

# Lighting the Farm Home



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# Lighting the Farm Home

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HOME LIGHTING plays an important part in your family's comfort, health, and enjoyment. With electricity becoming increasingly available for lighting farm homes, there is need for selecting permanent fixtures or portable lamps which fill the needs of all the family. There is need also to check over the lighting equipment occasionally to keep the lighting of your home efficient, safe, economical, and attractive. Often you will find you can improve old lamps and fixtures at little cost.

## ESSENTIALS FOR GOOD HOME LIGHTING

Following are three essentials to the proper lighting of any room, whether the light be natural or artificial:

1. Light sufficient in amount and located as needed to prevent eye strain or fatigue in carrying on any desired activity.
2. Light well diffused and distributed over the room so that there are no extremely dark sections, while other parts are brightly illuminated.
3. Elimination of all glare. Shade all bare lamps, whether on permanent fixtures or portable lamps. Arrange lamps and furniture so that no bare bulb is visible. Avoid reflected glare from shiny paper or furniture surfaces. Curtain windows to avoid glare from natural light.

## THE NEED OF ADEQUATE LIGHT

Light to be useful must fall on the surface to be lighted. More light is required to illuminate some objects than others. Those which are very small, very fine in detail, or very dark in color require more than those of larger detail and lighter color. You need more light to see dark stitches on dark cloth than dark stitches on light cloth; more for reading than for walking about in the room. In every case one should use an adequate amount of light to see without eye strain or fatigue.

Scientists have observed that in most cases, persons with defective eyes, even with corrective lenses, require more light to see without strain and



Fig. 1. — One lamp may furnish light for several people requiring different amounts of light if the lamp is carefully selected and located.

fatigue than do persons with normal eyes. The importance of determining the amount of light best suited to your eyes for various activities, is therefore obvious.

Enough natural or artificial illumination of the area being used by various members of the family, whether for working or reading, or by the children at their play, is a major requirement of healthful living.

*Some Guides for Measuring Light.* — Today it is possible to measure light with a small instrument called a light meter. This meter measures light in terms of foot-candles. One foot-candle is the intensity of light cast by a standard candle, on a surface one foot away. The foot-candles of light cast directly on a surface from a bulb vary with

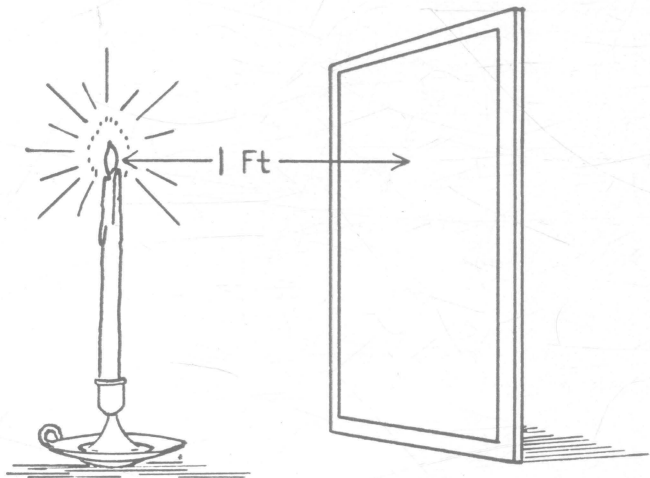


Fig. 2. — Illumination where arrow meets board is 1 foot-candle.



the type of bulb and its wattage. The intensity of illumination from a source of light varies inversely as the square of the distance from the source. For example, a 40-watt bulb may give an intensity of 60 foot-candles on a surface 1 foot from the bulb, while at 2 feet the intensity would be only one-fourth of 60, or 15 foot-candles, and at 3 feet only one-ninth of 60, or about 6½ foot-candles of light.

*Amounts of Light for Various Activities.* — The following recommendations are made by the Illuminating Engineering Society\* for amounts of light required for various activities carried on in the home. These are general recommendations and are made in terms of foot-candles rather than size of bulbs. It is impossible to state the definite wattage of bulbs to produce the amounts of light, as the surroundings, such as color and type of lamp shades, color of walls, and age of bulbs, differ.

1. To see large objects . . . . . 2 to 5 foot-candles  
*Example:* General walking about in a room.
2. To see objects of average size . . . . . 10 to 20 foot-candles  
*Examples:* Reading average sized print, ordinary writing, sewing on light colors, or local work at kitchen table or sink.
3. To see smaller objects or smaller objects of light colors . . . . . 20 to 50 foot-candles  
*Examples:* Reading fine print, prolonged sewing on light colors; studying and drawing.
4. To see fine details for prolonged time . . . . . 50 to 100 foot-candles  
*Examples:* Prolonged average sewing or fine work.

*Use Enough Light to Suit Your Eyes.* — You can determine whether or not the amount of light you are now using for any given activity is best suited to your eyes. For example, while using well diffused light for reading, experiment by increasing the amount of light, and find the intensity which makes it easiest for you to read.

Many persons form a habit of working in a room inadequately lighted, at the expense of severe eye strain and fatigue. Prevent the formation of such a habit. Determine the amount of light you need and use that amount.

You can estimate the cost of the electricity you think you need for lighting your home adequately. Divide the wattage of your light bulb by 1,000 and multiply by the price per kilowatt hour (k.w.h.) or 1,000 watt-

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\* This Society is composed of a group of engineers who work on equipment for improved lighting.

hours, and by the number of hours you use the bulb. For example, how will the cost of operating a 50-watt bulb for 30 hours compare with the cost of operating a 75-watt bulb for the same time, if electricity costs 5 cents per kilowatt hour?

$$\frac{50}{1000} \times 5 \times 30 = 7\frac{1}{2} \text{ cents, for 30 hours for 50-watt bulb.}$$

$$\frac{75}{1000} \times 5 \times 30 = 11\frac{1}{4} \text{ cents, for 30 hours for 75-watt bulb.}$$

### EFFECTIVE DISTRIBUTION OF LIGHT IS ESSENTIAL

Adequate general illumination throughout a room permits large objects and room areas to be seen easily. It prevents dark shadows and sharp contrasts.

The intensity of the general illumination in a room should be about one-tenth of that directed on close work, according to illuminating engineers. That is, if there are 50 foot-candles of light at the sewing table, about 5 foot-candles of light are desirable throughout the room.

Some local illumination is useful in most rooms for reading, writing, or other activity which requires seeing finely detailed objects. The intensity of local illumination required depends on your eyes and activity. The variation of the intensity of local and general illumination adds to the beauty of an interior.

The amount of light needed to illuminate a room adequately depends to a degree upon the reflective qualities of large surfaces such as walls, ceiling, and large furniture.

Colors and textures vary in their light absorption. Experiments show that white and very light colors are highest in reflective power, while dark colors are lowest in reflective or highest in absorptive power. A dull white or very light ceiling and light



Fig. 3. — An enclosed unit in the center of the kitchen provides general illumination, while a smaller unit furnishes additional light for work areas.

colored walls are factors which contribute toward lighting a room efficiently at minimum cost. Large areas of colors and textures which absorb considerable light increase the amount of light needed to illuminate a room adequately.

Proper shades on bulbs soften the light and direct it. There are many lighting fixtures and portable lamps on the market which are shaded to diffuse light and make the most economical, healthful, and comfortable use of it.

## *Selecting and Placing Electric Fixtures*

### CEILING FIXTURES FOR GENERAL ACTIVITIES

Although light for general moving about can be provided by portable lamps or wall brackets, a good central fixture provides such light conveniently and economically in most rooms.

It is convenient to have each ceiling fixture controlled by a wall switch (see "Convenience," p. 24). In addition, some ceiling fixtures have a switch as a part of the fixture, by which different intensities of light may be regulated. This is a desirable feature in many rooms.

All bulbs in ceiling fixtures require shading to eliminate glare and strong shadows. The type of shade will depend on the style of fixture. Both individual and collective shading is shown on following pages.

*Porch.*—An enclosing glass globe as shown in illustration on page 8 (see Fig. 5), with a 40- to 60-watt bulb, provides enough light on the

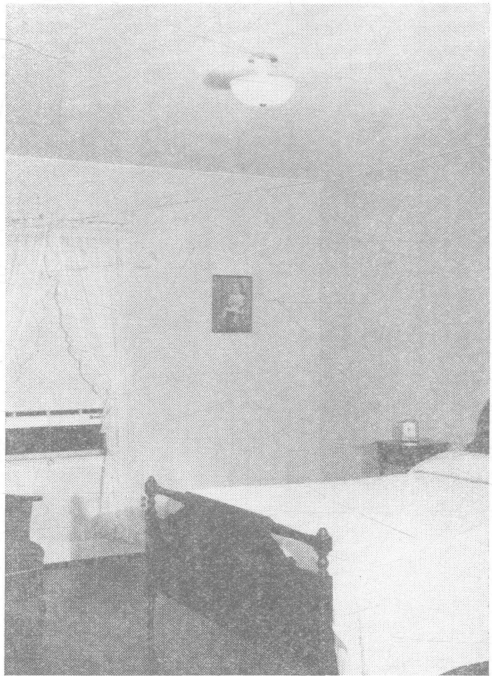


Fig. 4. — A center indirect fixture distributes soft light over this bedroom. Additional fixtures are necessary for activities requiring a higher level of illumination.

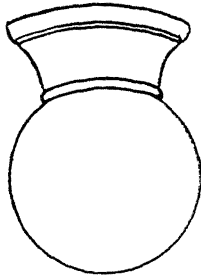


Fig. 5

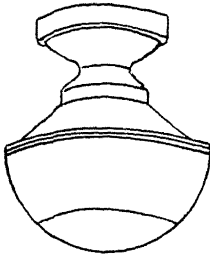


Fig. 6

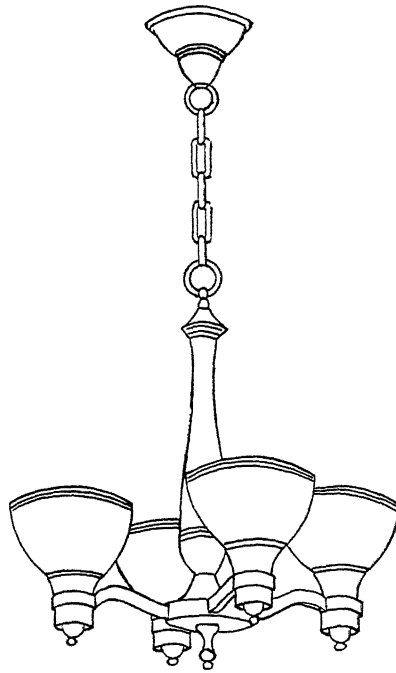
porch for safety and convenience. If desirable, more decorative fixtures are available.

*Hall.*—It is desirable to locate a fixture so the entire stairs may be illuminated. A fixture close to the ceiling, as shown in Fig. 6, with a 60- to 75-watt bulb, is useful in a low hall. A pendant type of fixture, with a 75- to 100-watt bulb, may be used in a high hall. A glass globe diffuses the light.

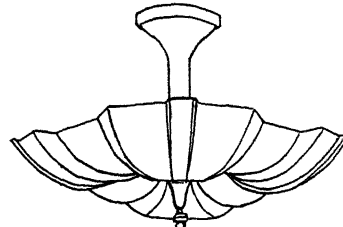
*Living Room.*—Shade all bulbs individually or collectively in central ceiling fixtures.

A pendant type fixture, as (A) Fig. 7, is only suitable for a room with a high ceiling. Each of the four 40-watt bulbs in the ceiling fixture (A) has a diffusing shade. A ceiling fixture having two 40-watt bulbs and shades gives adequate light for general activities in a small room. A ceiling fixture with four 40-watt bulbs protected by one shade is shown in Fig. 7 (B).

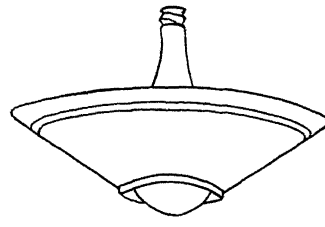
Fig. 7 (c) is an inexpensive indirect type fixture which gives great spread to the light; this fixture may be equipped with a 100- to 150-watt silver bowl bulb, or a bulb the tip of which is treated to reflect light. A close-to-the-ceiling fixture as (B) or (c) Fig. 7, is desirable in an average or low room.



A



B



c

Fig. 7

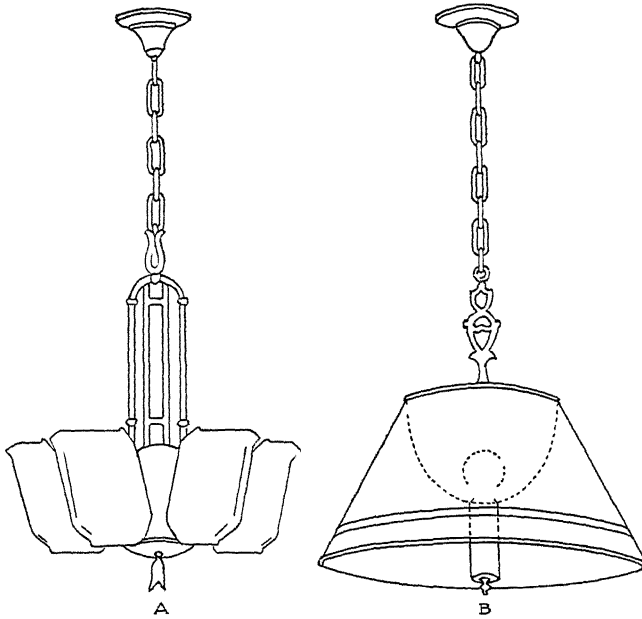


Fig. 8

*Dining Room.*

— A pendant type central fixture brings the light close to the table in the dining room. Illustrated opposite (A) is such a fixture equipped with diffusing shades for five 40- to 60-watt bulbs.

If reading and writing are done at the dining table, a central fixture which can easily be adjusted to provide a

smaller amount of light for eating, and a greater amount of light for reading or writing, is economical and desirable. A new "Better Sight" fixture which hangs low over the table is shown at (B). Its glass bowl casts a soft light downward, while enough light is directed upward to eliminate harsh shadows. This makes for eye comfort. This fixture is equipped with a 100-200-300-watt three-light lamp bulb, which contains both a 100- and a 200-watt filament (see page 15, "Lamps Giving Different Intensities of Light"). The 100-watt filament provides enough light for general activities, while the 200-, or both the 200- and 100-watt filaments are satisfactory for more detailed tasks.

*Bedroom.* —

A central fixture with two 25-watt bulbs or one 50-watt bulb gives adequate light for general activities in the smaller room. A glass diffusing globe enclosing one 75-watt lamp

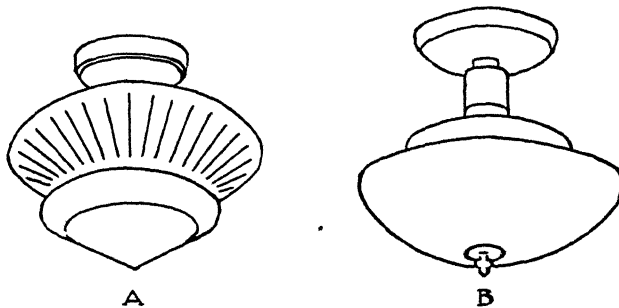


Fig. 9

which gives general light for an average-sized room is illustrated at (A) Fig. 9. Another style is a glass diffusing bowl (B) with three 40-watt bulbs,

which provides more light for a larger room. A totally indirect type of fixture is also satisfactory for bedrooms.

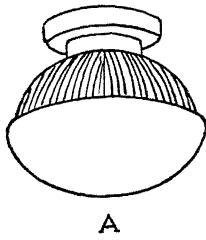


Fig. 10

*Bathroom.*—In a large bathroom, a central ceiling-type fixture as shown in Fig. 10 (A), which has an enclosing globe 8 inches in diameter with a 75-watt bulb, or 10 inches in diameter for a 100-watt bulb, provides light for general moving about. An upright wall bracket (B) at each side of the mirror is also most desirable (see Fig. 16).

In a small bathroom, the upright brackets with 40- to 60-watt bulbs provide adequate light for general activities as well as for dressing at the mirror. All lights should turn on and off at a wall switch. Because of the possibility of an electric shock caused by the occupant of the room touching the bathtub or other plumbing fixture and the light fixture simultaneously, a wall switch is a safety device.

*Closet.*—An outlet with bulb attached and equipped with a door switch is the most convenient. However, a pull chain socket (Fig. 11) is cheaper. The socket is handy if placed high in the room and just inside the closet at the knob side of the door. A 25- to 60-watt bulb gives adequate light for closets, depending on the size of the closet and color of its walls. High intensity of illumination in a closet makes it easy to find articles quickly. Since a light is used in a closet for short periods of time, a large bulb is practical, as it may be a time saver.

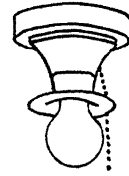


Fig. 11

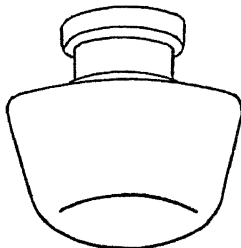


Fig. 12

*Kitchen.*—A glass enclosed diffusing globe at least 10 to 12 inches in diameter (Fig. 12), with a 100- to 150-watt bulb in the center of the ceiling, spreads the light and is sufficient for general work in the average sized kitchen. Two such units, or a larger one, may be used for general lighting in a larger kitchen.

*Laundry.*—Light from daylight or blue-colored bulbs most nearly approaches the color of natural light and is useful for the laundry. One or two fixtures with enclosing globes, each fixture fitted with a 100- to 150-watt bulb, depending on the size of the room, gives adequate light. If the ceiling is dark, a suitable reflector greatly conserves the light by reflecting it on the work surface. It is desirable that the surface of the reflector be one that will not lose its reflective

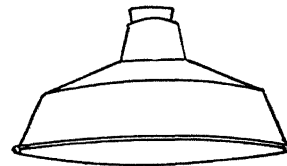


Fig. 13

power. The RLM dome, Fig. 13, has a porcelain enameled surface. This dome directs light downward and serves as a protection against glare.

*Cellar.*— It is desirable to locate a lamp so that it will illuminate the stairs and neighboring area. If the basement is used only for general activities for short periods of time, a bulb, or a bulb in a shallow reflector, is satisfactory. An enclosing glass unit similar to the kitchen unit (see Fig. 12) is desirable if the ceiling height permits. It is convenient to control the light by a switch at the head of the stairs. Additional pull chain sockets equipped with adequate sized bulbs are essential at fruit storage spaces or in other rooms. It is convenient to control one lamp by a wall switch at the entrance to each room. An additional lamp in the room may be controlled by a pull switch.

*Yard.*— Yard lamps which can be turned on and off at the house, the barn, and other convenient locations are useful. A yard lamp mounted about 15 feet above the ground permits a wide spread of light. Higher mounting is desirable in many cases to give greater spread of light. A lamp so mounted and equipped with a shallow dome (see Fig. 14), or an RLM reflector as shown in Fig. 13, directs all light downward and outward.



Fig. 14

#### WALL BRACKETS FOR GENERAL AND SPECIFIC ACTIVITIES

Wall brackets are useful to direct additional light on working surfaces near the outer edges of the room. Brackets are frequently used for decorative purposes, illuminating some beautiful art object. All bulbs in wall brackets require shading.

*Kitchen.*— In addition to a ceiling fixture, wall brackets are needed in most kitchens over the sink, work table, and stove for preparing food, and doing other work. A glass shaded bracket (Fig. 15), or an enclosing glass ceiling unit, is desirable over these surfaces to direct the light downward.

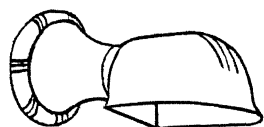


Fig. 15

Each bracket fitted with a 60-watt bulb gives adequate light. If the work areas are close together, one bracket may give enough local light; otherwise a bracket with bulb may be needed over each work area. A bracket placed at satisfactory height directs the light on the work surface and out of the eyes of the worker. This height may vary, but in general the distance is about 5 feet from the floor. Light from a wall bracket may be controlled conveniently at a wall switch. A wall switch is desirable for controlling each bracket which is within easy reach of the sink or other plumbing, for safety. If you use a pull chain on a bracket near the sink, be sure that the chain is provided with insulating links.

Other wall brackets have a switch as a part of the fixture for controlling the light and are satisfactory for some locations.



*Bathroom.*—An upright bracket with a diffusing glass shade open at the top (see Fig. 16), and placed at face level on each side of the mirror, about 30 inches apart, casts light on the face and eliminates objectionable shadows.

*Bedroom.*—An upright bracket with an open top shade and a 40- to 60-watt bulb placed on each side of the mirror at face level about 30 inches apart provides adequate light. A pair of vanity lamps high enough to direct light on the face, are often more desirable than the wall brackets, at the mirror on the dresser or dressing table. (See illustration (A), Fig. 18).

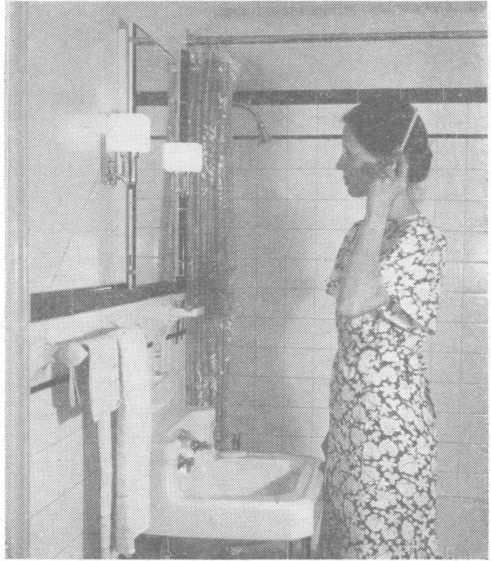


Fig. 16. — At each side of the mirror is a wall bracket with open top shade placed at face level.



Fig. 17. — Pin-up lamp with diffusing bowl gives a great spread of light.

A diffusing bowl as shown in the pin-up lamp (B), Fig. 18, gives a great spread of light. A similar bracket or lamp with a diffusing bowl placed at the head or at the side of the bed requires little space and provides adequate light for reading (see Fig. 17).

*Hall.*— If there is a telephone in the hall, a shaded wall bracket is useful near it. A lamp hung on the wall, or a table lamp may be substituted for the

wall bracket. All such brackets or lamps require proper shades so that light from the bulbs does not strike your eyes as you mount or descend the stairs.

*Living Room and Dining Room.*— Wall brackets are commonly used in living and dining rooms for decorative purposes only. A rather low intensity of illumination usually satisfies such lighting needs. All bulbs require proper shading so the light from them will not strike your eyes directly, no matter where you are in the room. These brackets are best placed so that they permit the furniture to be located most usefully.

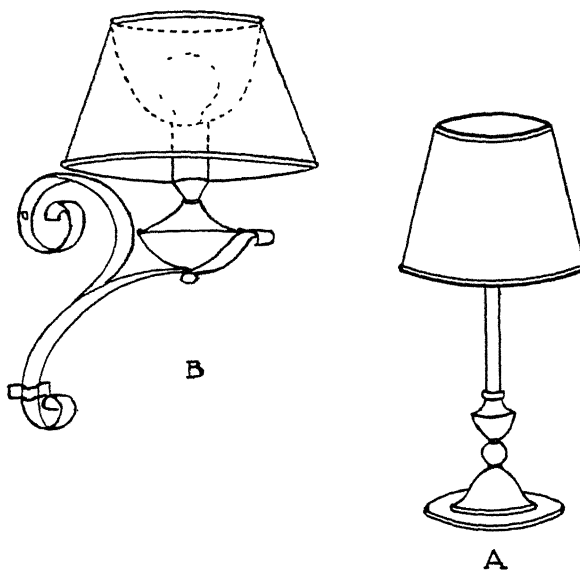


Fig. 18. — A vanity lamp (A) of the correct height, or a pin-up lamp (B) may be used at the dressing table in the bedroom.

Usually the best location for wall brackets is at the sides of the wall space rather than in the center. If you wish to have lamps over the mantel, it is often practical to install outlets to which small lamps may be attached when desired; this method permits the removal of the lamps at no cost.

## *Choosing the Right Lamp and Shade*



### PORTABLE LAMPS FOR SPECIAL USES

Lamps are necessary in the average room to give enough light to see fine details as for reading, writing, sewing, or for the children's play. Useful lamps give plenty of light where you want it without glare. A lamp plain in design, and with little or no trimming, is usually the most pleasing in appearance, and most satisfactory for good lighting (see Fig. 19). The number of lamps desirable in your room depends on such factors as the size of the room, the color of its ceiling and walls, your activities in the room, and other sources of light.

Taller lamps give a greater spread of light than low ones. Compare spread of light in (A) with (B), Fig. 20. When selecting a table lamp, con-

sider the eye level as well as the height of the surface on which lamp is to be placed. The highest ray of light directed by the edge of the shade should fall a little below the eye level when you are in position to use the light. Unless very low lamps with open top shades are placed high, there is a glare from the bulb through the shade opening at the top.

### SHADES FOR LAMPS

Wide-spreading shades as in (A) Fig. 20 allow an economical use of light. They permit the light to be cast over a large area.

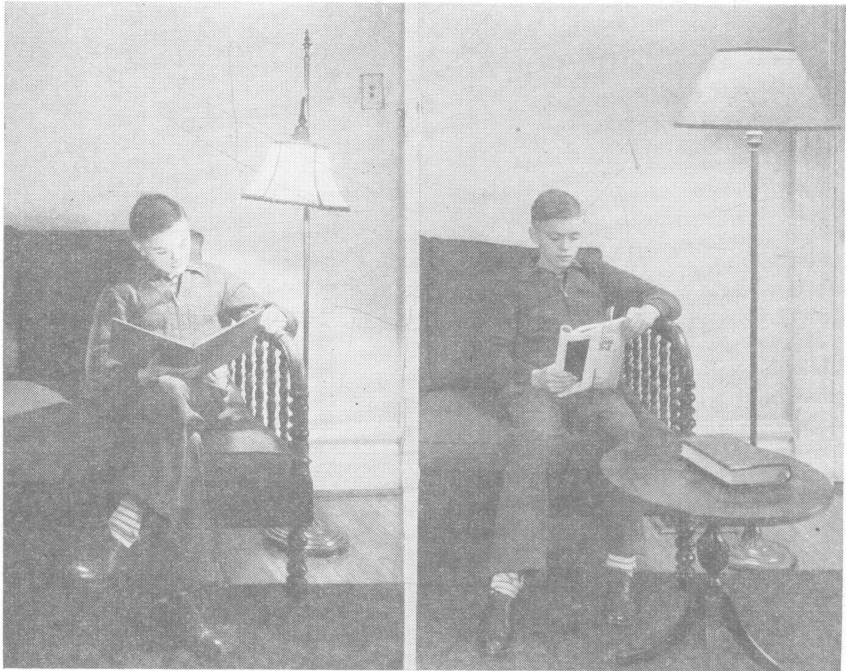


Fig. 19. — Bulbs of the same size are used in the lamps in photographs (A) and (B). Note the direct and reflected glare and dark shadows in (A). Objectionable glare and dark shadows are eliminated in (B) through the use of the lamp shown.

Open top shades direct some light upward for general illumination, and also direct light downward on the work. This distribution of light is necessary for eye comfort. (See page 6, "Effective Distribution of Light is Essential.")

A closed top shade on a portable lamp is useful only in a room having enough general illumination from other sources and where the lamp must be placed low. Occasionally a closed top shade is desired on a lamp in a lower hall.

White, or near white, is the most economical color for the inside of all

shades. White reflects the greatest amount of light. For the outside of shades, light soft colors, as tan, yellow, or peach, reflect somewhat the color of natural light and are desirable near light walls. Somewhat darker colors for the outside of shades blend with darker walls.

### DIFFUSING BOWLS FOR LAMPS

There are many lamps with diffusing bowls, inside which the bulb is placed (see Fig. 18B). Soft light passes down through the bowl on the work area. The bowl also directs light upward into the room for general illumination. A shade over the bowl directs the downward spread of light.

Lamps having diffusing bowls and fitted with large enough bulbs are useful in providing enough light for a close vision task, at the same time spreading enough light over the room, eliminating shadows. For efficiency, each size bowl requires a bulb of definite wattage.

Various types of lamps with diffusing bowls are on the market. Floor lamps, table lamps, and lamps hung from a hook on the wall are available. Lamps hung on the wall are practical where there is little table or floor space. A wall lamp is especially useful in the child's corner of the room, where another type lamp may easily be overturned.

### LAMPS GIVING DIFFERENT INTENSITIES OF LIGHT

Some light fixtures and portable lamps are made to use a bulb having more than one filament, thereby making more than one intensity of light available from the same bulb. For example, some lamps are equipped with a 50-100-150-watt three-light lamp bulb; others with a 100-200-300-watt three-light lamp bulb. Each of such lamps give one of the three levels of light by turning the switch on the lamp. Such a lamp is practical for use in a room where different light requirement tasks may be done. (See page 5, "Amounts of Light for Various Activities.")

### THE MEANING OF THE I. E. S. TAG ON LAMPS

Both floor and table lamps bearing an I. E. S. tag are available. Such a tag indicates that the lamp has been constructed according to scientific principles and has passed tests for mechanical, electrical, and seeing safety, as outlined by the Illuminating Engineering Society. Such a table or floor lamp, using a 150-watt bulb, produces about 50 foot-candles of light about 24 inches from the bowl, and 15 to 20 foot-candles about 3 feet from it. This lamp gives adequate light to see for such activities as general reading or sewing.

## PLACE LAMPS TO AVOID GLARE AND SHADOWS

For the sake of your eyes it is important that you place all lamps so the light from the bulbs falls on the work without casting a shadow. For such activities as writing, sewing, or playing the piano, the average lamp is best placed on the left for right-handed persons, and on the right for left-handed persons. Because a lamp with a diffusing bowl and the proper shade gives a great spread of light, its location may be varied without danger of casting harsh shadows.

The direct light rays from a bulb falling on glaring surfaces, such as shiny paper or furniture, reflect a glare. To avoid this glare, place the lamp

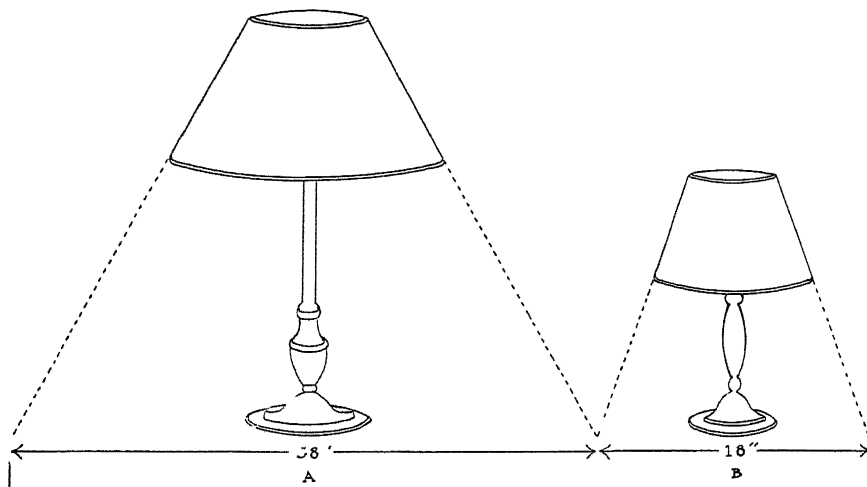


Fig. 20. — A properly proportioned shade, and a lamp of suitable height, are necessary for satisfactory spread of light. For example, a tall lamp gives a greater spread of light than a low one (compare A and B). The I.E.S. specifications for the height of a study lamp (table type), and for the shade, are: Height of lamp, 28 to 29 inches; diameter of shade at top 8 in., at bottom, 16 in., and depth 9 in.

farther away from the shiny surface or, better still, use a lamp with a diffusing bowl, properly shaded. If the lamp has no diffusing bowl, it may be placed to the side, rather than in front or back of the user, to prevent glare.

Place all lamps at such a height that no glare from the bulb is visible, while you are normally occupied. The eyes of small children playing on the floor need protection from the glare of light cast on the floor. Lamps with diffusing bowls (see page 15) are practical for illuminating the section of the room where some of the children play close to the floor, while others may be working at the table.

## *ABC's of Better Lighting*

●

1. Keep bulbs, diffusing bowls, and shades clean. Dust on bulbs, bowls, and shades greatly reduces the amount of light they supply to the room.

2. Use white inside-frost bulbs for general purposes. Colored bulbs cast fewer foot-candles of light per watt than white inside-frost ones. Daylight or blue-color bulbs are useful where the color of natural light is desirable, as for ironing or for washing lettuce. A daylight bulb of about one-half larger wattage than an inside-frost white bulb is required to give a similar amount of light. Colored bulbs are sometimes desirable for special decorative purposes.

3. Use bulbs having voltage rating which corresponds to the voltage of the electric current which you have in your home, to get the most light and the hours of service the manufacturer built into the bulb. The voltage and wattage are marked on the tip of bulbs. Have the company supplying your electricity check the voltage on your house circuits.

4. One large bulb gives more light per watt than two or more small bulbs, the total wattage of which equals that of the large one. However, in some cases it is economical to use a lamp with two or more smaller bulbs in order to adjust the amount of light to your task.

5. Keep the ceiling light in color and free from dust to get the greatest amount of light from the electricity you use. Dark ceilings and walls absorb light.

6. Provide enough light for the activities of each member of the family. Remember the small child. Select lamps or fixtures with large enough bulbs to give adequate light.

7. Prevent all glare from bare lamp bulbs and shiny surfaces.

8. Arrange your lamps to make the best use of the light. Remember that the intensity of light decreases rapidly as the distance from the light source increases (see "Some Guides for Measuring Light," pages 4-5). For example, if your lamp giving light directly from the bulb is 2 feet away from your work surface, the surface will only receive one-fourth as much light as if the lamp were 1 foot away.

9. When selecting or improving lighting fixtures, remember that simple, beautiful shapes are the most satisfying over a long period of time. Fringe, meaningless drops, and other useless decoration become tiresome, and often prevent the lamp from functioning properly. All lighting fixtures of similar styles are usually the most pleasing in one room, or in adjoining rooms.

10. Make the best use of a beautiful picture, wall hanging, or other decorative object in the home by directing light on it. A lamp or wall bracket with an open top shade may be placed to cast light upon the object or sufficient general illumination in the room may suffice.

11. Run no electric cords to lamps under rugs, over floors, or in door jams. The insulation becomes worn by walking, by rocking chairs, or by closing the door on the cord. Run no cords over radiators or steam pipes.

12. Repair or renew cords before the insulation becomes completely worn or breaks. A broken insulation may blow the fuse, creating darkness, or even start a fire. Use well insulated cords. The Underwriters Laboratories' inspection label on a cord indicates that the cord meets the minimum requirements for safety.

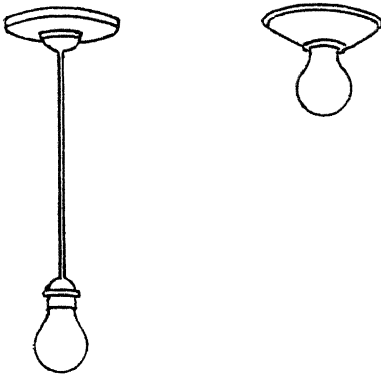


Fig. 21

*Modern Light from  
Older Fixtures*



Many lighting fixtures and lamps installed in homes years ago can be improved at little expense so they will give better light from the current used.

Adapter fixtures, such as shown in Figs. 21 to 26, are available for most types of electric lamps.

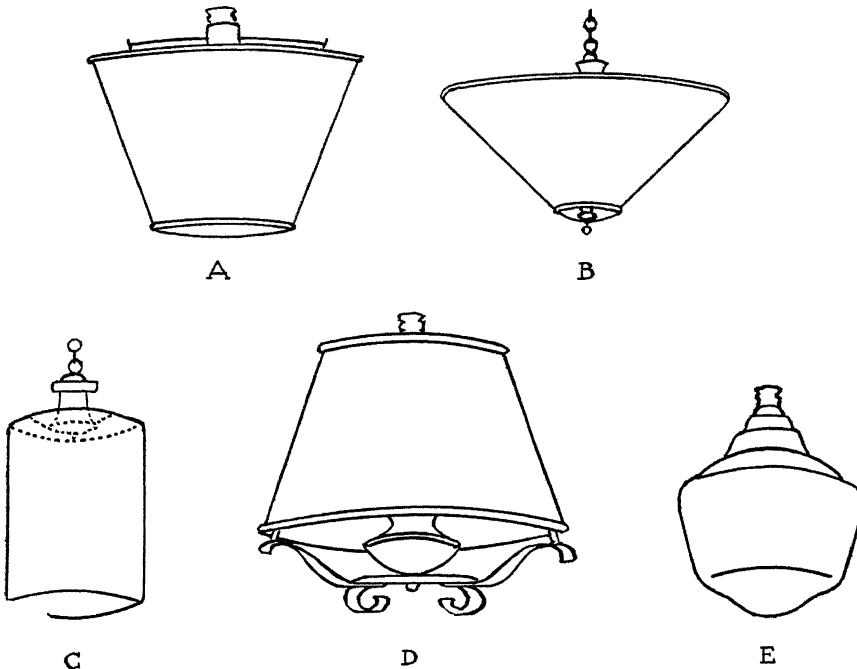


Fig. 22. — Adapter fixtures which prevent glare and ensure good light.



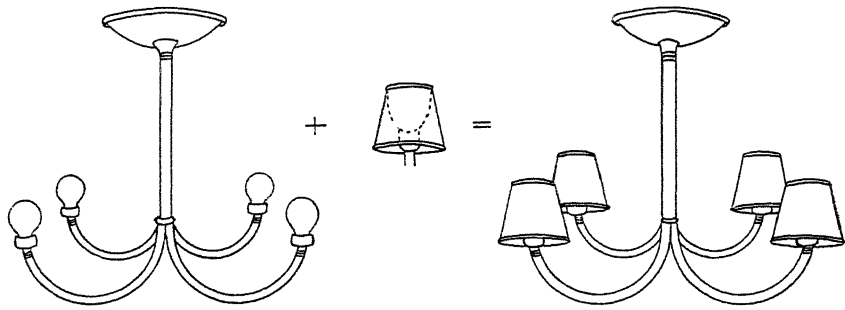


Fig. 23

Shade all lamp bulbs. (See "Shades for Lamps," page 14.) Use a bulb large enough to give adequate light. (See "The Need of Adequate Light," page 3.)

For the single socket fixture or drop cord, as Fig. 21, there are inexpen-

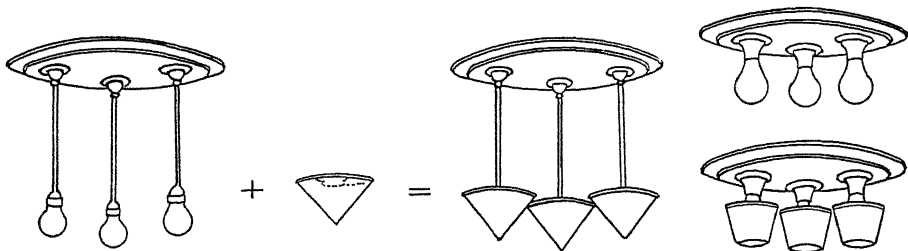


Fig. 24

Fig. 25

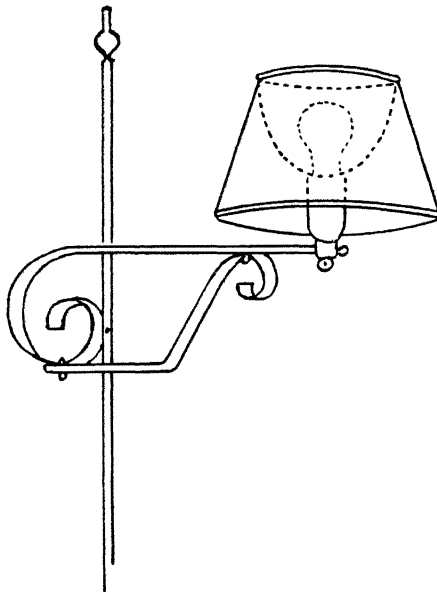


Fig. 26

sive adapter fixtures equipped with shades which can be screwed into the light socket, such as in Fig. 22. Various shaped shades, as (A), (B), (C), which can be clamped to the bulb are available. A parchment drum open at the bottom, such as (c) is useful to cast some light directly downward from the bulb. Hang it low enough to prevent glare from striking the eyes.

Each upright bulb in the central fixture or wall bracket, may be fitted with a small shade and a small bowl under the shade, as in center diagram, Fig. 23.

For inverted bulbs in central fixtures, individual parchment

cones or shades, as shown in Fig. 24, are available. For the shower type fixture close to the ceiling, individual shades, as in Fig. 25, are suitable.

A diffusing bowl with a shade may be fitted to an old bridge or table lamp to eliminate glare and soften the light (see Fig. 26). Various types of shades for better lighting are available for the bridge lamp. For example, bridge shades, combining the advantage of a diffuser and a shade, are on the market for the inverted bridge type lamp. A shade with a reflector top used with a silver bowl is another type.



## Electric Wiring for the Home

By

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THE electric wiring system, although usually not seen, is a very vital part of the electric lighting system. Electric wiring is not only necessary for lighting but for the other uses of electricity as well. Of the more than 200 different uses of electricity on farms, all can be grouped under three general classes, namely, light, heat, and power. The same wires that furnish electricity for light also furnish electricity for heat and power.

The purpose of this section on electric wiring is not to give instruction in the actual methods of installation, but to give assistance to the prospective user of electricity in planning the electric wiring system.

Everyone should be interested in securing a safe, adequate, convenient, and economical wiring system.

### REQUIREMENTS OF A WIRING SYSTEM

*Safety.*—Safety in the wiring system needs to be given special consideration, so as to guard against shock and fire hazards. Electricity is probably the safest source of energy used on the farm. It can be kept safe by installing a good wiring system and then keeping it in good condition. The wiring installation should meet the minimum requirements of the National Electric Code. This code, a set of rules that has been drawn up to promote safe practices in wiring, has been accepted as an American Standard by the American Standards Association, and is published as the regulations of the National Board of Fire Underwriters. Even though there may be no inspection required of the electric wiring before the electricity is turned on, the requirements of the code should be met. Inspection by a competent and reliable inspector is highly recommended.

Only approved materials that bear the Underwriter's label or appear on the Underwriters' list should be used. It should be remembered, however,

that these labels or listings mean only that the material or the equipment has passed the minimum requirements; they do not give a measure of the quality of the products bearing those labels.

In bathrooms, basements, damp places, near water pipes or grounded surfaces, non-metallic fixtures such as porcelain, rubber, or bakelite should be used. Then in case of a short in the fixture, a person will not get an electrical shock by intentional or accidental contact with the fixture. It is also well to see that equipment used in those places is grounded to prevent shocks from accidental shorts. The electric washing machine, particularly if used in the basement, should be grounded.

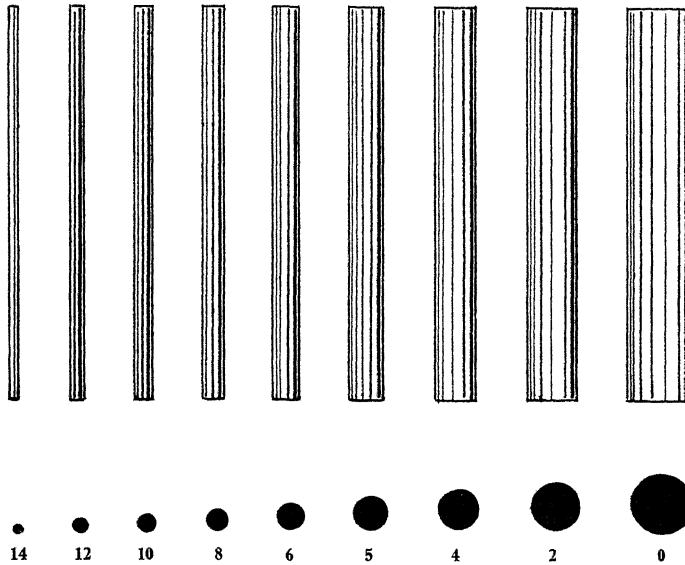


Fig. 27. — Approximate sizes of electric wires are shown with insulation removed.

*Adequacy.*— A wiring system, to be most useful, must carry the current to each place where its use is needed, and in such amounts as to do the work satisfactorily and economically.

Just as the size of a pipe in a water system is an important factor in determining the amount of water that the pipe will carry, likewise the size of an electrical wire or conductor is an important factor in the carrying capacity of a wire.

In the electrical system the pressure is measured in units called *volts*, and the flow of electricity in units called *amperes*. In a water system similar measurements are expressed in units called pounds per square inch, and gallons per minute.

A product of the volts times the amperes in a circuit gives the rate at which electrical energy is being used, and is measured in units called *watts*. Light bulbs, irons, toasters, and many other pieces of electrical equipment are designated as to size in watts. The total amount of electrical energy used over a period of time is measured in a unit called a *kilowatt-hour*, which is 1000 watt-hours. A *watt-hour* is the amount of electricity used during one hour at a rate of one watt.

The voltage or electrical pressure that is used for lights and socket appliances is 115 volts. Motors of  $\frac{1}{2}$  h.p. and larger, electric ranges, water heaters, and similar equipment are generally used on 230 volts.

Since electricity is used at a number of different places about the home there is need for several branch circuits. The smallest size wire that is permitted by the National Electrical Code for permanent wiring is No. 14 copper wire, and has a safe carrying capacity of 15 amperes. A No. 12 wire has a safe carrying capacity of 20 amperes; a No. 10, 25 amperes; a No. 8, 35 amperes; and a No. 6, 50 amperes. (Fig. 27 shows the various sizes of wires). For protection of the different circuits, each circuit should have a fuse or protective device of the proper size — that is, not larger than the safe

carrying capacity of the wire.

To be adequate, the wiring system must have enough circuits and large enough wires to carry all of the current needed without overloading any of the circuits and causing too great a drop in voltage.

The wiring system cannot be planned for lighting alone, because of the other uses about the home. The consumption of electricity increases from year to year as new uses are added. That should be taken into consideration in planning a system that will be adequate not only for this year, but for a number of years to come. The only way that the

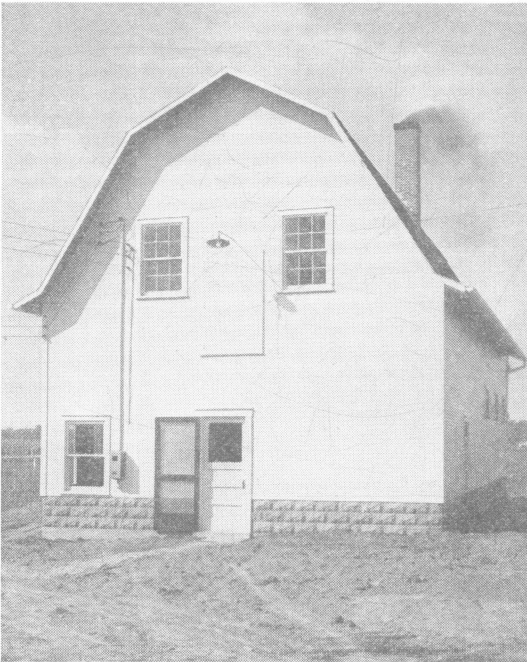


Fig. 28. — A typical three-wire service entrance with the electric meter located on outside of the building is shown. Note the height of the lamp on the end of the building.

system can be planned intelligently is to consider the possible future uses and make provision for them.

A No. 14 wire is most commonly used for house lighting circuits. The code permits a maximum load of 15 amperes on a 115-volt circuit of No. 14 wire. There are three types of openings to be considered—lighting fixture outlets, convenience outlets, and switches. Many wiring systems are now being put in with No. 12 wire instead of No. 14.

Adequate capacity for present uses and an opportunity for future expansion may be had by one of two methods. The circuits may be of No. 14 wire, provided they are not loaded to the full capacity of 15 amperes, the maximum permitted. The other method is to use No. 12 wire, with a limit of 15 amperes instead of 20.

The kitchen, being the workshop of the home, is usually the center of the electric load. Quite often it is desirable to have a circuit of No. 10 wire for those uses in the kitchen other than lights. The electric range and the electric water heater require special individual circuits of their own, usually of No. 6 or No. 8 wire.

It is good procedure to plan a very complete wiring system with ample capacity for present and possible future uses. Then if the entire system cannot be put in at one time, the part that is put in should be put in as outlined on the complete plan.

That procedure in making the installation will eliminate costly changes whenever other parts of the system as originally planned are added.

The service entrance wires and service entrance switch are important, as all of the electricity used must pass through them (see Figs. 28 and 29). The secondary service from the transformer to the service entrance switch should consist of a minimum of three No. 6 wires. The minimum size

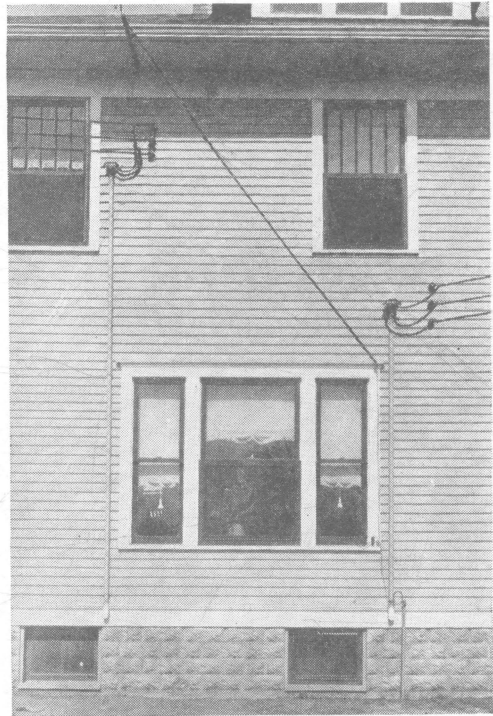


Fig. 29.—A secondary (115-230 volt) service entrance through rigid conduit is shown at right to the service entrance switch in the basement and the same service leaving the house for the barn is shown at the left.

entrance switch that is recommended is a 60-ampere switch. These are minimum recommendations and should be increased according to requirements.

The number of circuits leading from the distribution panel will be determined by the use and number of current consuming openings. The average farm home should have a minimum of four 15-ampere branch circuits, in addition to special circuits (see Fig. 30).

*Convenience.*—The wiring system, if installed properly and kept in good repair, should be good for the life of the building. That calls for careful planning in locating the lighting outlets, the convenience outlets, and the

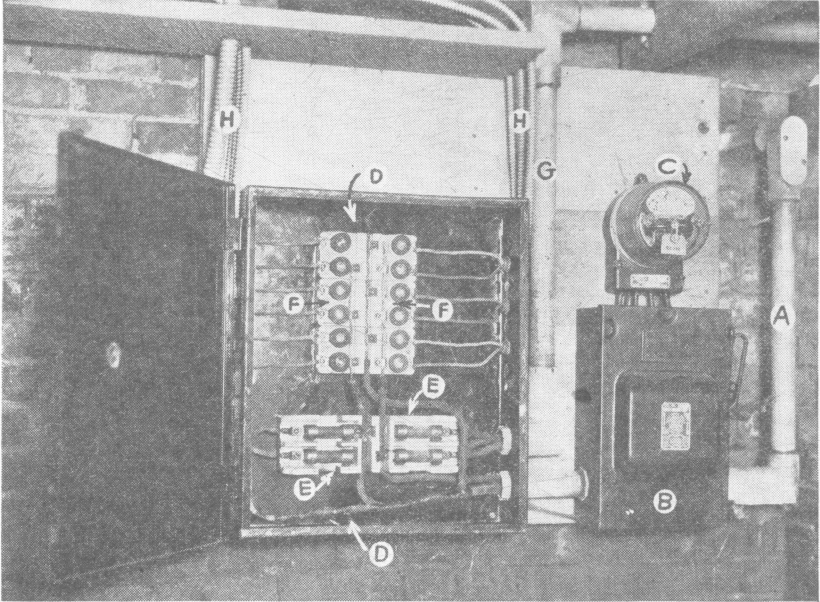


Fig. 30. — A typical service entrance switch and distribution panel with inside meter.

- |                                 |   |
|---------------------------------|---|
| A. Rigid conduit entrance.      | E. 230 volt service fuse blocks.                      |
| B. Service entrance switch box. | F. 115 volt service fuse blocks.                      |
| C. Watt hour meter.             | G. 115-230 volt service for farmstead.                |
| D. Main distribution panel.     | H. Flexible conduit and BX cables for house circuits. |

switches, so that electric service will offer the maximum of convenience. If mistakes are made in the locations of outlets and switches, much of the convenience and safety of electric service may be lost. It is not always easy to correct those mistakes, as sometimes considerable expense may be involved.

All center lighting fixtures should be controlled by wall switches, located at convenient places. Three-way and four-way switches should be used to control lights in halls, stairways, or in rooms that are used as passage ways. These switches make it possible to turn on the lights ahead of, and off behind one's path of travel. In the course of a year many steps will be saved

by not having to retrace to turn off the lights. Possible injury may be averted by not having to go through unlighted rooms or up and down unlighted stairs.

Provisions should be made for enough convenience outlets (see Fig. 31) which make it possible easily and quickly to attach portable pieces of equipment to the electric circuit. The increase in the use of floor and table lights make it highly desirable to have an abundance of convenience outlets, so that it will not be necessary to attach them to center fixtures, or have extension cords run under rugs or around the rooms.

At least one double convenience outlet should be installed on each wall of every major room. In the living room, outlets should be so placed that from any place along the wall it will not be more than ten feet in one direction or the other to a convenience outlet.

The location of lights for convenience and good lighting has been discussed under Lighting.

*Economy.* — Everyone should

be interested in getting an economical wiring system. An economical wiring system is not necessarily the one that costs the least money. The wiring system is a long-time investment and should be considered as such. Along with the cost of the system must be considered the safety, adequacy, and convenience of that system. By saving a few dollars on the installation the system may be a fire or shock hazard.

If the wires are not large enough to carry the current needed, lights and equipment will not operate efficiently. The money saved in putting in a system that does not have large enough wires or enough circuits is soon used up in greater cost of operation. The increased cost continues, of course, as long as the system is used under these circumstances.

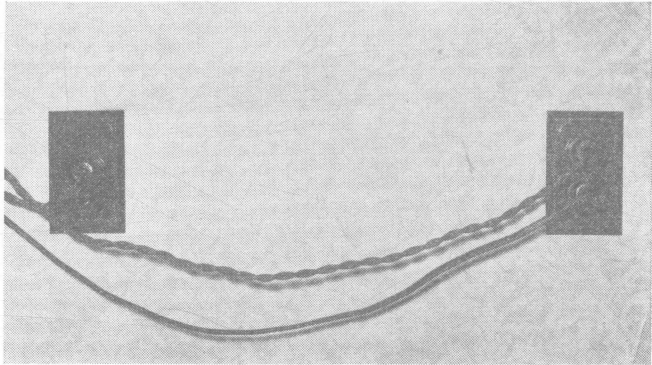


Fig. 31. — Outlets conveniently located are necessary for the fullest use of portable lamps and equipment. Here is shown a double convenience outlet on the right supplying current for a radio and an electric clock; on the left is shown a special connection for the ground and aerial of the radio.

## TYPES OF WIRING

There are three types of wiring that are generally used at the present time. They are: (1) knob and tube; (2) cable, both metallic and non-



metallic sheathed cable; and (3) rigid conduit. There are other less commonly used types for special purposes or conditions. These different systems of wiring are approved by the National Electric Code if installed in accordance with the requirements of the code.

*Knob and Tube.*— Knob and tube wiring gets its name by reason of the wires being supported on porcelain knobs, or run through porcelain tubes or loom wherever it is necessary to go through joists, studs, or partitions. It has been used satisfactorily for a number of years, and is probably still the cheapest type of wiring that can be installed, particularly in new buildings. The rubber covered wires that are used have very little protection against mechanical injury, and for that reason it is not very satisfactory where exposed to possible injury. If used in old buildings it is not easy to conceal the wiring without increasing the cost to such an extent that it may be more expensive than some of the other systems.

*Metallic Sheathed Cable.*— This type of wiring consists of rubber covered wire enclosed at the time of manufacture in a flexible spirally wound metal covering. This metal covering gives good protection against mechanical injury. It can be fastened directly to almost any type of wall surface. It is well adapted for concealed wiring in old houses, as it can be readily installed behind walls with very little cutting. The metal covering is rust resisting, but if used in very damp places or in stables where there are likely to be ammonia fumes, corrosion is likely to occur.

Another difficulty that may be experienced with this type of wiring if it is not carefully installed is "shorting" between the metal covering and the wires. Careful installation should practically eliminate that serious trouble.

*Non-Metallic Sheathed Cable.*— In general, this is quite similar to the metallic sheathed cable except that it does not have a metal covering. It offers considerable protection against mechanical injury, although not equal in that respect to metallic sheathed cable. Since it does not have a metal covering it can be used in slightly damp places without danger of corrosion. It is not satisfactory for places where there is likely to be considerable moisture. The covering is treated with a rodent repellent material, so that it is not likely to be chewed by rats or mice. Where it is likely to be exposed to mechanical injury it should be protected by wood strips or installed in ordinary iron pipe.

*Rigid Conduit.*— This type of wiring system consists of first installing a rigid metal pipe system called conduit. Then rubber covered wires are pulled into the conduit. This system offers the greatest mechanical protection, and is also the most expensive. It is not easily installed in old buildings if it is to be concealed. The high cost and installation difficulties in old buildings makes use of rigid conduit on farms very limited. There are two types of conduit in use, the standard type and the thin walled or electric metallic tubing. Special fittings are required for each type.

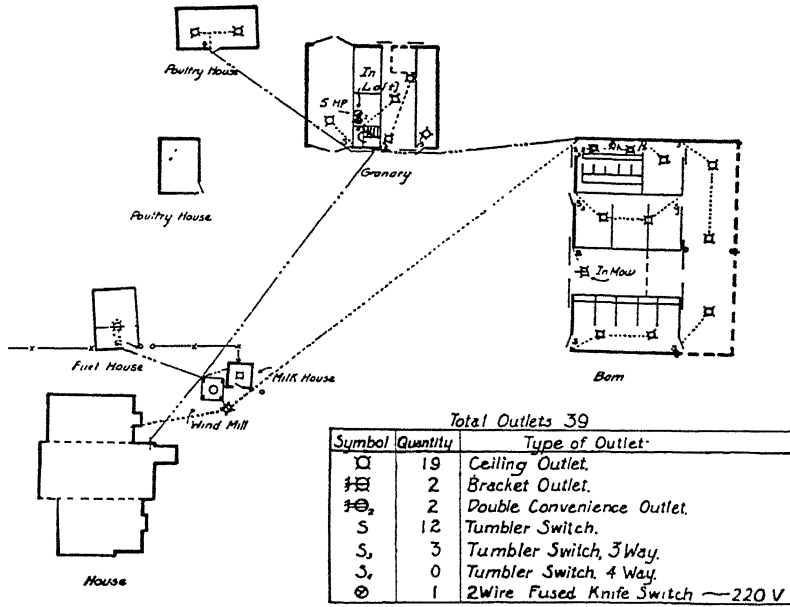
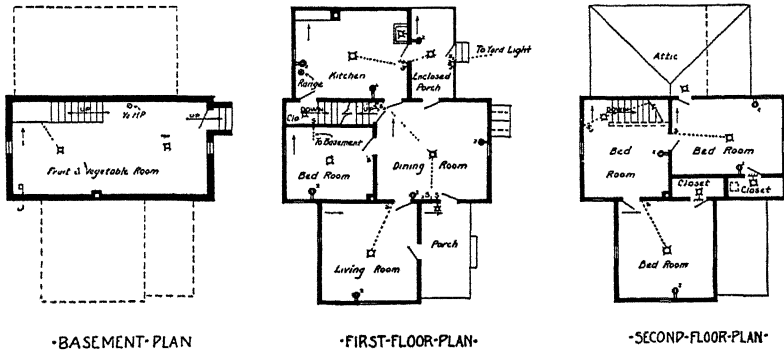


Fig. 32. — Wiring diagram for the Charles Nicol farmstead.

———— 3 wire 110-220 volts  
 = = = = 2 wire 110-volt only  
 ..... Designates connection between outlets



Total Outlets - 43

Symbol	Quantity	Type of Outlet
□	12	Ceiling Outlet.
⊠	4	Wall Outlet
⊕	11	Double Convenience Outlet.
S	7	Tumbler Switch.
S <sub>3</sub>	7	Tumbler Switch-3 Way.
S <sub>4</sub>	0	Tumbler Switch-4 Way.
⊙	1	3 Wire Fused Switch 110-220 Volts.
⊖	1	2 Wire Fused Switch 110 Volts only.

Fig. 33. — Wiring diagram for the Charles Nicol farm home.

..... Designates connection between outlets.

*Metal Surface Raceway.*— This type of wiring is an adaptation of rigid conduit, and is used in homes that have solid masonry walls where it is usually very difficult to conceal the wiring. The raceway fits close against the wall and is not very objectionable in appearance.

*Lead Covered Cable.*— Lead covered cable consists of rubber covered wires encased in a lead covering. It is used in damp places and for underground circuit to well pits or buildings where overhead services are objectionable.

#### CONTRACTING FOR THE WIRING

Since wiring is a specialized job, very few people do their own wiring. One of the first steps, and a very important step in contracting for the wiring job, is to make a plan of the wiring system, showing the location of lights, switches, convenience outlets, and power outlets (see Figs. 32 and 33). This plan should include provision for possible future uses. The plans then can be submitted to several electrical contractors for bids.

With definite plans and specifications as to types of wiring to be used, the different contractors will be bidding on the same items. This will eliminate the wide variations in bids that are likely to be received if the contractors do not know exactly what is required. With contractors bidding on definite plans, then the lowest bid may be accepted with reasonable assurance that you are getting what you want at the lowest price. It is very important, however, that a competent and reliable electrician be secured.

It should be remembered that even though the best materials obtainable are used in the wiring system, the safety of the system will be dependent upon the way the installation is made and the manner in which it is cared for.