The Shack Layout

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A shack does not begin with equipment. It begins with a place to ham. Most often this will be part or all of a room. A room—any old room—may seem to be just four bare walls and a ceiling. But if the room is to be our shack, we must take a close look at everything in it and about it. We may just have to live with some undesirable features, but until we look we will never know whether there might be some things we can do to make it a better shack.

By *room* I mean any potential space to be used as the shack. It may be located inside the house or in the basement or garage. It may be only part of a room. In fact it might even be a converted closet. Whatever space we have to use for the shack, we need to analyze and. to the extent possible, transform it into good hamming space. Large or small, the same factors will be part of our thinking.

There are many properties of a room we can look at. Here is a starter list

1. size
2. shape
3. windows: size and location
4. doors: location
5. wall color and texture
6. power outlets: number
7. light fixtures
8. fixed furnishings, e.g., bookcases
9. heating and cooling facilities
10. temperature and humidity
11. construction and location
12. location in house

There are even more features, but these are some of the main ones which will influence the design of our shack. The list only assumes that our shack will not be located in either the *kitchen* or the *bathroom.*

Which room should we use for a shack? Assuming that we have a somewhat free choice (which is rarely the case) the best places, in order of priority, are these:

- In a separate, but fully convenient and comfortable, building apart from the main house;
- In a room within the house, but separated from disruptive activities or activities which hamming would interrupt—hence, away from the center of family activity and away from bedrooms;
- In a basement, attic, or garage in which we can control temperature and humidity;
- In a room used for similar purposes by other family members, with the hamming portion screened off and (preferably) lockable;
- In a room used for other activities, with the operating position and any other test or construction functions able to be closed off in locked desks, benches, or cabinets.

The only priority on the list which may not be obvious is the listing of *2* ahead *of 3.* The reason is this: despite the fact that the usual unfinished condition of a basement permits more do-it-yourself improvements designed just to meet hamming needs, the temperature and humidity of a room in the main part of the house are most easily controlled. If these two vital elements present no problems, then the basement, attic, or garage shack may be more advantageous than a room in the house.

SIZE AND SHAPE

Analysis begins with a sketch and measurements of the size and shape of the room proposed for the shack. The sketch should also include the location and sizes of doors and windows, along with any built-ins such as bookcases. With this much information alone, we can begin to assess the best location for the operating position and other functions to occur in the room.

Figure 1 shows such a sketch. The odd shape will help us illustrate the principle that we can sometimes use problem areas to advantage.

Figure 2 presents three possible layouts for the operating position, as well as some adjunct functions we hardly ever note until we miss them. Along with the operating desk placed slightly away from the wall for convenient access to the cables, are some bookshelves and a reading chair and lamp. Near the operating desk we can store and use the manuals, handbooks, and ham journals we collect. When the bands go dead, this gives us a better way to use our time than merely listening to receiver hiss.

Design *A* locates the operating table at one end of the room with only a short cable run to the window, if it happens to be conveniently located for access to the antenna system. The reading chair is at the opposite end of the room with the bookcases along the wall. One advantage of this layout is that it uses the alcove space well. A second is that uninvited guests will not see the tempting equipment when passing the door. However, on the disadvantage side of the ledger, the reading position is separated from the operating position by a great space. Too, if the house has forced air heat, the floor or wall outlet is likely to be at the proposed position for the bookcase.

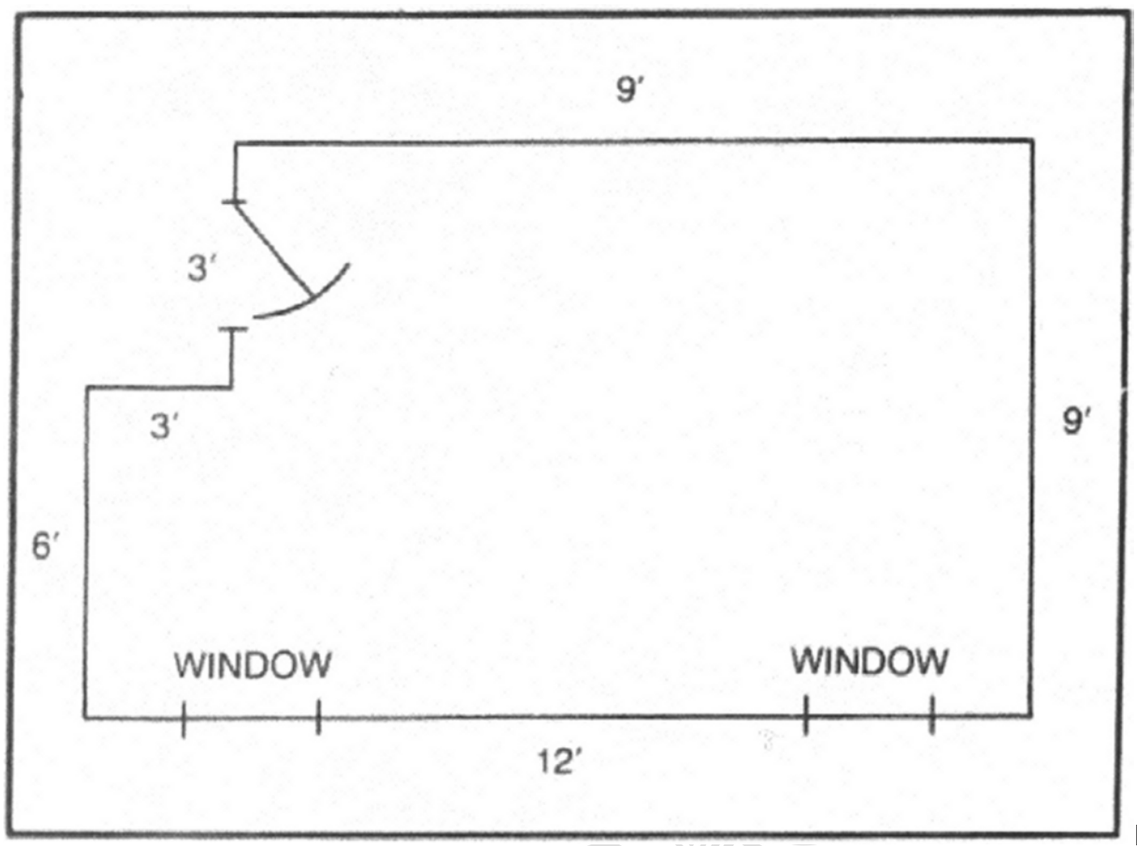

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Fig. 1: A bare room for the shack

Design *B* concentrates the station at one end of the room and places the reading chair near a window. The station is in ready view of people passing the door and the desk may appear to some to block easy entry to the room. More positively, the arrangement does free the alcove for other functions, such as a test bench or family activity.

Design *C* overcomes the blockage of the doorway by placing the operating table against the long wall, again near a window. Moving the chair to the inside comer takes it away from natural light, but permits a concentration of functions. The bookcase between the chair and the door does not block entry, but does separate reference material from the operating desk. As in design *B* the alcove end of the room is free for other activity and the heat duct area is open and away from equipment and materials. As in design B, however, the station is in view of passersby.

The exercise of Figure 2 has two uses. First, it illustrates that there is for any room no perfect arrangement of shack elements which will satisfy all desires. Any one of the designs might strike us as preferable to the others for a host of different reasons. Design *A* may be an unnecessary precaution if no children or untrained visitors tramp through the area. Designs *A* and C may both be unnecessarily close to windows if there is an alternative and better route for cables. What we plan for the rest of the room may also make one arrangement better than the others. Figure 2, of course, does not cover all the possible arrangements.

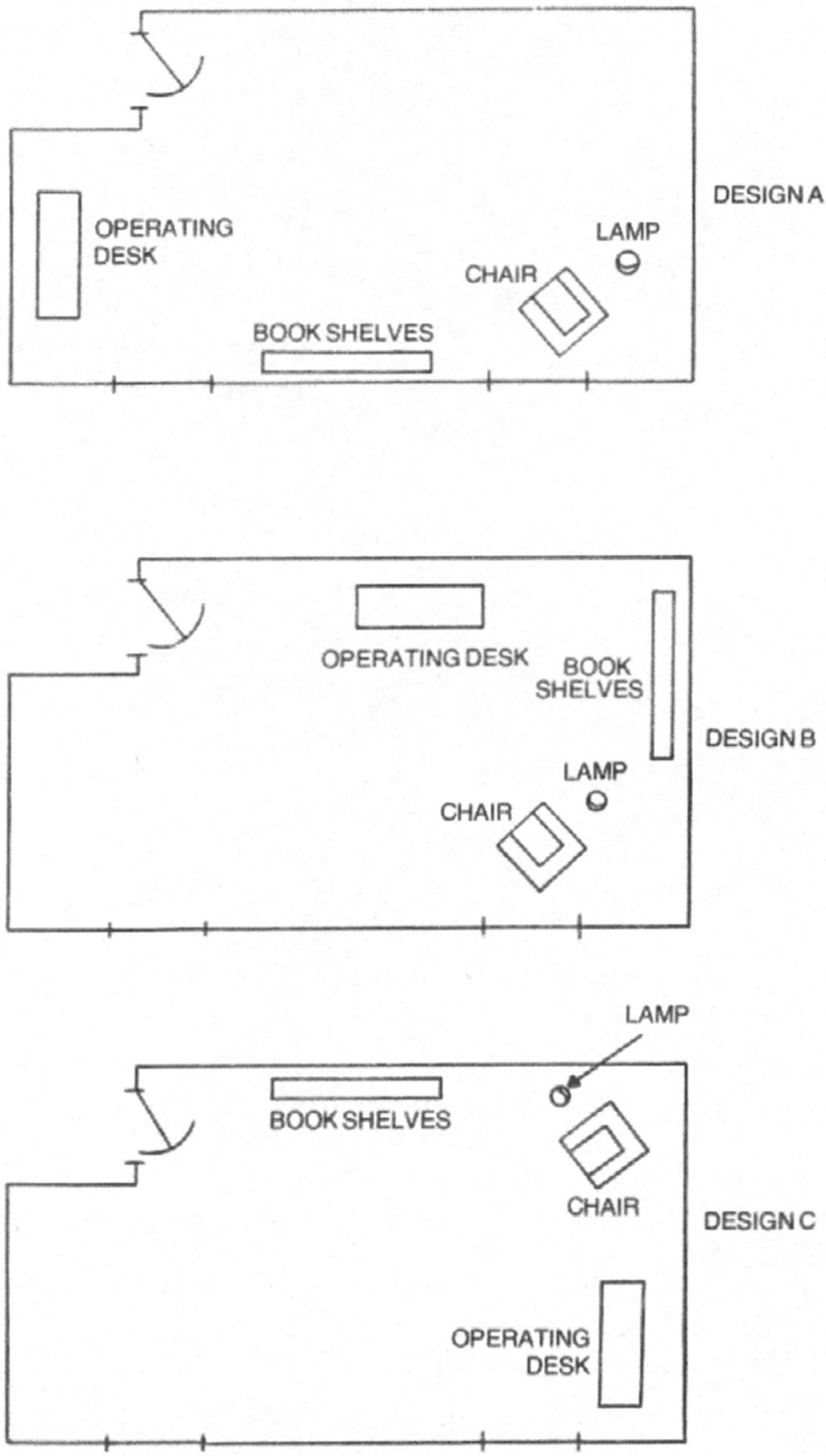

Fig. 2: Three arrangements for the room in Fig. 1

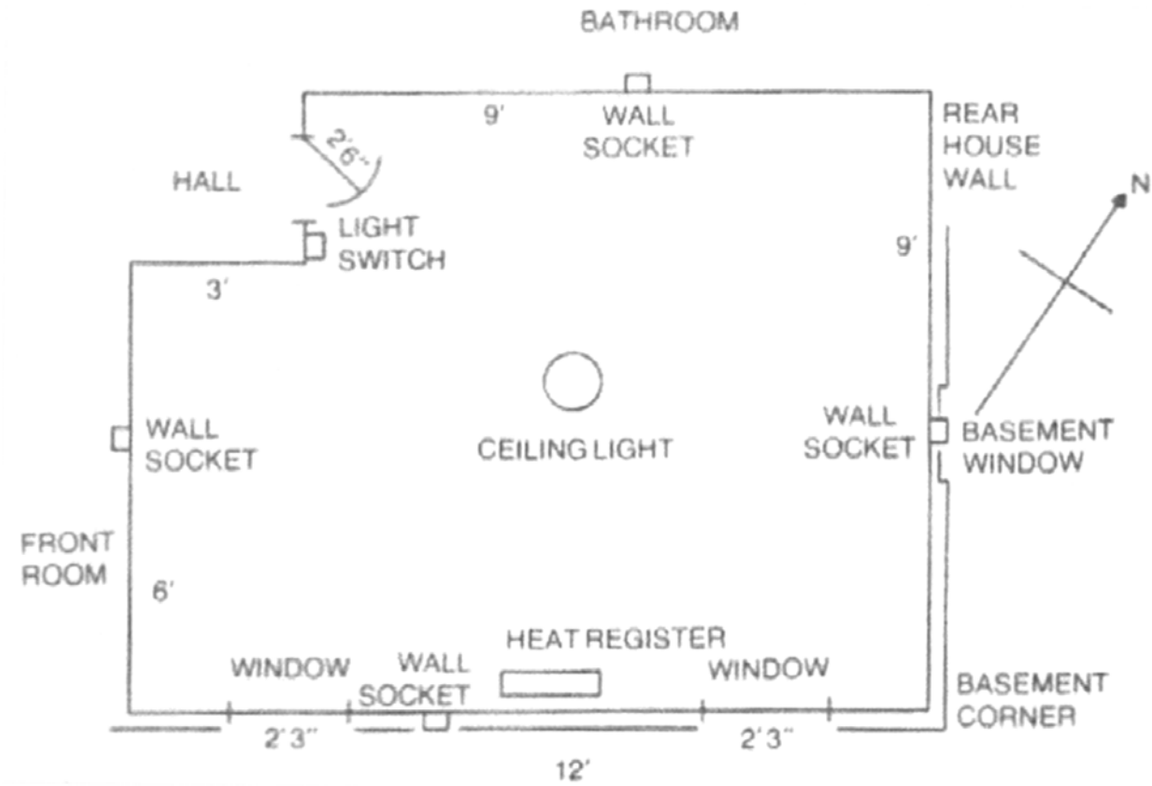

Fig. 3: Filling in essential room information

Second, the exercise illustrates the process which we should all go through in planning our shacks. Pencil and paper are cheap and little cut out desks and bookcases, drawn to scale for the furniture we have or will buy or build, are light and easy to move. Therefore, the process of analyzing a room proposed for the shack begins with a scale drawing.

The drawings should be more complete than Figure 2. In addition to the door and window placements, it should also show the heat outlet or radiator, the electrical outlets, permanent lighting fixtures, and built-ins. On either this drawing or another you should also sketch-in what is above and below the room, since this will guide and set limits to what remodeling is possible. Figure 3 shows a more complete sketch.

GENERAL REQUIREMENTS

Besides having room enough for the operating position, a good room for a shack should also have some other basic features. They are listed here with occasional examples to use as guides.

- The room should have heating and air conditioning vents placed where they provide good temperature and humidity control without interfering with operator comfort or convenience. Figure 4 shows examples of good and bad placement relative to the operating position. Although the desk clears the vent, the air flowing against the operator's legs can create discomfort. The obstructed vent also prevents good air circulation in the room. Likewise, the air flow of an overhead air vent should be arranged to keep drafts from the back of the operator's neck.

- The walls of the room should have a pleasant appearance. In a basement, we can create walls with paneling; upstairs, either paneling or a new coat of paint may do the job. Some shelves above the operating desk may break up a flatly colored wall as well as providing useful space for equipment. Avoid brightly patterned wall paper for two reasons. First, sitting close to it can cause eye

strain. Second, accidents to wall paper leave more evident and irreparable scars than on painted or paneled walls.

- Examine the ceiling. In addition to inspecting its construction and condition, test it with your voice for acoustic properties. If the sound is harsh or if the room produces echoes, acoustic treatment may be needed. Acoustic tile is reasonably easy to install with glue on finished ceilings and with lath strips and staples on unfinished ceilings. In the latter case, the lighter color of the tiles can improve general lighting.

- Measure the window sill heights to determine how they may affect furniture placement. The average height of a table or desk is about 30 inches, of a counter or workbench 36 inches, and of an end table 19 to 20 inches. Low sills may prevent us from placing furniture along some walls; high sills may open good areas for furniture.

- Determine the clearance needed for doors, doorways, and pathways through the room. The clearance areas must be left open for passage. In addition, be prepared to protect equipment which borders on the passageways from passing elbows (and protect the elbows from equipment).

- Check the placement of activity positions for mutual interference, if more than one activity goes on simultaneously. Figure 5 shows a corner placement of an operating bench and a test bench. For a bachelor, this arrangement may prove compact and efficient. For a family of hams, the arrangement may prevent the OM from checking the two-Meter rig while the XYL is working a traffic net. Figure 6A and B shows how a bookcase can keep a file cabinet from being opened, and how to take this into account

- Examine the flooring to insure that it can support the weight of the activity positions in the room and that it can take the wear which those activities will demand. Even a calm operator will wear the finish from wood flooring under the operating table. Solder and cigarette ashes can harm some kinds of flooring materials. Use carpets, throw rugs, and protective mats wherever needed.

- Be sure the construction of the walls will bear the weight of shelving and any other fixtures which you wish to install. If you cannot locate studs (a relatively easy job on gypsum walls with a magnetic stud finder, but often difficult with plaster), be sure to use hollow wall anchor bolts, and limit the loads on such installations.

- Do not let furniture or equipment block access to light switches.

This list, while not exhaustive, does alert you to the importance of looking at every surface and every feature in a room which may become your shack. In addition to these general requirements, you should pay special attention to power, access to the outside, lighting, and safety. Each of these considerations is vital enough to deserve a special section.

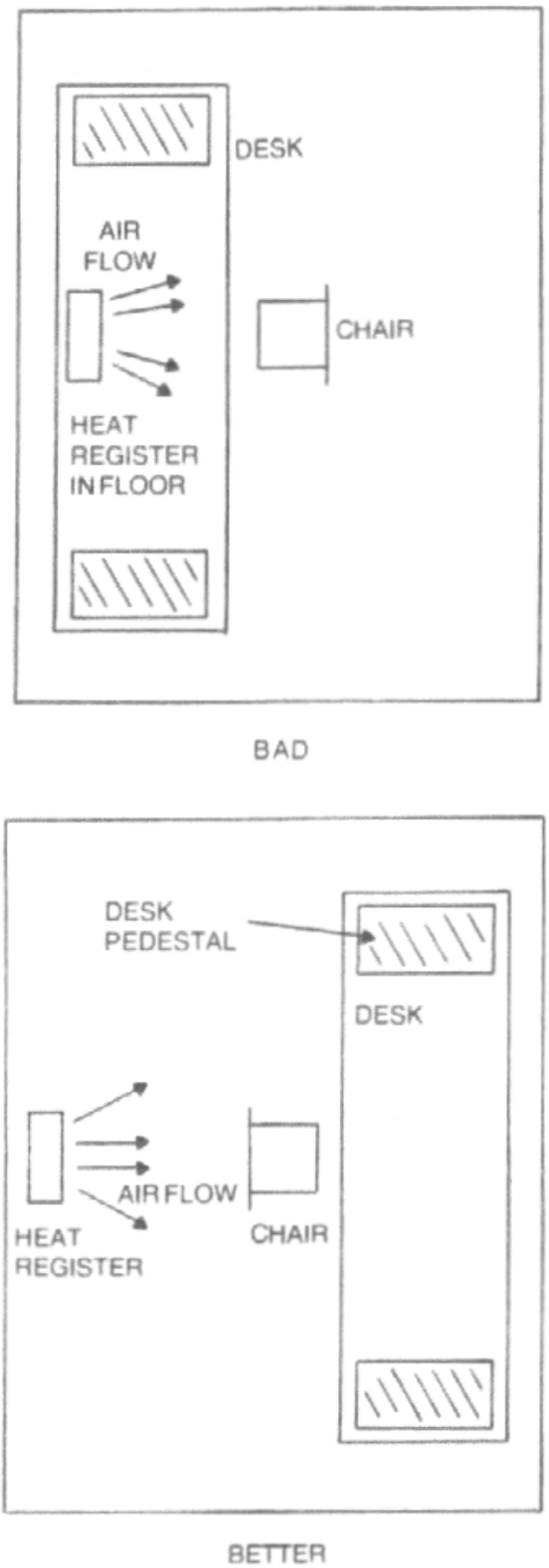

Fig. 4: Air flow in the shack

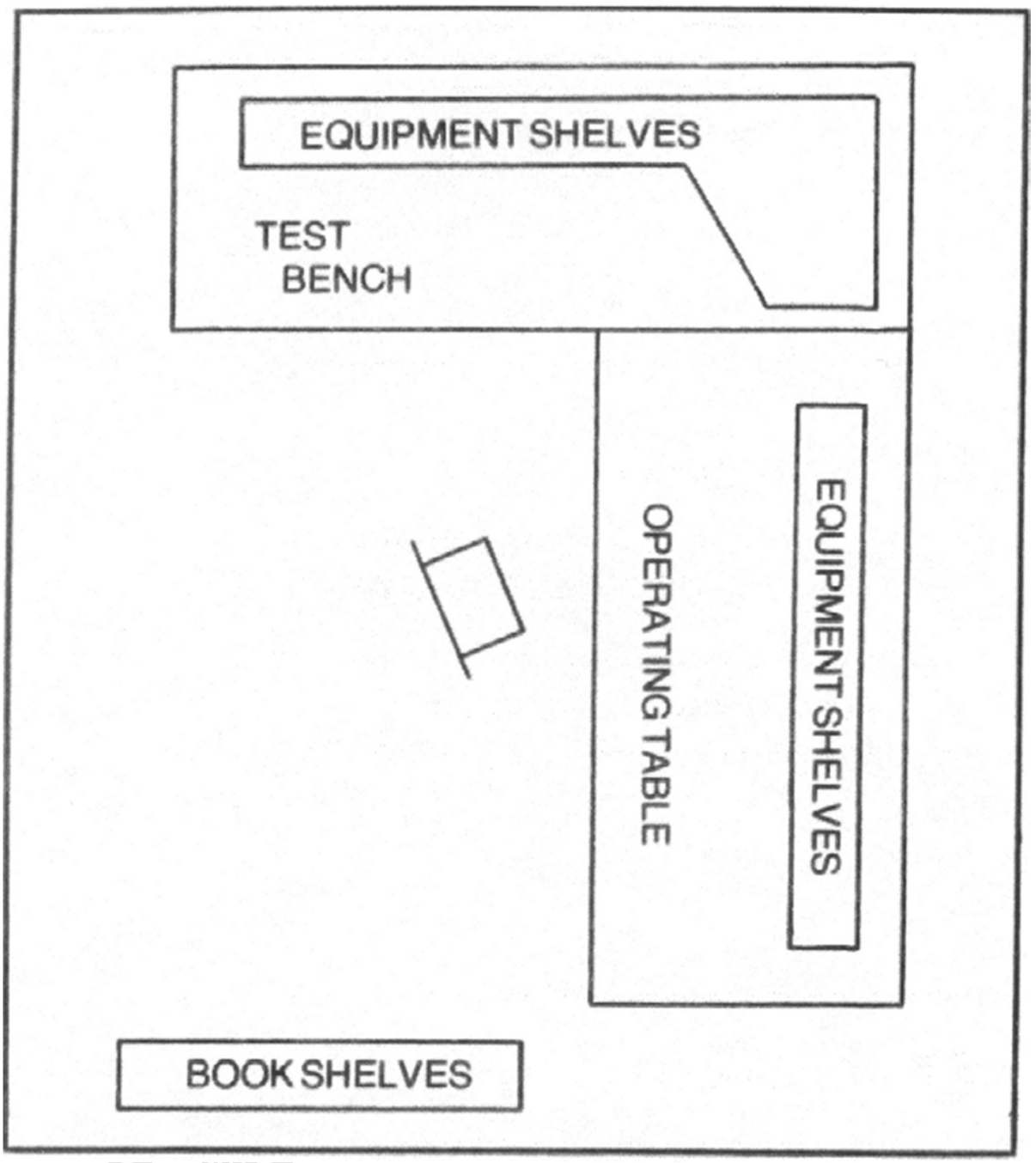

Fig. 5: Efficient comer arrangement for a one-operator

POWER

The room in which you locate your shack should have a satisfactory supply of line current arranged in convenient outlets. Some hams arrange their shacks around their outlets; others arrange the outlets to suit their stations. Which way you go will depend on what you discover when analyzing your room's power situation.

- *Power adequacy:* The shack should be fed by a branch circuit with suitable capacity and in excellent condition. Older houses often have number 14 wires. The modem standard is number 12 for the average 15 amp circuit breaker. Do not judge the capacity of a line by the size of a fuse in the box: many homeowners have dangerously installed fuses of excessive capacity to keep an appliance from blowing a smaller one. The heat from the excess load may not be detectable in the wall and may not cause a fire, but it may have deteriorated the insulation on the wires. The only way to discover the condition of wiring is to inspect it (with power to the circuit removed).

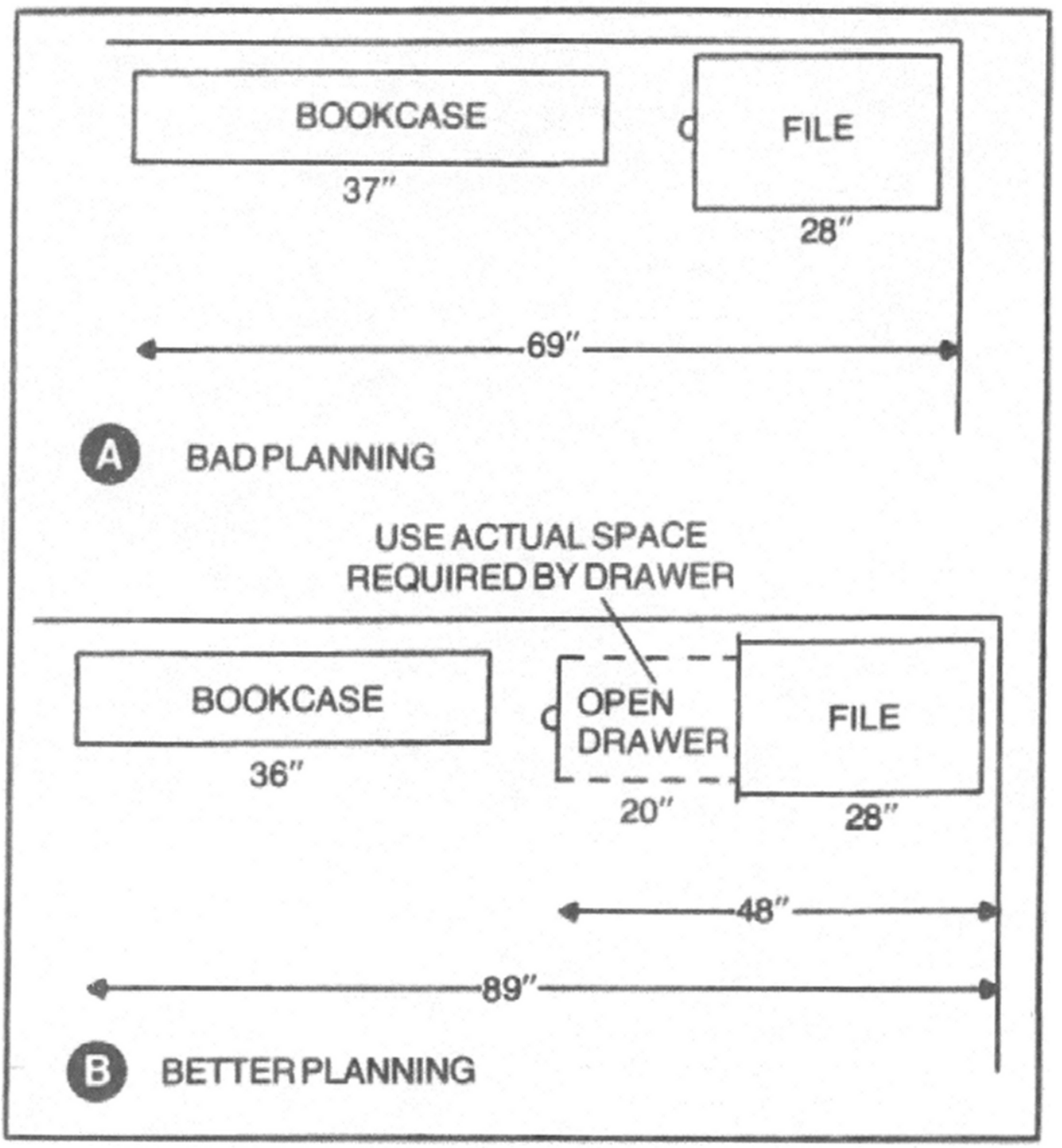

Fig. 6: Beware of obstructions like this

During your inspection, find out what else may be on the same circuit. The best situation is one in which the shack has its own circuit, since this will minimize voltage drops when other appliances are turned on (although nothing may help when the central air conditioner compressor goes into action). If a separate line is not possible, be sure that the combination of the shack and equipment in other rooms does not draw excessive current.

- *Outlet convenience:* The outlets serving the shack should be numerous and conveniently located. The use of extension cords for the operating table and for the test bench is not recommended. However, outlet expanders (plug-in units with more outlets than the standard two outlet device) may be used if you are judicious about observing load limits for them. The best system is to have a station power panel with a separate master switch which will cut off power to the entire station if a mishap occurs. (All members of the family should be briefed on where this switch is and how to use it.) The test bench should be similarly equipped.

The older the home, the more likely that outlets will be few and inconveniently placed. Moreover, older homes are more likely to have too many outlets on the same fuse or circuit breaker. Consequently, the temptation to add extension cords or surface mounted strips connected to an existing wall socket is greatest just where it should be avoided. Although adding capacity and convenience to the shack's source of power may require some work and expense, it is a good investment in safety and effective operation.

States and localities vary in their codes concerning installation of house wiring by persons not licensed as electricians. Whatever the laws, this fundamental rule applies: The installation of house wiring must be done to meet high standards of workmanship, materials, and overall power distribution. If it is permissible for you to do the job, be sure you know what you are doing before tackling the job, and be sure you do it right. If you cannot be a hundred percent sure that you can do it to perfection, have a professional do it. And if the law or local codes require it, be *sure* a professional does the work.

Old houses may require additional circuits to increase the capacity of the central fuse or circuit breaker box and perhaps even of the lines going from the power pole to the house. In short, the entire house may need to have its electrical system upgraded and updated. If this is true of your house, it may pay to have the main system, the kitchen, and the shack done all at once by a professional.

If you are able to upgrade the shack's power system, do not overlook the addition of a 220-volt line. Power amplifiers will be the main users of this source, and if you plan to use more than one, be sure the line has adequate capacity. At the same time, you may want to add one or more 110-volt lines to the shack with outlets at the most convenient locations. A separate line for the operating table and the test bench are good measures, even if the combined loads will not strain a single line. Figure 7 shows a sample sketch. If you design the most desirable system for a room in advance, you will be in a better position to work with the electricians installing the wiring. Planning for the maximum activity is one good way of guaranteeing that the system will not require a second upgrading later.

Certain features of the sketch in Figure 7 are worth noting. First, both the operating position and the test bench are equipped with two outlets each. One goes under the bench or table (but not behind a cabinet or leg) for the permanent equipment or for the line from the master power panel. The other is in the open so you can make temporary connections to equipment or instruments (on the test bench, however, a piece of equipment under repair should be powered through the roaster switch). The second outlet makes the connection of extra equipment less painful to the knees. More important, the equipment will be easier to disconnect.

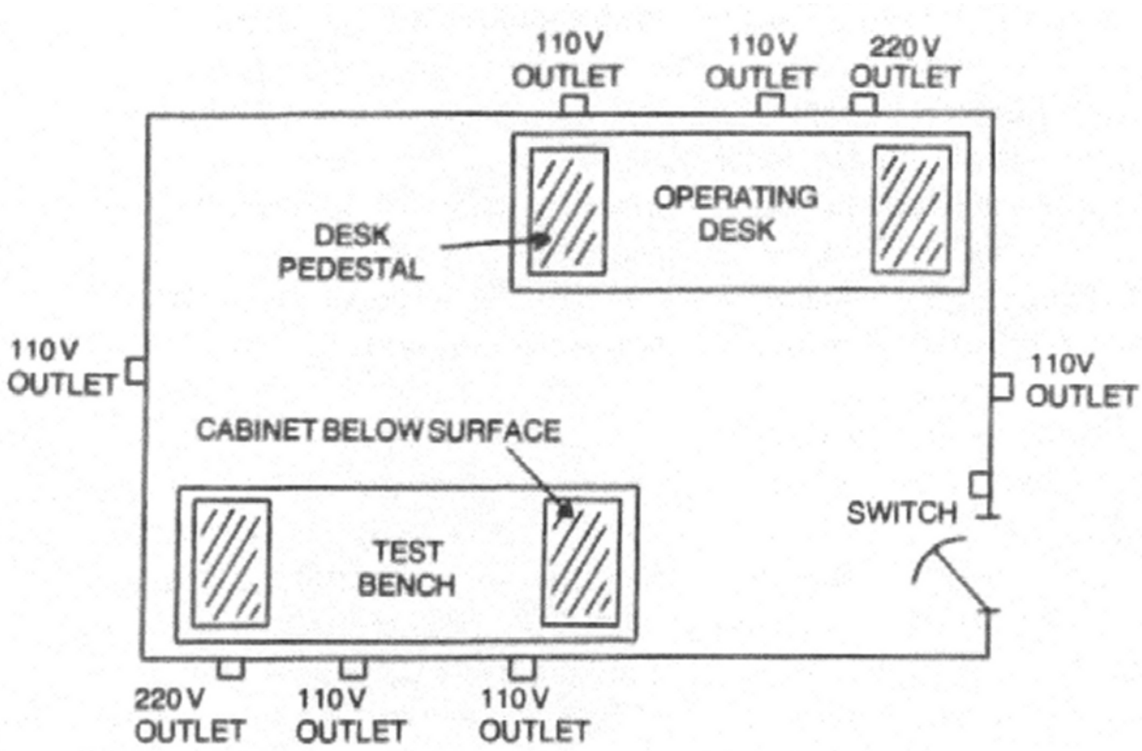

Fig. 7: Planning ac power tor convenience whether operating or testing

Second, both the operating table and the test bench are equipped with 220 volts. While many operators remember to add such a line to the operating position, they forget that linears also need occasional repairs. Third, the remaining 110-Volt outlets are placed in the open near positions of greatest use. The reading chair is one such place.

An advantage of the set-up shown is that the separate 110 volt lines for the operating and test positions are symmetrically balanced with respect to the 220 volt line for the shack. Thus, a single branch circuit can supply power to the shack. However, before setting this or any other system in place, be sure to add up the loads for each outlet, along with the 220 volt lead. Then add this to the overall house load. This evaluation serves as a final check on your plans. Adequate capacity, good materials and workmanship, and convenient outlets add up *to safer* as well as better operating.

ACCESS TO THE OUTSIDE AND TO GROUND

In the previous section, we looked at the power for the equipment in the shack. Unless you plan to use an antenna taped to the ceiling, you also need to think about getting the transmitter's power output outside. Access out of the shack can often be a greater problem than power—not only must you have a place to run the antenna cable, you must also have a good ground.

The best possible route for both antenna and ground cables is the shortest one. The quicker they both get out of doors, the less trouble will exist inside—Murphy needs no help in creating havoc in the shack. The shortest route is not always possible, however. In such cases, we must do the best we can.

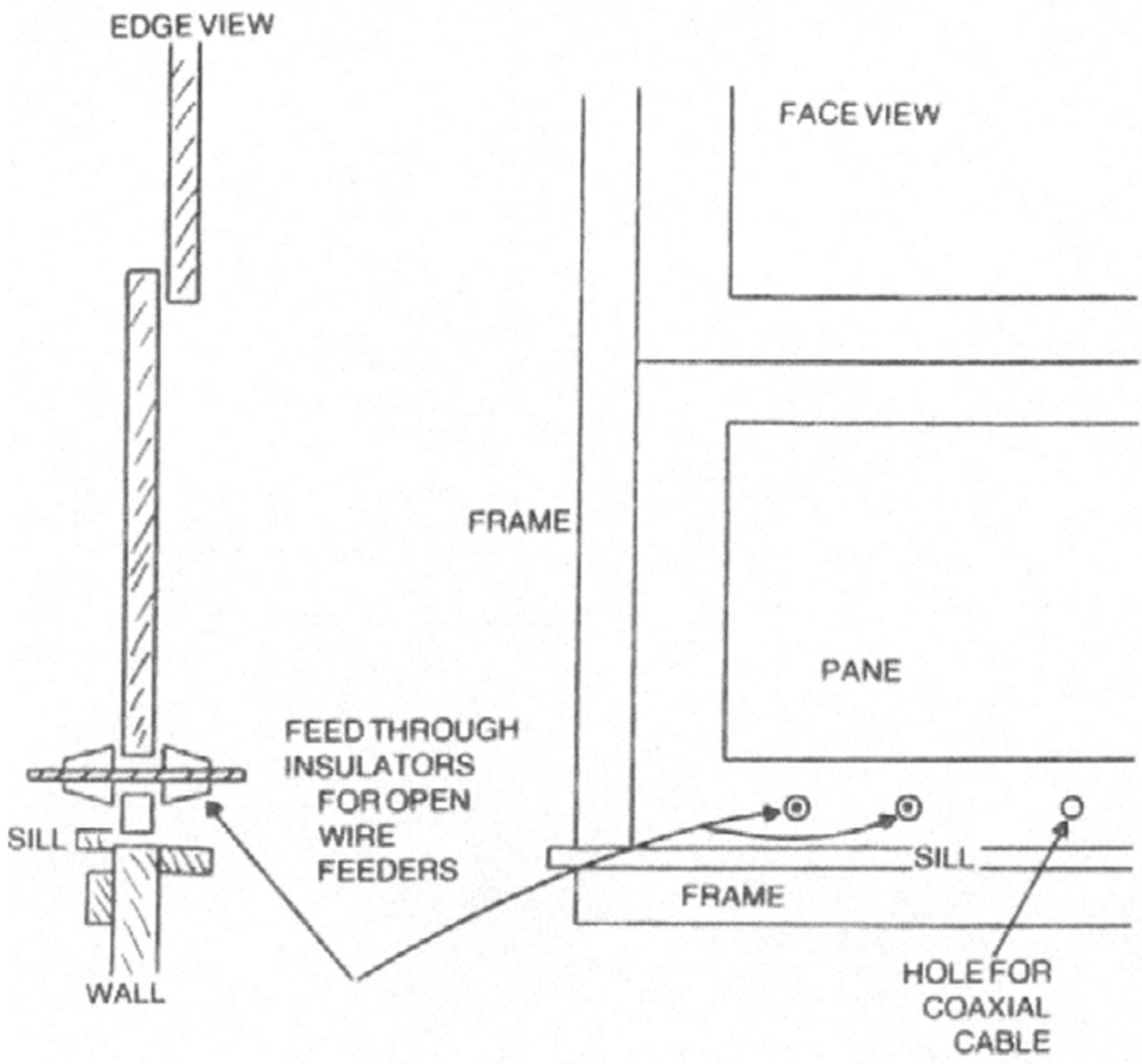

Fig. 8: Running cables through window frames

There are four major routes to the outside:

- *The window:* A window which faces in a direction convenient both to the connection point for the antenna and to a good ground location, if it needs to be out of doors, presents the fewest problems. Although some hams run cables through the window frame itself, as shown in Figure 8, the system in Figure 9 is preferable—it leaves no permanent marks and scars on the house. Using a board or plate in the window sill does require that you take precautions to preserve the security of the shack and the house; therefore, do not omit the locking bracket between the two parts of the window. In addition, be sure to use plenty of insulation around the edges to conserve house heat and cooling.

- *The wall:* Figure 10 shows the cables running through the wall. Be sure *before* you drill that no electrical circuits run in the area you are drilling. Although coaxial cables can be run through the hole without support, a length of plastic tubing or pipe will keep them in place. The points of emergence should be well caulked to minimize air leakage and the possibility of rain getting in. This technique does mark the house, but perhaps not irreparably. If the exterior of the house is brick or rock, this method of gaining access to the outside may involve more work than you care to do.

- *The floor:* If the shack is over the basement, you may want to drill or cut one or more holes in the flooring. This route may provide you with the shortest ground cable run to the water pipes. In addition, you may be able to run the antenna

feedline outside at the base of the house. Figure 11 illustrates the idea. The floor holes can be disguised or hidden while you use the house. When it comes time to sell the house, you just plug the holes. If you cut a larger hole, you may be able to put in a short piece of flooring and finish it to match the rest.

- *The attic:* A second-story shack may provide easier access to the attic than to the basement. Figure 12 shows one way to run a cable through to the corner of the room. Antenna cables enter through the hinged baseboard and run out of sight into the attic. They pass outside through the ventilation screen. The trough itself is paneled to match the rest of the wall. One advantage of this system is that the antenna cables leave the house well above the level at which anyone might grab or trip over them. A disadvantage is that unless the house has hot water or steam radiators, there is no way to have a short ground connection.

Each system has its own particular advantages and disadvantages. How the shack is oriented in the house and with respect to the yard will Figure 11. Running cables through the floor very likely determine which system is best for you and more than your own desires—any of them can be made to work.

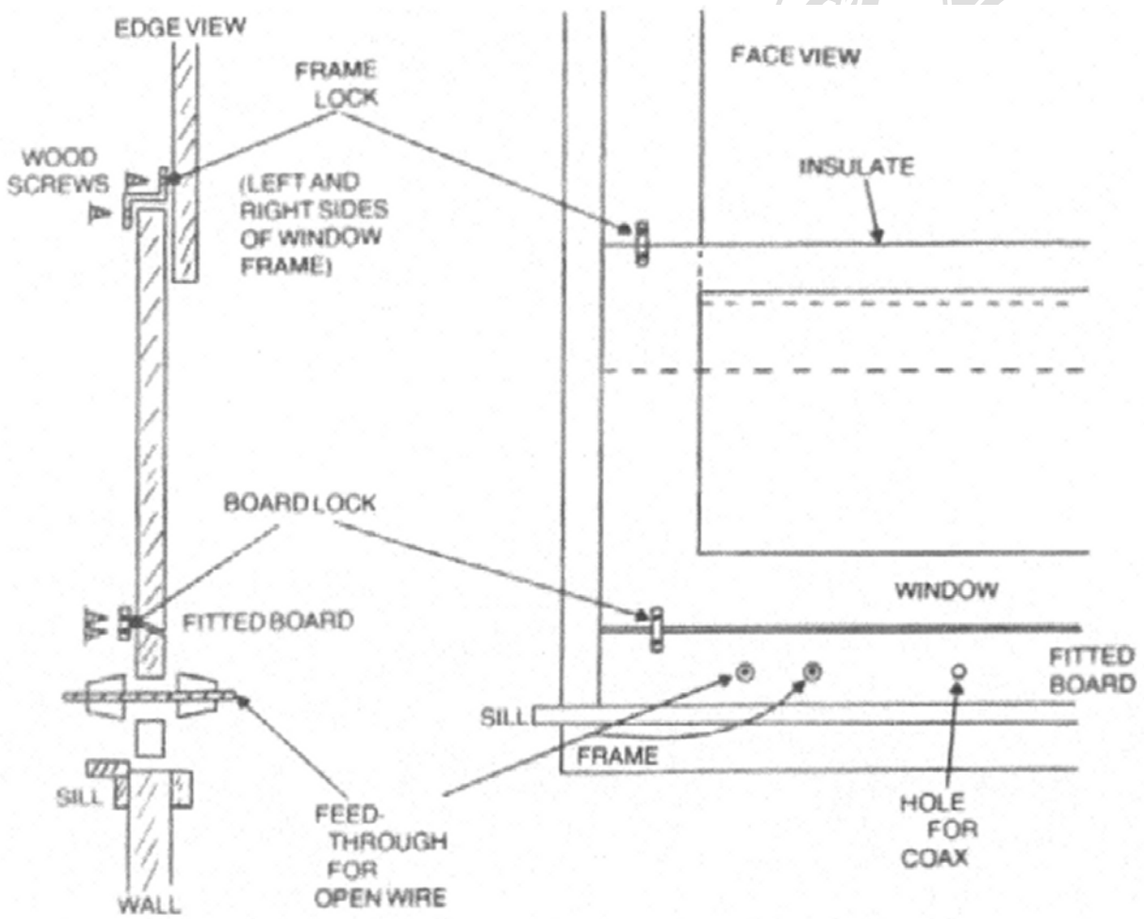

Fig. 9: Running cables through a fitted board in the window frame

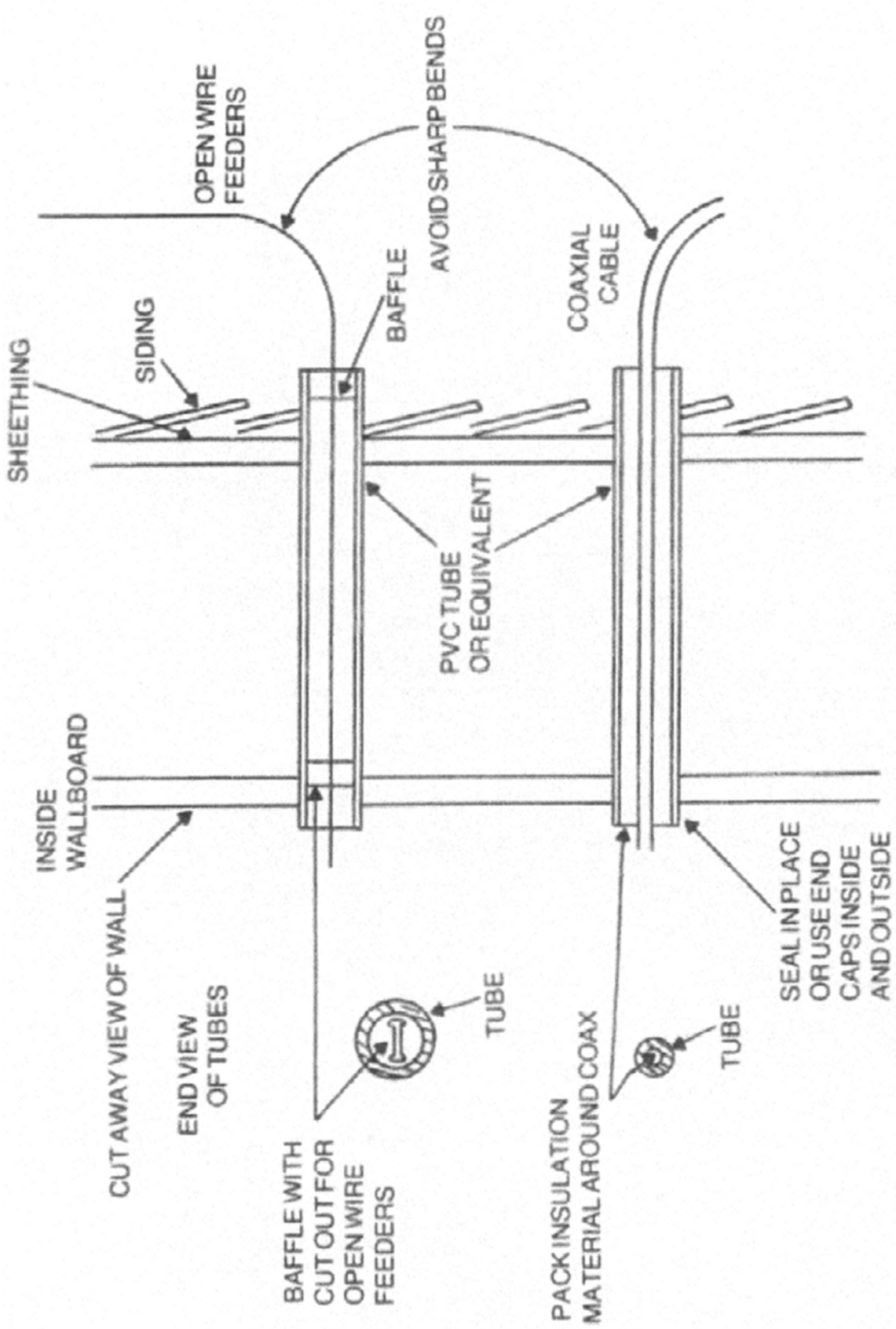

Fig. 10: Running cables through walls

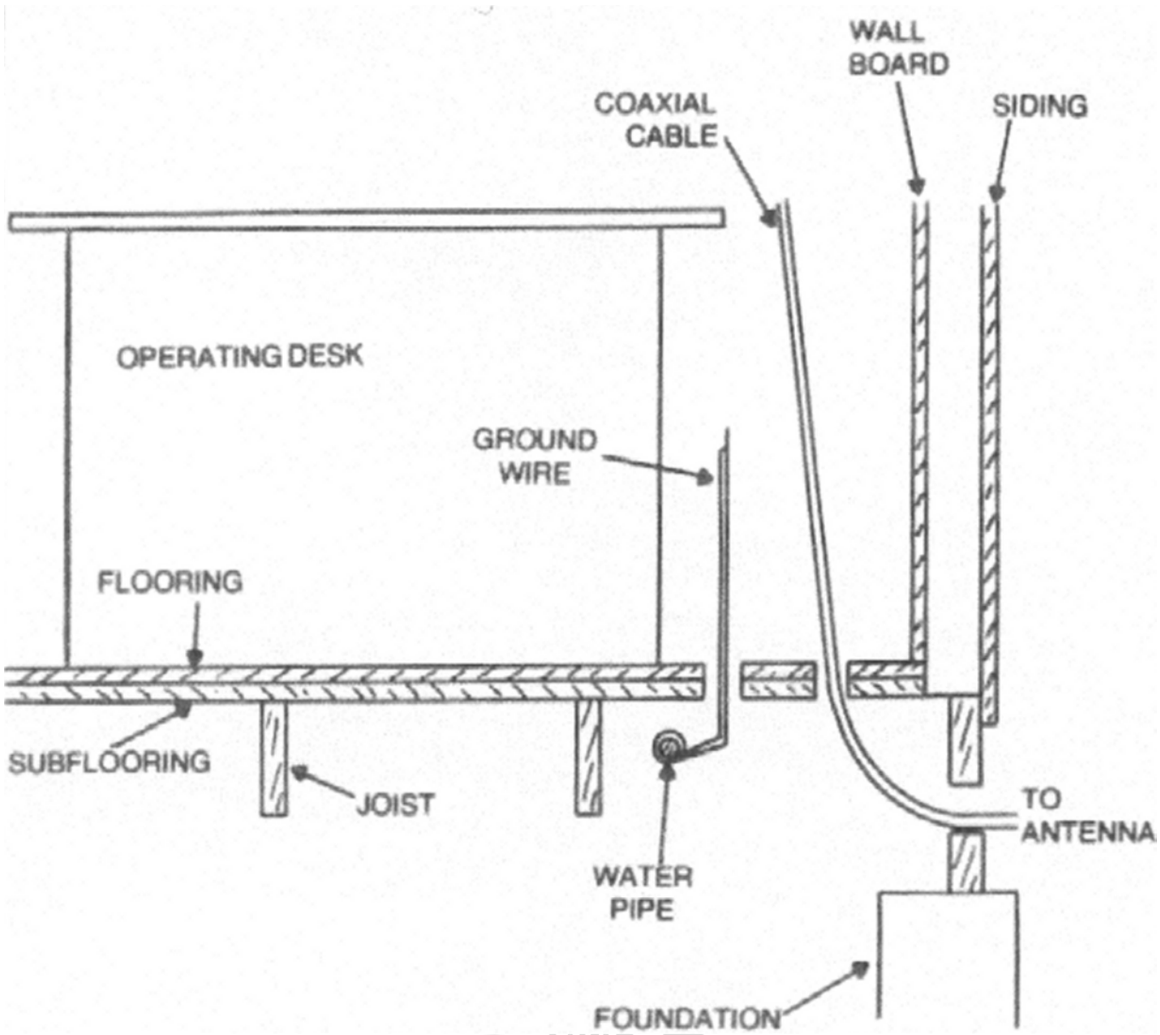

Fig. 11: Running cables through the floor

In running cables into and out of the house, it is best not to let them rest on rough or sharp surfaces. A narrow surface, although it might not cut a coaxial cable, may still deform it enough to disturb its impedance. In general, coaxial cables need all the support you can give them.

Protective ground cables, according to the *National Electrical Code* should be No. 10 copper, bronze or copper-clad steel. Chassis interconnection should be No. 14 or larger to minimize resistance and voltage differences between units. Although a water pipe system is the most highly-recommended connection to ground, other connections are possible. The use of electrical conduit is only recommended where it has been connected in turn to a water pipe system. Ground rods, a minimum of eight feet long, are only effective in permanently damp soil. If you are uncertain about the quality of your earth ground connection check it and try to improve it. Any voltage difference between a metal case and any other object calls for a better grounding system.

LIGHTING

Although ham radio is addictive, it should not be physically debilitating. An occasional glass arm from a 48-hour CW contest is permissible, but other health problems should not occur. Unfortunately, one of the most overlooked and common problems in ham shacks is eyestrain. Most of the time it is due to inadequate lighting. In general, we should never let our urge to conserve energy lead us to mistreat our eyes

Lighting of the shack is important not only to protect our eyes, but to ensure that we are able to use the shack to our best advantage as well. Poor lighting could result in mis-soldering a circuit board. We may short a high voltage terminal to ground if we cannot clearly see the test point Even reading the latest issue of a ham magazine can be excessive work if the lighting is poor.

Lighting can *be* poor for three main reasons;

— We do not have the right amount.

—We put it in the wrong places.

—It is the wrong kind.

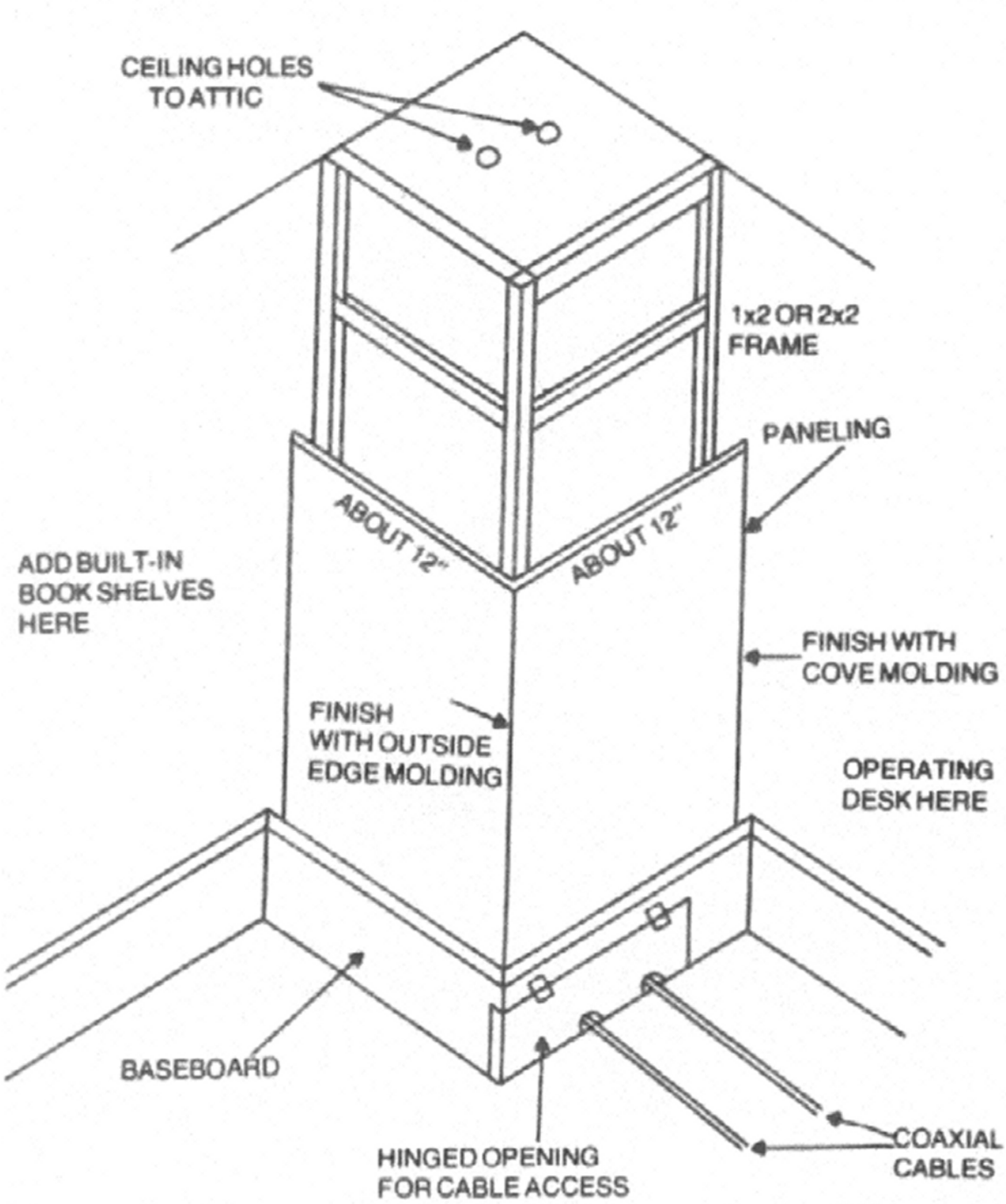

Fig. 12: Running cables to the attic

Let us look at the types of lighting that typically occur in the shack and see in what ways we can arrange them to serve us.

- *General room lighting:* Most rooms in modem houses are equipped with a ceiling fixture which we control by a wall switch. It often consists of two or more bulbs behind a frosted glass or plastic diffuser. If we have had a hand in designing our house to our own tastes, the general room lighting might consist of fluorescent or incandescent bulbs near the ceiling along the walls, indirectly lighting the room by bounding the light off the ceiling.

These light systems can serve for general illumination if we remember a few facts and lake measures to check their adequacy. First, the shack is an activity room, not a bedroom. The light level we find satisfactory for pulling socks from die dresser early in the morning is usually not adequate for activities. Thus, we should usually increase the level of general lighting by using larger bulbs or more bulbs in the ceiling fixture. In no case, however, should we exceed the limits of the fixture, which may bear an inscription such as *Use 60 watt or smaller bulbs.* These limits are usually a combination of the electrical and heat safety limits of the fixture. If we cannot get enough general lighting from an existing fixture, we should consider adding more fixtures or replacing the existing one.

The general lighting should provide light for the entire room. Often a centrally located ceiling fixture will mean that activities along the walls will be interfaced with by our own shadow. Thus, the problem may not be the total amount of light, but how to get it where we need it. Figure 13 shows two ways of eliminating the shadow—one being a supplemental fixture over the work area, the other being a lamp. Both methods will work and which one we choose may depend on the amount of effort involved in the installation.

In addition to quantity and placement, the *quality* of the light should concern us. General lighting should not be the direct glare of an incandescent bulb nor an unfiltered fluorescent bulb. Diffusion screens are one method of softening both the light and the edges of shadows. Another method is indirect lighting—the efficiency of which may depend in part on the reflective qualities of the ceiling or wall from which the light is bounced. The desired effect is to have *plenty* of *soft* illumination.

- *Area lamps:* We usually supplement area lighting with lamps of sufficient size to cover the major work areas. Thus, our operating table, test bench, and reading chair may all have associated lamps. One common fault of the lamps we purchase or drag out of the basement is that they are often designed more for decoration than for good lighting.

The *Better Light Better Sight Institute* has developed plans for lamps which produce good reading or study lighting. These standards, except for special cases, probably apply to the bulk of work, both operating and building. The lamp design has been produced by several manufacturers and is sold in both a desk and floor model. The principle is to begin with a large enough bulb (200 Watts) and then to reflect and diffuse the light so that a great quantity of gentle illumination occurs. Similar principles should be kept in mind when putting any lamps in the shack.

Placement of the lamps is also important. Floor lamps should direct light over the shoulder onto the reading material. This makes diffuse light even more important. A lamp on the operating desk should be placed in a position and at a height where it

spreads light evenly over the surface but does not shine in our eyes. Again, sharp shadows should be avoided. Figure 14 shows a sample arrangement of an operating desk and reading position from both a top and side view.

- *Spot lighting:* Occasionally we have need for special lighting over a small area. Doing fine work when building or highlighting a small area may call for additional lighting. The principle to remember is that this should be *supplemental* lighting—not *the only* lighting.

There are a variety of fixtures, both fluorescent and incandescent which direct light to small areas. High intensity lights can work well in this job. However, all such fixtures should be used only so long as the job lasts and we should never look directly at the intense light.

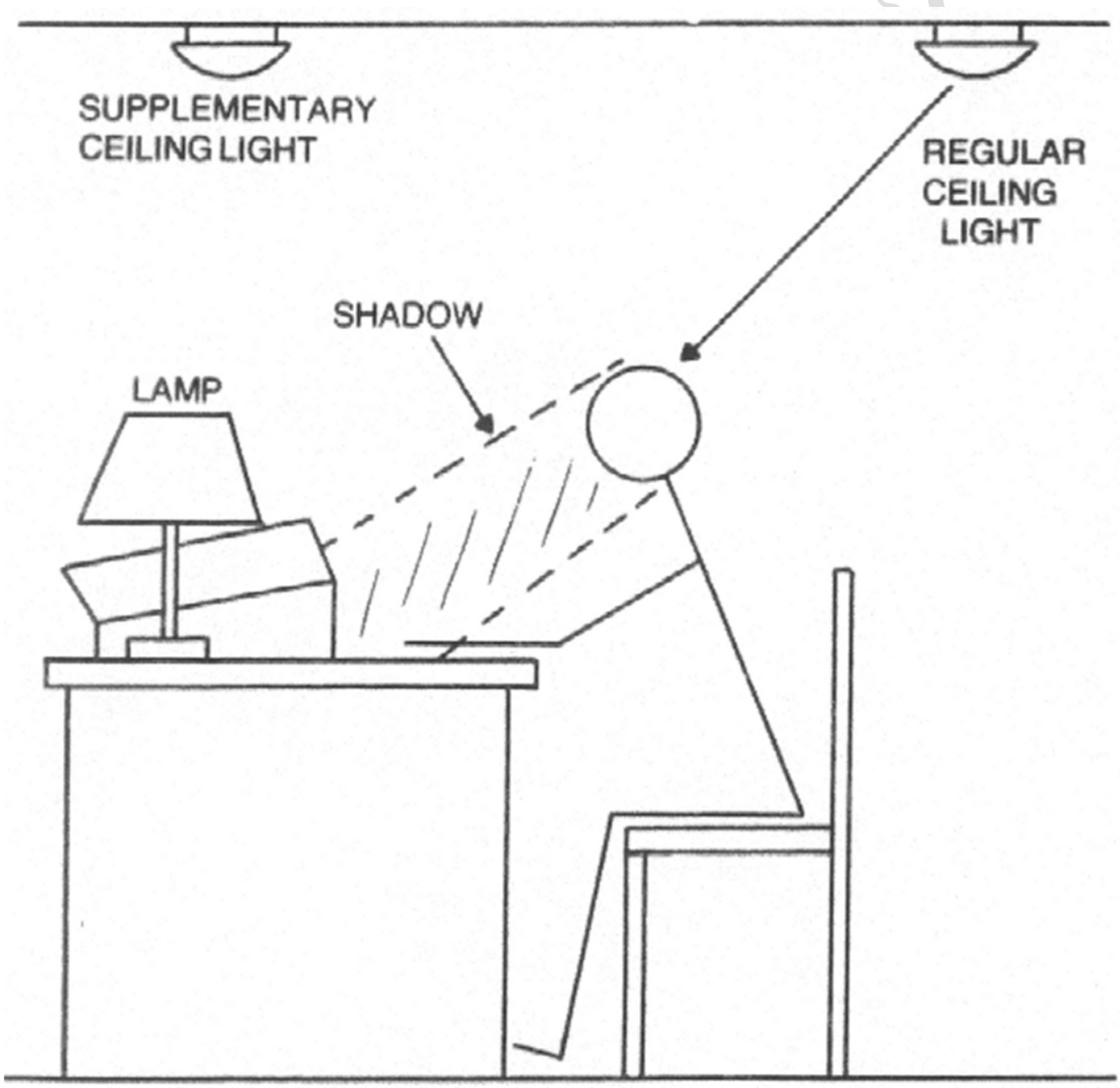

Fig. 13: Eliminating shadows at the operating position

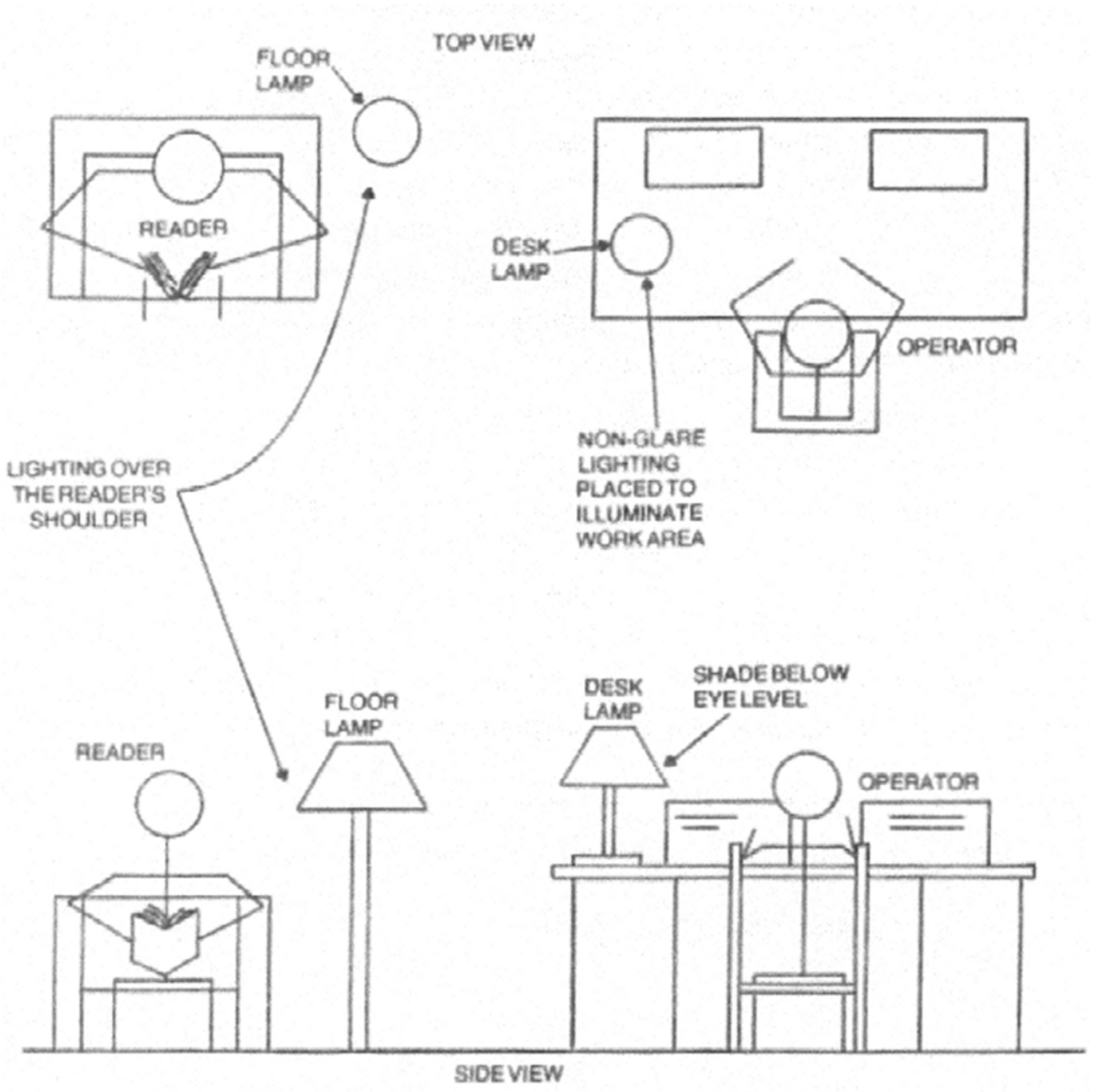

Fig. 14: Placing lamps effectively

Most of us will not have access to light meters to be sure that our shacks meet standards for light levels. However, if we plan our shack lighting carefully, we can be sure that the net effect is one which permits comfort as we work. When we are satisfied with the level of general illumination, we can then check the supplemental effect of lamps. Only then should we introduce the special lighting devices. This amount of planning will make the shack a pleasant place to spend our hours.

SAFETY AND SECURITY

Beyond comfort and efficiency, we should examine the shack with respect to how safe a place is to live. Equipment, antenna, and other forms of safety will appear as parts of oilier chapters. Here, we want to look at the overall room and check the elements of *basic* safety.

Anything we can trip over, fall into, get cut on, or otherwise use to hurt ourselves is an unsafe element in the room. Items such as furniture which are individually safe become unsafe if the arrangement leads naturally to carelessness or unexpected obstructions. A footstool in the middle of a walking passage, a desk jutting into a doorway, a cord across the floor, or a wobbling bookcase can all be the source of dangerous accidents for us, for family members, or for guests. Even the shack in the basement, where theoretically no one ever goes, should be built and arranged with physical safety in mind.

Moreover, we should be conscious that combinations of elements, each safe by

itself, may create troubles. A damp cellar invites more shocks than a dry one. Metal shelves and metal equipment cases can also yield shocks if they are not *all* well grounded. For these reasons, and many more like them. we should take several long looks at the room and its basic arrangement to be certain that everyone who enters will be physically safe.

You should examine all those elements in the shack which carry any danger. Ordinarily, these will be items with the potential for shock. RF bums. or heat bums. In making your inspection of the shack, think of every other person who may enter as *a child* who will handle *everything* accessible without any knowledge of what it does.

Whatever holds any potential for danger should be made inaccessible whenever you are not present.

The easiest way to ensure security is to be able to lock the shack when it is not in use. This requires that we develop two habits. The first is to inspect the room before every departure to check that every source of power is off and that all equipment is in a safe condition. The second habit we need to establish is actually to lock the room each time we leave.

An alternative is to build the operating and test benches such that all equipment is behind locked doors when not in use. This demands habits similar to the ones we use when we always lock a room. Nothing is secure if we forget to fasten the security devices.

If the most likely shack intruder is a small child, then security might be accomplished with high latches on the shack door. This preserves easy access for adults while protecting the child.

Remember that the entire point of thinking about security is the protection of the life, health, and safety of others, especially children too young to realize the danger potential of electrical equipment. As the child grows, education can gradually replace locks. Properly educated young hams are in the end perhaps the best safeguards against accidents and tragedy.

Looking over the room in which your shack will be located has turned out to be a long and detailed process. Many often neglected details came to our attention in the course of our inspection. Nothing is too little or too insignificant to not warrant evaluation. If we can change some things before we start operating in the room, then we will likely save ourselves many problems later on, when correcting the matters will be more difficult.

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