cord. When a plug is inserted into a SET jack, the equipment wired to that jack is removed from the circuit and placed in series with the inserted plug. The original circuit is closed through another set of contacts in the SET jack. An LPG jack can be used to insert monitor equipment into a circuit while a SET jack may be used to remove equipment from a circuit for testing purposes. When tracing current through these jacks, plugging a cord into them closes all open contacts and opens all closed contacts.

12-28. The jacks used in communications are identified according to the number of contacts that are made or broken when the plug is inserted in the jack. The tip and sleeve of the plug are not considered when identifying the jacks; in diagrams, only the contact points indicated by the arrows are used. Figure 58 shows a plug inserted in a make-one, break-one jack. The schematic diagram of the jack and plug is shown so that you can easily identify the various parts.

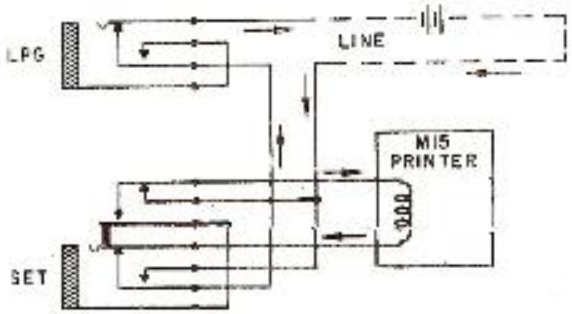

Figure 57. Teletypewriter jacks and circuits.

12-29. When special switching equipment (equipment which supplies power and testing facilities) is not necessary, a common switchboard used at small installations is the SB–6/GG, shown in figure 59.

12-30. *SB–6/GG.* This switchboard makes possible direct connection of the signal line to teletypewriter equipment without patching or strapping. It also makes possible the interconnection of circuits coming to a particular station as well as allowing the addition of special pieces of equipment to each line. The SB–6/GG does not furnish power or a means by which equipment and circuits can be tested, other than a place where test equipment can be connected to a circuit merely by inserting a patch cord into a jack.

12-31. This switchboard is designed for small station operation and should be used primarily for connections that are to be made within a station. If it is necessary to expand the use of this switchboard, four of these switchboards can be connected together. Note, however, that four is the maximum number of SB–6/GG's that can be connected together for efficient operation.

Figure 58. Jack and plug showing internal connections.

12-32. The SB–6/GG is constructed to handle four outside signal lines and eight pieces of equipment. The switchboard has 16 jacks: 4 labeled "LPG–1," 4 labeled "LPG–2," 4 labeled "SET," and 4 labeled "MISC." All 16 of these jacks are make-before-break jacks; the LPG–1, LPG–2, and the MISC jacks are of the make-one, break-one type, and the SET jacks are of the make-two, break-two type.

12-33. The jacks are arranged in vertical groups so that there is an LPG–1, and LPG–2, and a SET jack connected to every incoming signal line. In addition, there are four MISC jacks that have no direct connection to the line.

12-34. *SB–66/FGT.* Another type of switchboard found in small communications installations is the SB–66/FGT (or K–6 push key cabinet). This unit is a more complicated type of switching device than we have mentioned previously. By "more complicated" we mean that it is more diffi-

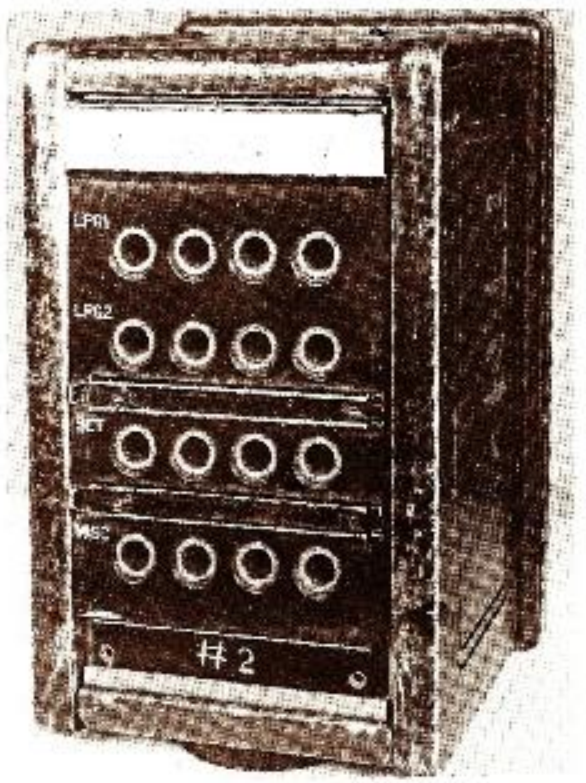

Figure 59. SB–6/GG switchboard.

cult for the mechanic to repair and troubleshoot. However, because of its construction, it is much simpler to operate than a jackbox or an SB–6/GG. The operation simply requires the depressing of the correct key to connect any one of the incoming lines to any desired piece of equipment.

12-35. The K–6 is a 36-key cabinet, as shown in figure 60, designed to handle a maximum of six lines and six pieces of equipment. However, under many circumstances two K–6's are connected in multiple. This means that the signal lines are connected in series through two switchboards, thereby giving the station a switchboard that will handle 12 pieces of equipment and 6 signal lines.

12-36. The K–6 adds flexibility to station signal line and equipment connection. By this, we mean that in place of having only a certain piece of equipment on a particular signal line we can switch any prescribed number or type of machines to any of the incoming signal lines.

12-37. The K–6 can be mounted in either an upright position (on a wall) or in a flat position (on a desk or table), whichever is more convenient for operation. For maintenance on the switchboard or to prepare for line testing, the switchboard can be opened by removing two screws on the top and tilting the main part of the switchboard forward. This opens the cabinet, exposing the various line-test and equipment-shorting switches and the line and equipment terminal boards.

12-38. As stated previously, the K–6 can handle six signal lines and six pieces of equipment. Each one of these lines and pieces of equipment is represented by a row of keys on the cabinet. The horizontal rows (key banks) represent pieces of equipment, and the vertical (up-and-down) rows represent signal lines. To make necessary connections, depressing the key at the intersection of a line and an equipment row connects that piece of equipment to the specified line.

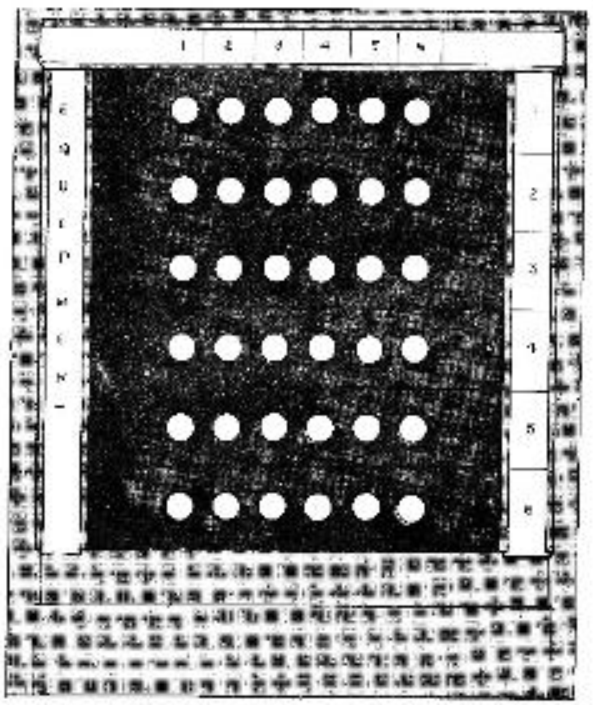

Figure 60. K–6 push key cabinet.

12-39. **Patch Panels.** A large communications center may use patch panels similar to the one shown in figure 61. The patch panel is usually located in the technical control section of the center. A patch panel may consist of one or more of these units housed in frames or bays which are approximately 20 inches wide and 7 feet high. The jack strips shown in figure 61 occupy the top half of each bay. Each bay is provided with a fold-down table, 1 foot wide, for use as a writing surface or as a base for portable test equipment.

12-40. All local equipment, incoming and outgoing lines, and local and special circuits are normally connected to the patch panel via a main frame. This main frame is similar to those found in telephone central offices. As such, it provides a convenient location for the grouping of circuits. Local circuits are provided with battery through the frame, allowing one wire circuit to be used with a common ground return. This reduces the number of wires running to the patch panel and simplifies troubleshooting procedures.

12-41. *Line and equipment receive (send) jacks.* Referring to the jack field of our patch panel in figure 61, we can see that the board is divided into several sections. The uppermost portion of the patch panel is reserved for special circuits. These jacks provide monitoring and patching capabilities for multiplexing, conference lines, dummy loops, and spare relay circuits. Twelve receive and twelve send circuit groups are available in this section of the panel. They are wired as shown in details A and B of figure 62. Note the types of jacks used: the lower pair are LINE jacks, while the upper pair are called PATCH jacks. Also note that the circuit is a one-wire circuit with a common ground return. Insertion of a plug in the LINE REC jack, in detail A, places the tip of the patch cord in series with point 1 while the circuit to point 2 is opened. When a patch cord is inserted into the EQUIP REC jack, the cord is in series with point 2, while at the same time the circuit to point 1 is opened. The MON jacks may be used to place additional equipment in series with the circuit through the use of a patch cord. While both MON jacks seem to perform the same function, having two jacks in the same circuit makes it possible to monitor both the LINE (point 1) and the local

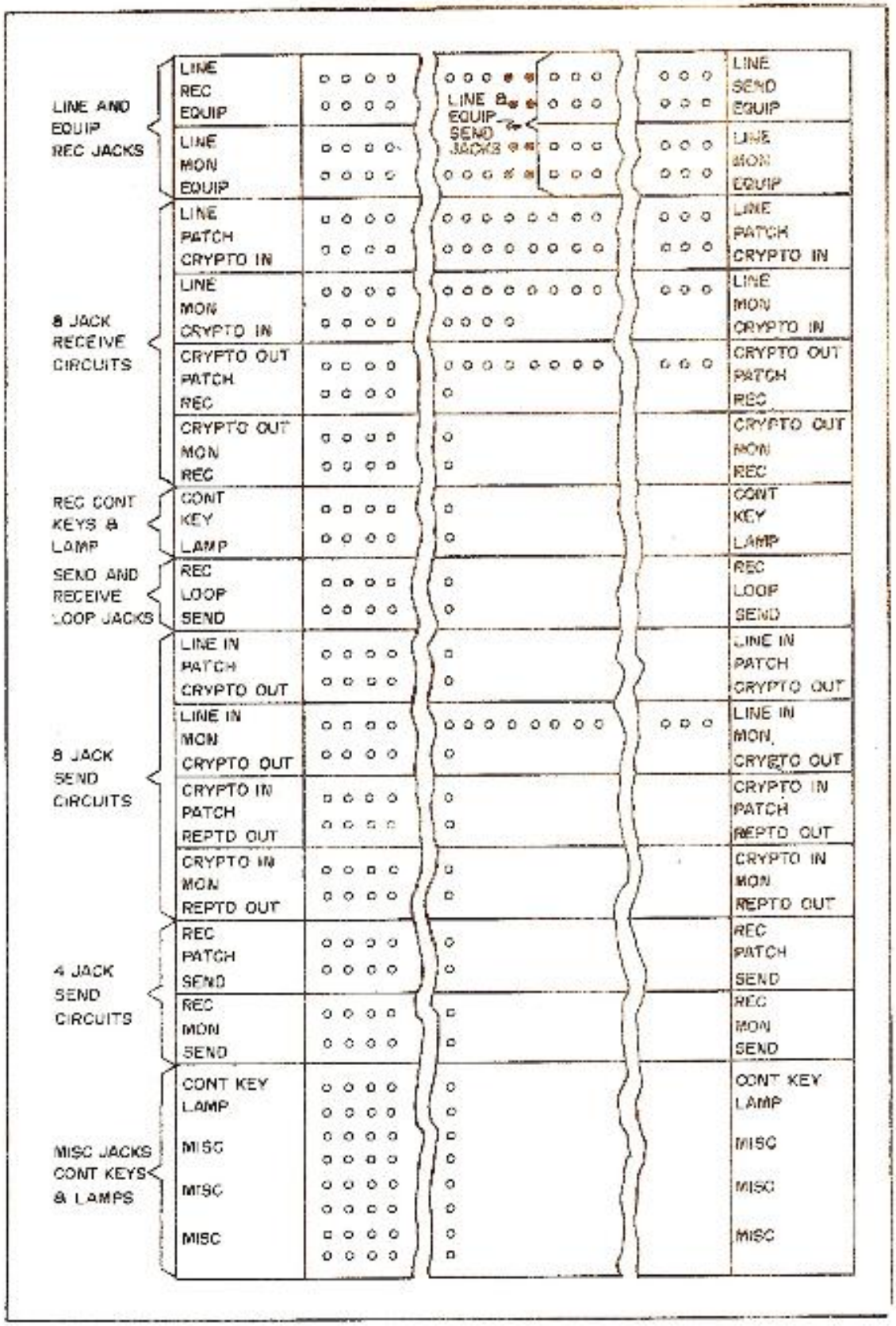

Figure 61. Patch panel jack designation.

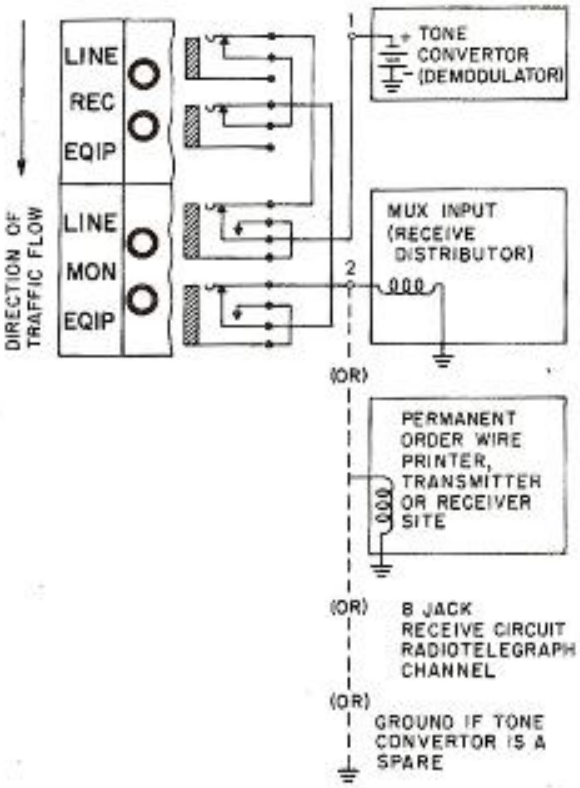

Figure 62. Receive and send jack circuits.

equipment (point 2) at the same time—using separate units of equipment. The same is true about points 1 and 2 in the send jack circuits.

12-42. *Eight-jack receive circuits.* The next section of the patch panel is wired as shown in figure 63. The panel provides 26 groups of eight jacks for incoming lines. When you study figure 63 carefully, you see that we have four PATCH jacks and four MON jacks in each group of eight. By inserting a patch cord in the proper PATCH jack, we can place a specific portion of the circuit in series with the inserted cord, while disabling the rest of the circuit. Through the correct placement of patch cords in the MON jacks, we can monitor portions of the circuit without affecting normal operation.

12-43. *Control keys and lamps.* Located beneath the eight-jack receive section is the receive key and lamp section of the patch panel. The patch panel is equipped with this section to provide for remote disabling of traffic teletypewriter equipment by technical controllers. Operation of the control key (CUT) on figure 63 grounds the receiving cryptographic equipment and causes it to remain in a steady marking condition. The associated lamp on the patch panel will glow when the key is operated.

12-44. While there are additional sections to the patch panel shown in figure 61, we will not discuss them at this time. Our main interests are the type of jacks employed and the method of wiring. Operation of the panel usually is the concern of the Technical Control section, while the original wiring to the main frame is normally performed by telephone cable splicing specialists. However, you may be called upon to trouble-shoot and replace faulty jacks or wiring in the panel itself. Our coverage of the subject is sufficient to illustrate the use and wiring of the various types of jacks used in the patch panels found in teletypewriter communications centers.

12-45. **Power and Signal Line Cabling.** The responsibility of connecting a communications center to the required trunks and cables is not part of the job of the communications machine repairman, for it is a specialized job and requires a great deal of knowledge and skill. The job of running the lines required for small communications centers usually falls to Ground Electronics Engineering Installation Agency (GEEIA) personnel or, in some cases, it might be done by a local telephone installer. In either case, that individual must see that these lines are properly terminated within the communications center. This termination of lines will usually be to the switchboard mentioned. Running the lines of communications from the switchboard to the machines may then become the responsibility of the communications equipment repairman. If, however, there is a telephone installer available, it is usually best to have him run the lines within the center, since he has the knowledge and skill to do this job much faster and easier.

12-46. If you cannot get a telephone installer to do the inside wiring of the communications center, it then becomes your job. The signal line connections between the switchboard and the machine are titled "inside wire runs" and should be connected in accordance with prescribed telephone installation procedures.

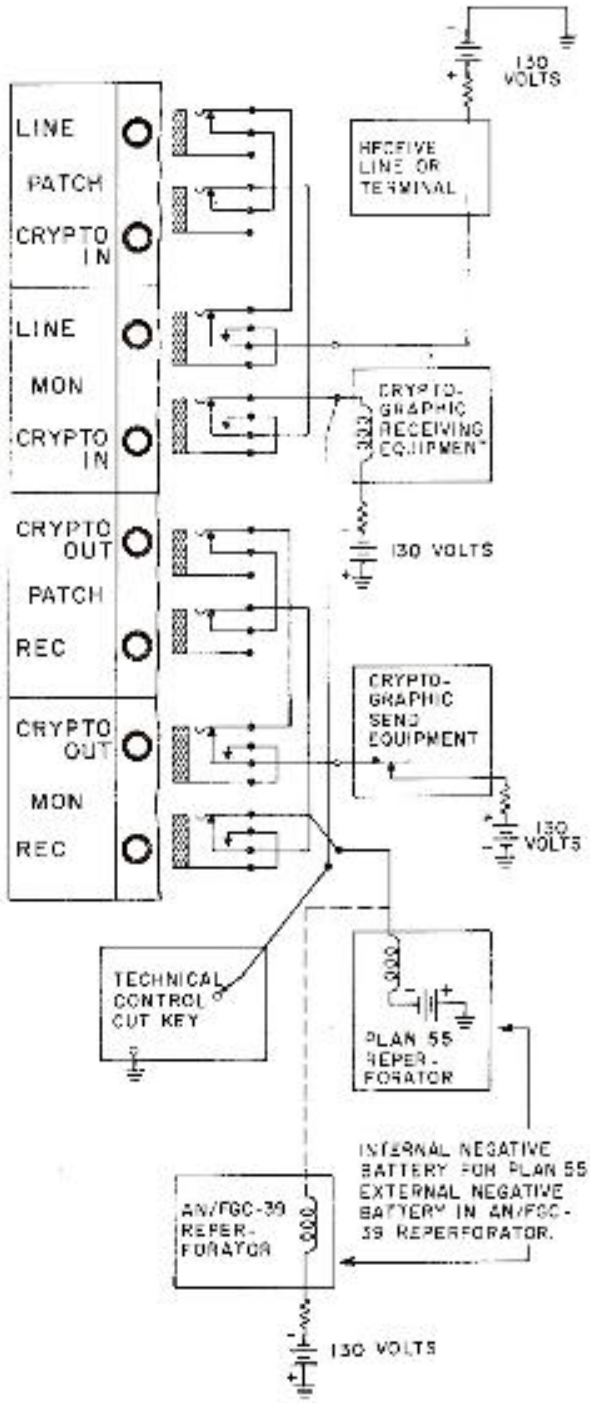

Figure 53. Eight-jack receive circuit.

12-47. **Wire Runs.** The inside wire run should follow a reasonably direct path from the switchboard to the machine location and should be free from obstructions. It is better to select a longer route if, by so doing, you can avoid a concentration of pipes, electrical equipment, or moisture areas which would be damaging to the wire. Select conditions where minimum maintenance is needed, and satisfactory service life is increased. These should be the deciding factors and are more important than the length of the wire run.

12-48. The appearance of the inside wire run is also important. In every situation a workmanlike job should be done and an effort made to see that the wiring job looks neat. Thus, since a concealed wire run eliminates most appearance problems and some maintenance problems, you may frequently select a concealed wire route. However, in selecting and using such a route, you need a working knowledge of building spaces. For example, frame buildings generally have air spaces between the studs, and brick buildings may have an air space behind the inside wall. Where appearance or probability of wire damage is of sufficient importance, you may thread the signal line through these spaces. However, more rapid installations can be made by following a moulding or baseboard. Where installations are not suited for concealed runs or the time factor is to be considered, most wire runs must be made on the surface.

12-49. Several rules apply for surface runs. For example, it is better to follow the ceiling line than it is to follow the baseboard of a room or basement. When running the wire in a room, use wire mouldings, picture mouldings, or raceways when they are available. It is best to place the wire in a metal or wood moulding on vertical runs, where picture or door mouldings are not accessible. Sometimes the moulding is needed to prevent damage. It is important to be sure that the inside wire does not interfere with the operation of windows or doors. Also, the wire run should not span open places or stair wells when these areas can be avoided. Beam-to-beam runs should not be made above workbenches or where boxes are stored unless the wire can be placed where it will not be damaged. Where joists must be spanned, it is best to stay within 3 inches of the wall. Wire installation techniques depend upon the job situation. Throughout the wire run, wire must have the proper clearance and protection. Where wire is secured to walls or goes through walls, floors, or ceilings, it is necessary to use proper fasteners and prescribed protection methods. The fasteners for inside wire are designed to fit almost all situations which you will encounter. However, remember to place the fasteners over studding in the walls and also never to fasten wires directly to conduits, pipes, or to pipe supports. The protection for inside wire is selected to suit the job at hand. You should maintain at least 6 inches between signal lines and foreign ground wires. However, this is not always possible, and some type of protection covering such as friction tape or porcelain tubing, should be used where the wires cannot be separated from other objects by the correct distances.