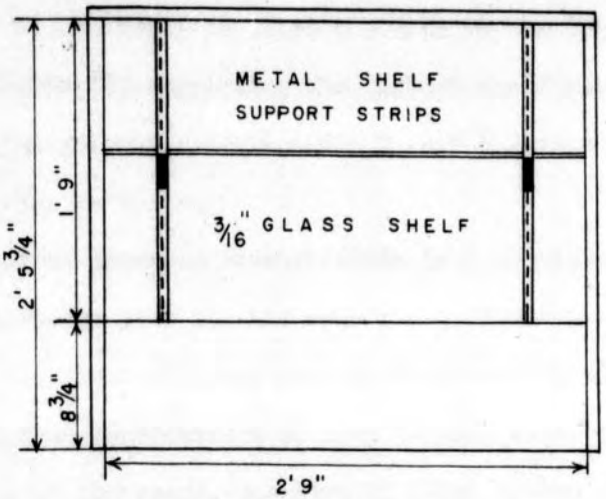
[88]General Electric mimeographed sheets. Demonstration Kits are available from the General Electric Lighting Institute, Nela Park, Cleveland, Ohio.

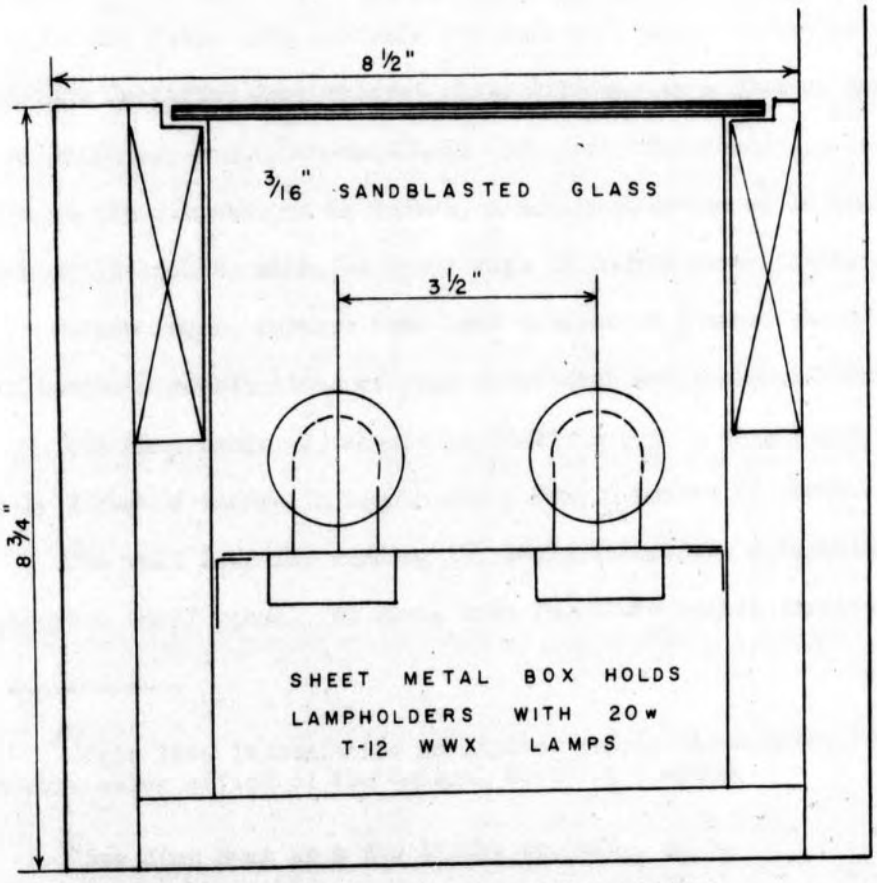
FIGURE 19

LIGHTED SHELF UNIT



ELEVATION

SCALE: 1" = 1'0"



LOWER SECTION AND LIGHTING DETAIL

SCALE: 1/2 SIZE

Bracing may be necessary to allow the unit to stand independently.

The table (R) supporting the lighted shelf unit should be 2 feet 6 inches in height and approximately 3 feet 6 inches in length and 1 foot 3 inches in width.

A General Electric Demonstration Lamp (S) is recommended to serve as the table lamp in this area and to demonstrate the importance of correct placement of lamps and the functional design of portable lamps, including such factors as lamp height, size, color, and translucency of the shade, position of light source within the shade, and diffusion of light.[89] This lamp would fulfill the following General Electric specifications for a table lamp for reading:

A Senior Table Lamp suitable for tables 21 to 25 inches in height; a 10-inch Certified Lamp Makers' glass diffuser or a 10-inch bowl-shaped glass diffuser; a 100/300-watt bulb (300 watts for reading); and a shade having a top diameter of 14 inches, a bottom diameter of 16 inches, and a depth of 13 inches, with its lower edge 18 inches above the table top.[90]

Other lamps, perhaps from home management houses, should be used to illustrate combinations of good functional and aesthetic design.

The lamp table (T) should be 24-25 inches in height and approximately 2 feet 6 inches in length and 1 foot 6 inches in width.

The wall lamp for reading (U) would illustrate a lighting application for small rooms, for rooms with furniture beside windows and

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[89] This lamp is available in limited supply through the local district sales office of the General Electric Company.

[90] See Your Home in a New Light, op. cit., p. 9.

doors, and for homes with active children and pets.[91]

A wall lamp of the swing-arm, extension, counterbalanced type would allow flexibility in demonstrating. It should be mounted on the wall 15 inches from the center of the lounge chair (V) in the direction of the table lamp, and at a height which would allow the lower edge of the shade to be raised to approximately 58 inches from the floor. This placement would permit the wall lamp to be properly placed for reading provided the counterbalance cord would allow a minimum of 16 inches in height variation, and it would also allow the lamp to be moved when either the table lamp or the floor lamp was being demonstrated.

Since this suspended fixture would be in the line of vision, it should be designed so that "both the contour, and the top and bottom shielding, . . .provide visual comfort at standing and seated levels."[92]

The specifications for this type of lamp in General Electric's recipe for reading using a wall lamp are as follows:

A louvered or slightly curved plastic diffusing disk about 1 inch above the lower edge of the shade, and a shield at the top for visual comfort when this portion of the lamp is below eye level; multiple bulbs totaling 180 watts; and a shade with a minimum bottom diameter of 14 inches and a depth of 6 inches.[93] The shade should allow some upward light.[94]

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[91] Ibid., p. 10.

[92] Ibid., p. 5.

[93] Ibid., p. 10.

[94] Ibid., p. 5.

A floor lamp for reading or hand sewing (W) should fulfill the following General Electric recipe specifications:

A Senior Double Swing-Arm Floor Lamp (preferable to a Standard Lamp because only the shade may be moved from reading to sewing position without moving the entire lamp); a 10-inch Certified Lamp Makers' glass diffuser or a bowl-shaped white glass diffuser; a 100/300-watt bulb (300 watts for reading and for sewing) plus a 32-watt deluxe warm white circline tube 12 inches in diameter, and for prolonged sewing or for fine detail, an R-30, 75-watt spot lamp in a holder fastened to the lamp stem; and a shade with a top diameter of 14 inches, a bottom diameter of 18 inches, and a depth of 10 inches.[95]

Colored Lamps

To demonstrate the effect of colored light on such surfaces as furnishings, fabrics, and complexions, and on the creation of desired mood, the investigator recommends the installation of eight R-40, 150-watt, colored incandescent flood lamps (X) in the opaque suspended ceiling directly over the reading area in the south-east corner (Figure 8, Overlay, Section 4). Two each of blue, green, pink, and yellow lamps should be used, and they should be surface-mounted in louvered "eyeball" type holders which are movable for directing beams as desired. Each like-colored pair of lamps should have a master panel dimmer control which would allow the demonstration of each color separately or of combinations of colors in different proportions.

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[95]Ibid., pp. 8 and 12.

Chalkboard

The two sections of chalkboard (Y) nearest the door of the classroom should be left in their present positions, but the blackboards should be replaced with greenboards which are generally accepted as being more restful to the eyes (Figures 8 and 9). The third section of chalkboard should be removed.

Projection Screen

The projection screen (Z) should be mounted 7 inches from the wall (Figures 8 and 9). This would allow it when lowered for use to clear the bracket lighting over the chalkboard. It might be mounted just below the edge of the suspended ceiling, or to conceal it from view when not in use, just above the ceiling edge. The latter choice would require an indentation in the suspended ceiling, the edge of which is on this side 6 inches from the wall. The indentation should be 5 inches in width and 6 feet 4 inches in length.

Bulletin Board

A bulletin board (AA) for posting materials related to home lighting and wiring is recommended to adjoin the chalkboard on the west side (Figures 8 and 9). The framing should be the same width as that of the chalkboard, and the total dimensions of the bulletin board should be 4 feet $5\frac{1}{2}$ inches in height and 3 feet 1 inch in width.

Spot Lamps

Two master panel controlled, R-40, 150-watt spot lamps (BB) should be surface-mounted on the opaque suspended ceiling over the bulletin board centered approximately 4 feet 9 inches from the wall (Figure 8, Overlay,

Section 4). They should have louvered "eyeball" type holders, which would permit manual adjustment of the direction of the light beams. These lights would be used primarily to call attention to items on the bulletin board.

Luminous Room Divider

Recommended for the space beside the bulletin board is a luminous room divider (Figures 8 and 9) (CC), which would illustrate general illumination through the use of luminous panels for entire walls, sections of walls, or room dividers (Figure 20). The overall dimensions of the divider are 6 feet 6 inches in height, 4 feet 2 inches in width, and 9 inches in depth. The unit should be constructed in two panels, each of which would contain framed translucent plastic sheets 6½ inches apart on each side of two 72-inch, 55-watt, deluxe warm white, T-12, Slimline fluorescent tubes. The tubes should have a local dimmer control for light level variation and should be vertically mounted on the 2-inch by 6-inch boards which form the ends of the room divider and the center upright between panels.[96] The translucent plastic sheets should be of such a nature that the brightness developed is no greater than three times that of any surrounding surface. One luminous side of the unit was planned to swing open on hinges to allow access for changing tubes and for cleaning. Fasteners should be used to hold it in a closed position. Bracing may be necessary to allow this portable unit to stand independently. For flexible use in other areas, the unit should be mounted on lock-type rollers.

Demonstration Desk

A demonstration desk (DD) 8 feet long, 2 feet wide, and 2 feet

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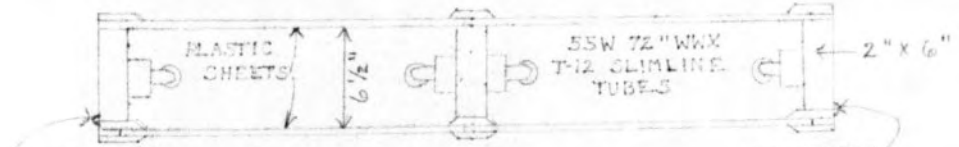
[96] Builders Book of Lighting ([n.p.] : General Electric Company [n.d.]), p. 33.

FIGURE 20

LUMINOUS ROOM DIVIDER

ELEVATION



HINGES ALLOW THIS SIDE TO SWING OPEN

PLAN

FASTENERS TO HOLD IN CLOSED POSITION

SCALE: ½" = 1'

6 inches high is recommended for a space 2 feet 9½ inches from the wall in front of the chalkboard (Figures 8 and 9).

Four feet at the east end of the desk (DD1) should be used for storage of additional equipment needed for the use of the General Electric Demonstration Lamp.

For comfortable knee space for a person seated at the desk, a 2-foot space (DD2) following the 4-foot section should be left open on the wall side of the desk.

The remaining 2 feet at the west end of the desk (DD3) should be used for a master lighting control panel.

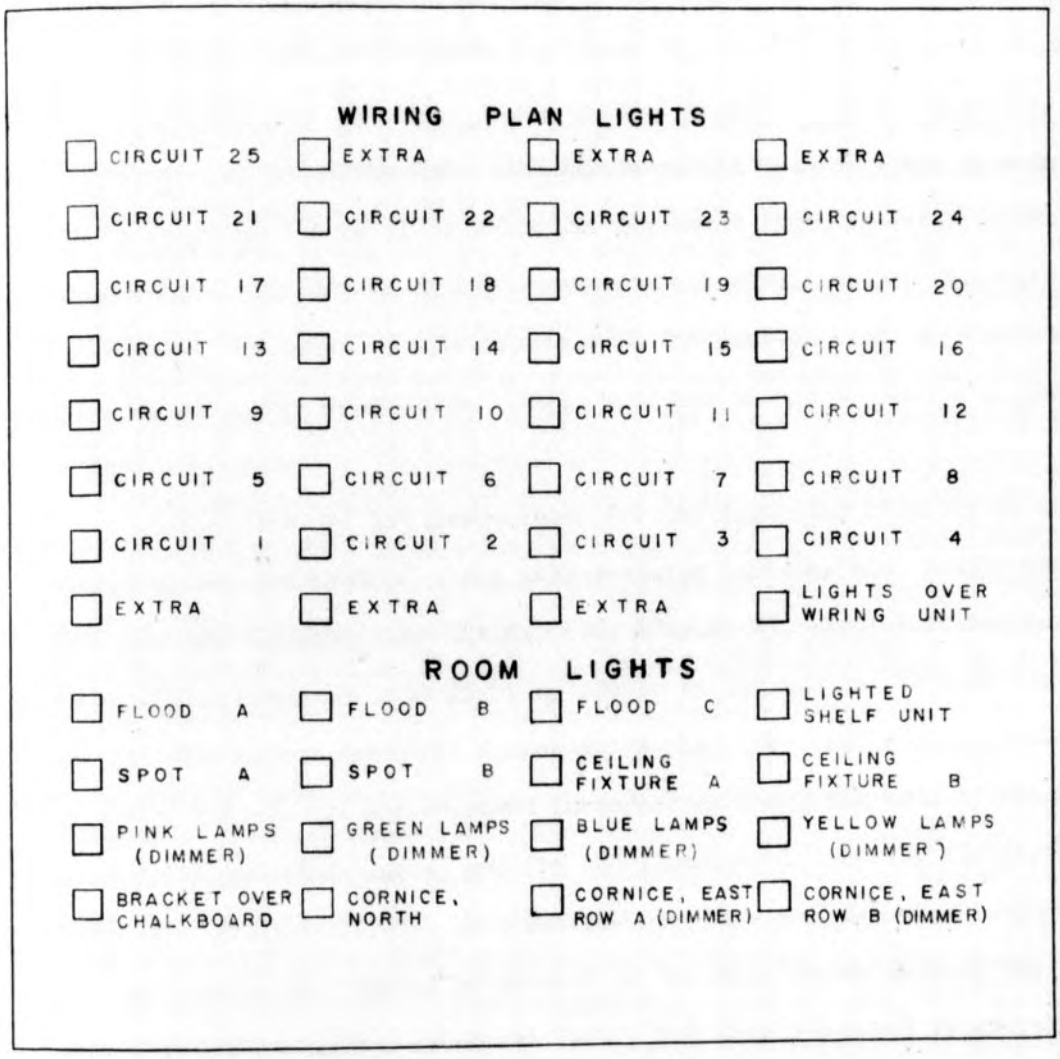
Flood Lamps

Over the demonstration desk as close as possible to Luminous Section 1, three master panel controlled, R-40, 150-watt, louvered flood lamps (EE) should be recessed in the opaque ceiling panel (Figure 8, Overlay, Section 4). This would illustrate the use of recessed lamps for local lighting. Installing the lamps over the front edge of the desk rather than centered over it should allow the use of the desk surface for demonstration purposes with few shadows on the viewers' side.

Controls

A master control panel (DD3) is recommended to demonstrate various lights through the room and also to serve as an example of a remote control center in a home (Figure 8). A low-voltage switching system should be used, and the switches should be easy to operate. Forty-eight switches, including six dimmers, are suggested to control the lights specified in the arrangement given (Figure 21). Each switch should be identified on the control panel as to the lighting installation which it controls. Switches

FIGURE 21
MASTER CONTROL PANEL



controlling like installations are designated, as Flood A, Flood B, and Flood C, according to the positions of the lights in the classroom from left to right of a person standing behind the demonstration desk operating the master control panel.

The switches controlling the lamps in the luminous ceiling installation should be located on the wall to the right of the entrance to the room and placed 48 inches above the floor (Figure 9). This would allow a person unfamiliar with the remote control panel to control lighting sufficient for classroom use. One switch should control lamps of such number and position as would bring the classroom lighting level to 30 footcandles. The second switch should control supplementary lamps which would raise the level to approximately 70 footcandles, and the third to approximately 100 footcandles. These switches should be the quiet push-button type.

Local controls are recommended for the installed lighting in the bathroom lavatory unit (K), the desk-dressing table-machine sewing unit (N), and the luminous room divider (CC) (Figure 8). Four switches for the bathroom lavatory unit lighting should be located on the west inside wall of the unit forty-eight inches above the floor, and should provide separate control for the overhead incandescent lamp, for each of the two overhead fluorescent lamps, and for the fluorescent lamps at the sides of the mirror (Figure 13, K). Two switches for the desk-dressing table-machine sewing unit should be located on the east inside wall of the unit forty-eight inches above the floor, and should control separately the two fluorescent tubes overhead (Figure 12, N). For further demonstration material, the switches for one unit should be the quiet type with luminous knobs and the other the Feathertouch type. The switch for the luminous room divider should be a dimmer control located forty-eight

inches above the floor on the end of the unit adjacent to the latch side of the opening (Figure 9, CC).

Wiring for the Classroom

A circuit-breaker panel for the classroom wiring is recommended for the south corner of the east wall to minimize length of runs to convenience outlets.

The wiring for the luminous ceiling lighting, the low-voltage wiring system for the adequate home wiring demonstration unit, and the wiring for all switches should be specified by the companies selected to install the systems.

The remaining installed lighting should be equally divided between two 20-ampere, 115-120-volt, 2-wire circuits using number 12 AWG wire. For the convenience outlets in the classroom, two 20-ampere, 120/240-volt, 3-wire, split-receptacle circuits using number 12 AWG wire should be used. One of these should serve the convenience outlets on the south and west walls, and the other the convenience outlets on the east and north walls (Figure 8). The upper half of the outlets on each circuit should be connected to the same side of the circuit.

The outlets are on 30 or 60-inch centers on a baseboard raceway which should extend around the entire room. The section of baseboard raceway (FF) from the doorway across the south wall should have a series of nine convenience outlets on 30-inch centers to serve portable demonstration equipment in that area (Figure 9).

Sheathed wiring concealed by draperies or by permanent units should extend from the raceway to lighting installations on the walls or the ceiling, making wiring concealed in the walls and the ceiling unnecessary.

Recommendations for the Addition of Other Demonstration Equipment

It is recommended that the transom (GG) over the doorway be reserved for the installation of an electroluminescent panel when these are available on the market. According to one prediction, by 196X:

> . . . there will be further developments in the field of electroluminescence--e.g., methods of sandwiching transparent phosphors between sheets of glass coated to conduct electricity. Result: the 196X window may be turned into a luminous wall at night.[97]

Electroluminescence is soft, glareless, shadowless light which may be evenly distributed from walls or ceilings of conventional appearance. Leading companies in the lighting industry have developed a variety of applications of this new method of illumination. Edward G. F. Arnott, director of research at the Westinghouse laboratory at Bloomfield, New Jersey, stated:

> You can see the possibilities in home decoration. . . . These panels can be built into any kind of surface, flat or curved. We have even developed flexible nylon panels which could be made into draperies. I believe we can have this kind of lighting ready for the market in two years if there's a demand for it. It may be a long time before we can approach the superior economy of the fluorescent tube, but theoretically we should be able someday to surpass it.[98]

The investigator recommends that other new methods of home lighting and wiring be evaluated as they become available to determine their usefulness for possible additions to or substitutions for demonstration equipment included in this design. Also recommended is the use of supplementary demonstration equipment in such areas as home management houses where there would exist the ideal situation of applications in a home setting.

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[97] "196X, The Next Revolution in Home Building," House and Home, XIII (January, 1958), 129.

[98] Harland Manchester, "Electroluminescence--A New Kind of Light," Reader's Digest, LXXII (February, 1958), 97-98.

Recommendation for Further Research

The use of this demonstration equipment in teaching should be supplemented by teaching materials planned specifically for each unit. The development of these materials might constitute another study.

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APPENDIX

THE WOMAN'S COLLEGE
OF THE UNIVERSITY OF NORTH CAROLINA
GREENSBORO

SCHOOL OF HOME ECONOMICS

February 26, 1957

_____
_____
_____
_____

Dear _____:

The School of Home Economics of The Woman's College is planning to set up a laboratory for teaching lighting and adequate wiring for homes. In making our plans, we feel that it would be most helpful to us to know what means are being used in other colleges for teaching this subject matter. We would appreciate very much your answering the questions below or directing this letter to the person most closely associated with the teaching of home lighting and wiring.

Is this subject matter taught as a part of your home economics curriculum? Yes____ No____

In what course or courses is it taught? _____
_____
_____

Is it taught through lecture-demonstration or laboratory, or both? (Underline)

Is it taught in a
special lighting and wiring laboratory? ____
household equipment laboratory? ____
home furnishings laboratory? ____
related art laboratory? ____
other? _____

Is it taught with small scale models or full scale equipment? (Underline)

If lighting and adequate wiring are taught in a laboratory designed for that purpose, would you describe it briefly on the back of this page?

Are blueprints of the laboratory available? At what cost?

Are mimeographed study guides for use in the laboratory available? If so, would it be possible to send us a copy?

Sincerely yours,

Rebecca Freeman
Graduate Assistant