HOME-BUILT LIGHTING EQUIPMENT

For the Small Stage

BY

THEODORE FUCHS

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INTRODUCTION

The descriptions of home-built stage lighting equipment included in this booklet are presented for the benefit of amateur stage workers, particularly those in schools, who realize the contribution that light could make to their productions were they not hampered by lack of equipment and funds, who are dissatisfied with continually having to contrive flimsy makeshifts, and who are interested enough to devote some time and effort to helping themselves by planning and building their own equipment - equipment that can be useful and effective out of all proportion to its relatively insignificant cost. The home-built equipment described in this booklet has been widely adopted in past years and has helped many small producing groups in schools and communities to achieve effective lighting results at minimum cost.

Such equipment, then, is practicable and workable, and produces more than satisfactory results. Although the labor involved in its construction is an appreciable item, such equipment requires relatively little expenditure of actual cash. Also, it is possible to incorporate in such equipment certain features which, highly desirable under individual operating conditions, cannot be found in ordinarily available commercial equipment. Such equipment, furthermore, teaches an appreciation of the principles and problems involved in its planning and construction that cannot help but develop an intelligent and critical evaluation of commercially available equipment. It should be made clear, however, that such home-built equipment is not advocated and should not be used if it is financially possible to acquire suitable and satisfactory commercial equipment.

The descriptions in this booklet are thorough enough to be used as specific designs if it is desired to use them as such. The drawings have been made to accurate scale; hence all dimensions can be easily "scaled off". But not the least value of the descriptions lies in their suggesting principles of planning and construction that can be effectively applied to individual local problems and conditions. It is recommended that construction of any unit of home-built equipment be not begun until these principles of planning and construction are thoroughly understood and until a fresh plan has been drawn, prefer-

HOME-BUILT FOOTLIGHTS
(See Drawing No. 1)

Home-built footlights should be of the open trough type and should accommodate only the smallest sizes of standard incandescent lamps (15-watt or 25-watt), closely spaced together. This combination will provide the nearest practicable approach in home-built equipment to the continuous unbroken line of low-intensity diffused light which characterizes the ideal footlight. The footlights described here and in the drawing are meant to be placed directly on the stage floor. The maximum size of lamp that they will accommodate is 25 watts, which might be used for the blue circuit, with perhaps 15-watt lamps for the other circuits, such as amber, pink, daylight, green, red, and clear, whichever colors are used. The lamps should be spaced on 2 1/2" centers. Three color-circuits should be provided, and these in turn should preferably be divided into three section-circuits. The overall height of the unit should be kept at an absolute minimum with barely enough clearance provided in which to get the lamps in and out of their sockets. The cross-section should be so designed that the angle of direct light cut-off will fall within the proscenium arch. This is necessary in order to restrict the light to the stage and to avoid undesirable spill.

The dimensions of this unit can be scaled directly from the drawing, which is one-half actual size, or this basic design can be changed to meet any special conditions which exist in individual cases. The length of the footlight unit will depend upon the size of the stage. The total length should always be from six to ten feet less than the proscenium width. It is best not to attempt to build the footlight in one complete unit, but to divide it into several small sections, each from 6' to 8' long. To fit a stage that has a curved front edge, still shorter sections should be built, and the ends angled so that all the footlight sections, end to end, will follow the curve.

The base (A) should be made of 1/4" 3-ply fir panel (to conserve height). The sockets should be of the moulded cleat type and should be mounted on the base (A) at the correct locations and spacing by

means of 3/16" by 1" flathead stove bolts, equipped with nuts and lock washers, installed head-down. Next wire the sockets, using No. 14 wire, preferably wire with slow-burning insulation. Solder all connections at the terminal screws of the sockets. Use electricians solder and paste-type soldering flux; do not use "acid-core" solder.

Parts B, C, D, and E are cut from 1/2" thick clear pine, and are fastened together with 1 1/4" No. 6 flathead wood screws. Fasten the front piece (B) to the base (A). Bore holes in the front piece (B) to permit entrance of a short length of No. 14 stage cable for each of the circuits. At one end of the cable attach a load connector, and splice the other end, inside the front piece (B), to the circuit wires that connect the sockets. These cables should emerge from the footlight unit, and should be "anchored" firmly within, at the end nearest the switchboard, by means of a "strap" such as is commonly used to secure armored cable. If it is desired to connect the color-circuits continuously through the several sections of footlights rather than to provide individual section-circuits, a similar set of cables equipped with line connectors can emerge from the footlight unit at the opposite end. Holes should be bored in the trough bottom (C) with an expansive bit to accommodate the tops of the sockets. The trough bottom (C) and the top piece (E) should be fastened to the back piece (D), the latter joint (D to E) being reinforced at one-foot intervals by 1/2" by 2" iron corner angles (F) fastened with 1/2" No. 7 flathead wood screws. The end pieces (G) are cut from standard 1" clear pine and fitted as shown.

The inside of the footlight trough should be painted flat white with scene paint or kalsomine, or with glyptal lacquer. The outer surfaces can be painted flat black (or stained as desired). The footlight can be screwed to the stage floor by means of 7/8" No. 7 flathead wood screws through the edges of the base (A).

In view of the fact that the lamps used are small in size and that the open trough provides adequate ventilation it is hardly necessary to line the interior of the trough with asbestos, although this can be done if desired, before painting.

HOME-BUILT BORDERLIGHTS
(See Drawing No. 2)

The construction of a set of open trough borderlights is very similar to the construction of the footlights already described. Similar observations regarding design, cut-off angle, color circuits, wiring, and other features apply. The major differences are in the size of lamp to be accommodated, in the necessary inclusion of ventilation slots and a baffle, and in the mounting. For the average small stage, 60-watt lamps, spaced on 3" centers, should prove adequate in size. Natural colored glass bulb lamps and color-sprayed lamps may be used, or the 60-watt S-21 vacuum type lamps may be used if dipped lamps are thought more desirable. Because of the larger size of lamp it is desirable to line the trough with a layer of sheet asbestos tacked in place with No. 4 upholsterers' tacks.

Except for the base (A), which should be cut from 1" clear pine, and fitted within the front (B) and the back (D), the materials and construction of the open-trough borderlights are essentially the same as in the case of the footlights. The cleat sockets should be mounted on the base (A) by means of 1 1/4" No. 6 flathead wood screws instead of the stove bolts used in the footlight construction. The upper edge of the back (D) should be provided with a 10"-long ventilation slot for every foot of its length, thus leaving 2"-long projections for every foot, to which the top (E) may be fastened by means of 1 1/4" No. 6 flathead wood screws. The top (E) projects beyond the back (D) and is provided with a baffle of 1/4"- 3-ply fir that will intercept spill light. The ventilation slots and baffle should be painted flat black to insure absorption of the spill light.

A convenient and very useful form of rotational mounting for the borderlight units can be provided as shown on the drawing. Equip the borderlight unit with lamps and on each end piece (G) determine the center-of-gravity line of the unit. This can be done easily by pricking the end pieces (G) with a pair of ice-picks or sharpened heavy nails, and lifting the unit by means of these sharp pointed devices at each end. After several attempts, the points can be determined at which the unit can rotate freely and remain in any position without

swinging. These points should, of course, be in corresponding positions on each end piece (G). Bore a 3/8" hole through the end pieces (G) at these points and insert from within the unit a 3/8" by 2 1/2" carriage bolt. Prepare two hangers (H) for each unit out of 1" by 3" clear pine batten. Bore a 3/8" hole at one end of the hanger piece (H) to accommodate the carriage bolt With an expansive bit bore a hole at the other end of the hanger piece (H) just large enough to slip over the pipe batten on which the borderlight is to be mounted. The borderlight unit can then be mounted by this method, using the necessary washers and wing nuts.

Compartment type borderlights, using lamps larger than 60 watts in size, are considerably more involved in details of design and construction than the open-trough type described here. Suggestions for constructing compartment type borderlights will be found later in connection with the description of the suspension floodlight, on page 21.

HOME-BUILT STRIPLIGHT
(See Drawing No. 3)

The construction of a simple open trough striplight is similar in principle to that already described for footlights and borderlights. Accommodation for 60-watt lamps, spaced on 3" centers, should be provided. When built in a short length, which will accommodate about eight lamps wired in one circuit, the striplight described on the accompanying sketch may be used as an entrance striplight. When built long enough to accommodate about 24 lamps, perhaps wired in two or three circuits, the striplight may be used for lighting ground rows and the horizon of a sky drop.

The base (A) and the end pieces (D) are cut from standard 1" clear pine; the trough bottom (C) is cut from 1/2" clear pine; and the sides (B) are cut from 3/8" 3-ply fir panel. The circuit cable should be brought out through a hole in one of the ends (D). The trough should be lined with asbestos. Entrance striplights of this type are usually mounted on the stiles and toggles on the back of scenery flats. This is best accomplished by the use of picture hooks and sockets, which are regular items of stage hardware. Longer striplights are usually used directly on the floor, and hence require no special provision for mounting.

Sheet metal may be used as a construction material if facilities for fashioning it are available.

HOME-BUILT PARABOLIC STRIPLIGHT
(See Drawing No. 4)

The construction of a parabolic trough striplight embodies many of the features of the home-built equipment already described, with the addition of a parabolic trough reflector. Accommodation for 60-watt lamps on 3" centers should be provided if it is desired to use both natural-colored glass bulb lamps and color-dipped 60-watt S-21 vacuum type lamps. If natural-colored lamps are to be used alone, larger lamps than the 60-watt size may be used, and the spacing changed accordingly. The lamps should be wired in three color-circuits. The light color primaries, red, green, and blue, (in the form of natural-colored lamps) will probably be found to be the most useful color combination, although tints such as amber, daylight blue, and pink could be substituted in special cases. Several 6-foot or 8-foot lengths of striplights of this type can be successfully used for lighting a small sky-drop or flat cyclorama. They can be used at the base of the sky-drop when they are equipped with floor-mounting cradles at their ends, or they can be used at the top edge of a small sky-drop when they are equipped with batten-mounting hangers such as were described for borderlights. Units made specifically for overhead lighting of a sky-drop should preferably have accommodation for lamps of the 100-watt, 150-watt, or 200-watt size.

The parabolic reflecting surface (H) is best made of medium-weight bright tin plate (often called "charcoal plate"; weight known as "IC" is suitable). The size of sheet in which this material is available (20" x 28") will determine to some extent the dimensions and construction of the striplight. This tin plate is shaped to form a trough with a parabolic cross-section. The most convenient size of parabola to use with 60-watt lamps is one with a 1 1/4" focal length. The lamps and sockets must be so mounted in relation to the parabola that the center of the lamp filament coincides with the focal point of the parabola. The surface of the parabolic trough will reflect the light from the lamp filament so as to form a flat concentrated sheet of light.

Before construction, the section view of the striplight should be

carefully drawn to full size, using the particular size of lamp that has been determined upon. The parabola should first be plotted separately and an inside template made of the curve. The template should be of stiff paper or cardboard, and can be used in making the drawing. From this drawing can be determined the outline of the frames (E) that are required to shape the tin plate and to give structural rigidity to the entire striplight. Each frame (E) is best made of two symmetrical halves (F) of 1/2" clear pine, and screwed together with a 1/4" 3-ply fir cleat (G) and 3/4" No. 6 flathead wood screws, while being fitted carefully to the parabola template. A template should be made for the half-frame (F) outline, to facilitate marking out and cutting. Complete frames (E) are needed at each end of the striplight and at approximately one-foot intervals between. Circular holes must be cut in the tin plate to admit the lamps to the sockets beneath. This can be easily done with the simple cutting tool described on the accompanying sketch.

The base (A) of the striplight, the edge strips (D), the end pieces (C) and both parts of the cradle (K) (or the hanger, for batten mounting instead of floor mounting), are all cut from standard 1" clear pine. The half-frames (F) are cut from 1/2" (actual) clear pine. The sides (B) and the frame cleats (G) are cut from 1/4" 3-ply fir panel.

In assembling the striplight the frames (E) are made first and then the frames (E) and the end pieces (C) are fastened to the base (A). Next the sockets are mounted on the base (A) and the wiring is carried out. Then the sides (B) are fastened to the frames (E), end pieces (C), and base (A). Then the parabolic reflecting trough (H) is formed by fastening the tin plate reflector to the frames (E) and to the edge strips (D), preferably by means of 5/8" No. 6 roundhead wood screws. The sheet tin trough must of necessity be in several sections; joints may be lapped and should occur at the frames, to which they should be fastened. The trough ends should be covered with a flat reflecting surface of bright tin plate (I). The mounting assembly (J) can be applied as in the case of the borderlights.

If the bright tin plate reflecting surface of the parabolic trough produces too marked a sheet of light, a more diffused reflection may be achieved if inside-frosted lamps are used, or if the tin surface is lightly and evenly scratched by rubbing it with steel wool, or if it is given a coat of heat-resisting glyptal aluminum lacquer. The end reflecting pieces (I) should always be bright and polished, however.

If the striplight is designed to accommodate lamps of 100 watts or more in size, and to be used in an inverted position as in the case of batten mounting, a row of ventilation holes 1" in diameter and spaced on 3" centers should be bored in each side piece (B) near the base (A).

HOME-BUILT SPOTLIGHT
(See Drawings No. 5 and No. 6)

Home-built spotlights are somewhat more involved and difficult in their design and construction than are the various units of open trough equipment described previously. This is caused by several necessary features; among them are the lens, the provision for focussing adjustment, and the provision for adequate ventilation. Because of the heat radiated by a spotlight lamp within the completely enclosed housing of the spotlight, the question of ventilation requires very careful consideration in connection with spotlights that are constructed of wood. For this reason it is wise to confine the spotlight to the "baby" size which can accommodate lamps from 100 watts to 400 watts. The spotlight pictured on the drawings is of this size. It can be built at relatively low cost and is capable of giving very satisfactory results on a small stage. Necessary dimensions can be easily scaled off the drawings. Number and letter designations in the descriptions refer to corresponding parts of the sketches.

Begin the construction of the spotlight with the back (B), which is cut from 1" clear pine. Cut the back ventilation opening, and apply the asbestos lining. For the asbestos lining use 3/32" thick asbestos paper, and tack it in place with No. 4 upholsterers tacks. Screw the spacers (B-1 and B-2) and the sheet metal baffle (B-3) in place over the interior of this opening, using 1" No. 6 roundhead wood screws. This and the other baffles used in the spotlight should be cut from No. 26 gauge sheet iron. Bore two 1/4" diagonal holes, positioned as shown in the sketch, for passage of the wiring.

Next construct the top (T), which is cut from 1/2" clear pine. Cut the ventilation slot, apply the asbestos lining, and screw to the underside of the top the spacers (T-1, T-2, T-3, and T-4) and the sheet metal baffle (T-5). Screw the retaining strip (T-6) and the color groove (T-7) to the underside of the top (T).

Construct the bottom (U) from 1/2" clear pine. Cut the ventilation slot and apply the asbestos. Bore a 3/16" hole in the spacer

(U-2) for the accommodation of the 3/16" x 1 1/4" carriage bolt which will hold the front lens plate (F) in position. Then fasten the spacers (U-1 and U-2) to the upper side of the bottom piece (U).

The sides (D and E) should be made of 3/8" 3-ply fir panel. At the proper location on each (the center-of-gravity balancing point) bore a 3/8" hole and insert the 3/8" x 2" carriage bolts that serve as mounting stud screws for the spotlight. Apply the asbestos lining and attach the spacers (D-1 to D-4, and E-1 to E-4) and the sheet metal baffles (D-5 and E-5) in position with 7/8" No. 6 roundhead wood screws.

The front lens plate (F), which is detachable in order to provide means for relamping the spotlight, can also be made of 3/8" 3-ply fir panel. Cut the circular opening for the lens, being careful that its center will be in optical alignment with the filament of the spotlight lamp when the latter is inserted in the socket. The lens opening should be 1/4" less in diameter than the actual diameter of the lens which is being used. Apply the asbestos lining. Next assemble the lower color groove (pieces F-1, F-2, and F-3) and attach it to the front lens plate (F) as shown. The condenser lens, which should for average use be of 6" diameter and 12" focal length, can then be fastened in place by means of four small brass lens clips (F-4). These clips can each be made out of a strip of brass 1/16" thick, 1/2" wide, and 1" long. This should be bent in the middle and one half drilled and countersunk to receive a 1/2" No. 5 roundhead wood screw by means of which the lens clips can be fastened to the lens plate (F).

The lamp carriage (C) should be built of 1/2" clear pine, with its component pieces (C-1, C-2, C-3, C-4, and C-5) assembled as shown in the sketch. A 1/4" hole should be drilled through pieces C-2 and C-3 as shown, to accommodate a 1/4" x 1 1/4" thumb screw. The latter will serve as a means of fastening the lamp carriage in place when the spotlight is being focussed. Countersink the nut for the thumbscrew in the upper side of the piece C-2 in such manner that it cannot turn. Apply asbestos lining to the top side of piece C-1 and mount a medium cleat socket in the correct location on piece C-1 as shown in the sketch.

Cut the slide (S), on which the lamp carriage moves, from 1/2" clear pine. To the center of its under side tack a strip of sheet metal (using No. 6 upholsterer's tacks) over the area where the focus-

sing thumb screw will grip the under side of the slide-bar (S). Cover the entire upper surface of the slide-bar with sheet metal also.

Slip the lamp carriage (C) over the slide-bar (S) and screw the slide (S) in place on the spacers (U-1 and U-2). Then screw this assembly of slide (S), lamp carriage (C), and bottom (U) to the back piece (B). Wire the socket with No. 14 flexible, asbestos-insulated wire. Anchor the two wires carefully to the lamp platform, and, keeping the wires separated, lead each through the diagonal wiring holes in the back (B). Then screw the top (T) in place on the back (B). Next screw the sides (D and E) onto the already assembled parts (T, B and U). Now slip the front lens plate (F) into place. Mark the position of the hole needed near the lower edge of the lens plate (F) to accommodate the 3/16" x 1 1/4" carriage bolt that will hold the lens plate (F) in position. Remove the lens plate and bore a 1/4" hole in the marked position. Give the entire interior of the spotlight a coat of flat black glyptal lacquer, or some good grade of flat black stove polish. Ordinary oil paints or lacquers will disintegrate under the heat.

Construct the yoke (Y) of clear pine, the crossbar (Y-1) out of 1" standard thickness, and the side arms (Y-2 and Y-3) cut of 1/2" actual thickness. Bore a 3/8" hole near the lower end of each side piece (Y-2 and Y-3) and a 3/8" hole at the exact center of the crossbar (Y-1). Slip a leather washer over each of the side stud screws of the spotlight. Screw Y-2 to Y-1 with three 1 1/2" No. 8 flathead wood screws. Slip Y-2 over one side stud screw of the spotlight and Y-3 over the other and screw Y-3 to Y-1. Apply the iron washers and wing nuts to the side stud screws. The spotlight may be given a coat of flat black glyptal lacquer. The spotlight is now completed, except for color frames which can easily be fashioned out of heavy cardboard and gummed paper or clips. If the spotlight is to be used for more or less permanent mounting on an overhead horizontal pipe batten, a mounting can be provided such as is shown in the sketch. This is similar to an inverted yoke with short side-arms. The cross bar should have a 3/8" hole drilled at its exact center. By means of a 3/8" x 2 1/2" carriage bolt, a leather washer (between the two cross arms), an iron washer, and a wing nut, the spotlight yoke can be fastened in swivel fashion to the inverted mounting yoke. Holes just large enough to slip over the horizontal pipe batten should be bored in the short side arms. If it is desired to mount the spotlight on a vertical tormentor pipe, or on a telescoping pedestal standard, a 1/2" pipe floor flange can be screwed to the upper side of the cross bar of the spot-

light yoke. This will permit the use of standard devices such as short 1/2" pipe stems, locknuts, elbows, and pipe clamps to effect the particular type of mounting desired.

No reflector has been included in the spotlight, as its application and focussing adjustment is somewhat intricate. It is quite possible, however, to devise a suitable holder for a small spherical reflector, and mount it on the lamp carriage in correct relationship to the lamp filament.

The spotlight described above can accommodate a step lens, or Fresnel-type lens, in place of the regular condenser lens. The use of a step lens will increase the brightness and the efficiency of the spotlight, but it will also increase its cost in even greater proportion. Hence, the use of such a lens would not be economically advisable unless the spotlight were constructed of sheet metal, with durability and permanence, rather than low cost, the major considerations. A step lens has a relatively shorter focal length than an average regular condenser lens. This permits the placing of the light source closer to the lens for a given size of resulting lighted area, and this makes possible a greater pick-up of light by the lens, with consequent greater brightness and efficiency. A step lens requires the use of a tubular-bulb lamp, the shape of which permits the filament to approach closer to the lens. A lamp which is commonly used with step lenses is the 500-watt T-20 bulb C-13 filament medium pre-focus base spotlight lamp. This requires the use of a medium pre-focus socket. The use of a step lens, with its shorter focal length, permits the use of an appreciably shorter spotlight housing. The lamp carriage would have to be so designed as to permit the lamp almost to touch the lens at the extreme forward end of its traverse.

HOME-BUILT SCENE PROJECTOR
(See Drawings No. 7 and No. 8)

Very similar to a home-built spotlight in most of its features of design and construction is the home-built scene projector. The scene projector has no lens but it does require focussing adjustment, adequate ventilation, slide grooves, and so forth. Every small stage should have at least two such projectors, or "Linnebach Lanterns", as they are sometimes called. The scene projector described is of a suitable size for amateur use on the average small stage. It can accommodate a 1000-watt spotlight lamp and the slide grooves are designed to accommodate projection slides 18" x 24" in size. These slides may take the form of simple cardboard cut-outs, used alone or with pieces of colored gelatin, or they may be painted in transparent lacquer or lamp dip on clear gelatin that is supported in a suitable frame, or they may be painted on a piece of "double-strength" window glass.

No detailed instructions for building and assembling this unit need be given as practically all the component parts and operations are almost identical in nature, though not in size, with those required by the spotlight described previously. Component parts of the scene projector have the same designations on its sketches as have the corresponding parts of the spotlight sketches. In general the sequence of construction and assembly operations are the same for both units. The inside of the unit is black.

Some differences, however, should be noted. As the projector employs no lens it has no front lens plate. The socket is of the mogul size in order to accommodate the larger lamp. It should be so positioned that the filament of the spotlight lamp is opposite the center of the glass slide. As the unit is rather large the sides as well as the top and bottom can be made of 1/4" 3-ply fir panel. This requires several extra strips of wood, such as D-6 to D-9 inclusive and E-6 to E-9 inclusive, in order to provide rigidity and a means of securely fastening the unit together. The stop cleat (S-1) has been added to the under side of the slide-bar (S) in order to keep the lamp bulb a safe distance from the back (B). As the side walls of the unit converge toward

the back, four wedge-shaped pieces (D-10, D-11, E-10, and E-11) are necessary, two on each side, in order to provide parallel mounting for the side bars (D-9 and E-9) to which the mounting yoke is attached.

A swivel base as shown on the sketch provides a satisfactory means of mounting the scene projector on the floor, where it will most often be used. For overhead mounting, on a pipe batten, the yoke must be reversed, and a 1/2" pipe floor flange screwed to the outer face of the cross bar (Y-1). This will permit mounting by means of standard devices such as 1/2" pipe stems, locknuts, and pipe clamps.

HOME-BUILT OLIVETTE
(See Drawing No. 9)

The home-built 'olivette', or open-box floodlight, meant primarily for mounting on a pedestal floor stand, is somewhat similar to the home-built scene projector described previously. The olivette is shorter, it requires no focussing adjustment, and it is painted white inside instead of black. The double baffles are provided on the ventilating openings on the olivette in order to counteract the greater possibility of light leakage presented by the white interior. The olivette described is designed to accommodate lamps up to 1000 watts in size and color frames of the standard 18" x 20" size.

Begin the construction of the olivette with the back (B) which is cut from 1/4" 3-ply fir panel and is reinforced with the two vertical side cleats (B-1, B-2). These cleats are cut from clear pine, and applied with 1" No. 6 flathead wood screws. The baffle (B-3) is cut from sheet metal and should be applied to the vertical cleats (B-1, B-2) with 3/4" No. 6 roundhead wood screws. Two 1/4" holes, spaced 2" apart and located where shown, should be bored to permit the passage of the wiring.

The top (T) and bottom (U), which are identical, should be constructed next. The top (T) is cut from 1/4" 3-ply fir panel, and reinforced with the back and front cleats (T-1, T-3). These cleats are cut from 1" clear pine and applied with 1" No. 6 flathead wood screws. Cut out the ventilating opening and apply the spacers (T-2, T-5, T-6, T-7) and the color grooves (T-9, T-10) with 1" No. 6 flathead wood screws. Apply the sheet metal baffles (T-4, T-8) with 3/4" No. 6 roundhead wood screws, first applying a coat of flat black glyptal lacquer to all of the surfaces which will constitute the ventilating channels. The bottom (U) is constructed in exactly the same manner. Mount the mogul cleat socket in position on the top (T) by means of 1 1/4" No. 6 flathead wood screws through the baffle (T-4) into the spacer (T-2).

The two sides (D, E) are symmetrically identical. The right side (D) is cut from 1/4" 3-ply fir panel, and is reinforced with the two

vertical side cleats (D-1, D-2) and the top and bottom cleats (D-4, D-5). These cleats are cut from 1" clear pine and applied with 1" No. 6 flathead wood screws. Apply the wedges (D-7, D-8) to the upper and lower outside edge of the side (D) with 7/8" No. 7 and 1 1/2" No. 8 flathead wood screws. Bore a half-inch hole in the center of the vertical side-bar (D-9) and insert a 1/2" x 2 1/2" carriage bolt. Then fasten the vertical side-bar (D-9) to the wedges (D-7, D-8). Next, apply the sheet metal baffle (D-3) to the vertical cleats (D-1, D-2) with 3/4" No. 6 roundhead wood screws. The plywood side door (D-6), which will prevent side spill of light, should be applied by means of small spring hinges, fastened with 1/4" No. 5 roundhead wood screws.

The several completed parts of the olivette can now be assembled with 1" No. 6 flathead wood screws. Any exposed wooden surfaces in the interior of the olivette should be covered with sheet asbestos paper applied with upholsterer's tacks. Wire the socket with No. 14 flexible, asbestos-insulated wire. Anchor the wires carefully and lead them through the wiring holes in the back. Give the entire interior of the olivette a coat of flat white glyptal lacquer or flat white scene paint or kalsomine. A yoke should be provided for the olivette in a manner similar to that previously described for the home-built scene projector. A coat of flat black glyptal lacquer may be applied to the outer surfaces of the olivette if desired.

HOME-BUILT SUSPENSION FLOODLIGHT
(See Drawing No. 10)

For lighting small cycloramas, or for providing overhead floodlighting, a simple type of suspension floodlight for batten mounting is often useful. The home-built suspension floodlight described can accommodate lamps up to 500 watts in size and color frames of the standard 18" x 20" size.

The end pieces (D, E) provide the main support for the unit. These are cut from 1" clear pine in two parts (from 10" wide lumber) that are cleated together with 1/4" 3-ply fir panel and 7/8" No. 7 flathead wood screws. The upper strips of the side color grooves (D-1, E-1) which are also cut from 1" clear pine, are fastened to the sides with 1 1/2" No. 8 flathead wood screws. The lower strips of the side color grooves (D-2, E-2) are cut from 1/4" 3-ply fir panel and are fastened to the under edges of the sides with 7/8" No. 7 flathead wood screws. Bore two diagonal holes near the upper edge of one of the end pieces, to accommodate the wiring. The top (T) is cut from 1" clear pine, and the mogul cleat socket is mounted at its center.

The front and back pieces (F-1, F-2, F-3, F-10 and B-1, B-2, B-3, B-10) and the bottom color groove strip (U) are cut from 1/4" 3-ply fir panel. Back and front pieces B-3 and F-3 have slots cut in them, as indicated, to provide ventilation. To these pieces are fastened the spacers (B-4, B-5, B-6, B-7 and F-4, F-5, F-6, F-7) with 3/4" No. 6 flathead screws in the positions shown. The baffles (B-9, F-9) are cut from sheet metal (F-9 must be bent) and are fastened to the spacers with 3/4" No. 6 roundhead screws, after a coat of flat black glyptal lacquer has been applied to all of the surfaces which will constitute the ventilating channels.

Assemble the unit by first fastening the top (T) to the two endpieces (D, E) with 2" No. 9 flathead wood screws. Wire the socket with No. 14 flexible, asbestos-insulated wire. Anchor the two wires carefully and lead each through the diagonal holes in one of the end pieces. Then apply the several front and back pieces and the bottom color groove strip. Bore a 3/8" hole in each of the end pieces (D, E)

at the center-of-gravity balancing points. Cover any exposed wooden surfaces in the floodlight with sheet asbestos paper. Give the entire interior of the floodlight a coat of flat white glyptal lacquer or flat white scene paint or kalsomine. Mounting of the yoke type as described for the home-built spotlight, or of the batten hanger type as described for home-built borderlights, may be applied to the floodlight by means of carriage bolts protruding through the end pieces.

Suspension floodlights of the type just described may be built in multiple units that include two or more compartments and several color-circuits. This principle may be further extended, and if a 200-watt lamp is used as the basis of the design rather than a 500-watt lamp, the compartments can be considerably reduced in size, and a very practicable set of home-built compartment-type borderlights will result.

HOME-BUILT CYCLORAMA LIGHTING UNIT
(See Drawing No. 11)

For lighting average-sized cycloramas, or sky-drops, a logical and very practical extension can be made of the ideas embodied in the simple home-built suspension floodlight previously described. The principal advancements are the use of definitely-shaped reflecting surfaces that will concentrate the light from the lamp into a narrow sheet, and the extension of the single unit into a multiple unit that might contain six or more compartments wired in three color-circuits for color-blending of the light primaries, red, green, and blue.

The principal reflecting surface in each compartment is the running parabolic type employing a parabola with a focal length of 2". The reflecting surface and the lamp used (which may be a 300-watt or 500-watt lamp, preferably with an inside-frosted bulb rather than a clear bulb) must be positioned in respect to each other so that the filament of the lamp coincides with the focal point of the parabola. The reflecting surface can be easily fashioned out of bright charcoal tin plate which possesses very good reflecting qualities in view of its low cost. The tin plate can be held rigidly in a fairly accurate parabolic surface if a series of frames, or ribs, are provided throughout the length of the cyclorama unit. Two such frames should be provided for each reflector, or compartment. The front and back pieces of the unit can be fastened to the frames as well as the actual reflecting surfaces. Hence the frames will lend rigidity to the entire structure of the cyclorama unit as well as provide a means for achieving the correct parabolic cross-section of the reflecting surfaces. These frames are designed and built in a manner similar to that described for the frames of the home-built parabolic striplight. The frames should be cut of 1" clear pine. The outer edges should be cut to the contour of the outer pieces of the unit and the inner surfaces should be cut with a band saw to the shape of a parabola with a 2" focal length. In addition to the parabolic reflecting surface in the compartment for each lamp there should be two vertical plane reflecting surfaces, also of bright charcoal tin plate. These will help provide longitudinal distribution of light from the cyclorama unit and will make possible smoother blending of colored light from adjacent

compartments. The curved reflecting surface and the flat reflecting surfaces that make up each compartment can be held together by a light application of solder at intervals of two or three inches. This will keep the light tin surfaces rigid. Except for the features noted, the actual construction of this cyclorama unit, including provision for pipe batten mounting, is very similar to that outlined for the suspension floodlrght. For this reason no specific detailed instructions need be given. It is advisable to draw a full-size cross-section of the cyclorama unit before attempting to cut the parabolic frames and assemble the several parts of the unit.

HOME-BUILT RESISTANCE DIMMER
(See Drawing No. 12)

It is not possible for the amateur to do as much for himself in the field of home-built dimmer and control equipment as he can in that of home-built lighting equipment. Many reasons contribute to this, the principal being that a greater amount of theoretical knowledge and practical experience is required for the design and construction of control equipment. Because of the somewhat hazardous nature of electricity, any device for its control requires the use of construction materials and operations which may sometimes be out of the scope of the average amateur's experience.

Simple, inexpensive dimmers of the resistance type, however, can be designed and built by amateurs of reasonable experience, aided by a good set of workshop facilities and tools. The many detailed considerations which enter into the design of the dimmer described below will not be touched on here as a complete discussion of these is available elsewhere.* The following description includes simply the mechanical construction of the home-built dimmers.

These dimmers are of the slider-type with the resistance distributed over two parallel asbestos bars between which is an adjustable connecting slider. This slider has an operating handle which can protrude through a slot in the dimmer housing or in the dead-front face of the switchboard. These dimmers when properly designed and carefully built are very satisfactory for their purpose. They provide a smooth, well-tapered dimming of lamp loads of their rated capacities. They will prove quite suitable for average use on a small amateur stage; they are not meant to be subjected to conditions of severe or strenuous use. They should not be built in capacities higher than 1000 watts.

The resistance is in the form of a nickel alloy wire known as "Advance" resistance wire, which has physical characteristics that make it particularly well suited to use on dimmers. This wire is

* Stage Lighting, by Theodore Fuchs, Little, Brown and Co., Boston, pp. 375-384.

available in a wide range of sizes, which are designated by numbers on the Browne and Sharpe wire guage. Sizes ranging from No. 15 to No. 31 will be found most useful for dimmers of capacities from 250 watts to 1000 watts. As each separate size of this wire is not available in quantities weighing less than one pound, the "Feet per Pound" data given on the accompanying table will be found useful in planning and ordering.

The asbestos material for the resistor bars on which the resistance wire is wound is known as "Transite" asbestos wood. This can be sawed and drilled as easily as any hard wood. It should be ordered cut to size as follows: for the resistor bars, two pieces each 1/2" thick, 2 3/4" wide, and 24" long are needed for each dimmer; for the operating handle of each dimmer one piece 1/4" thick, 4" wide, and 8" long is needed from which can be cut the smaller pieces of which the the handle is built.

Both the "Advance" resistance wire and the "Transite" asbestos wood are relatively inexpensive, but because of the cost of minimum quantities it is uneconomical to build only one or two dimmers. It is better to plan for at least eight or ten dimmers and then purchase the necessary material for these at one time.

Two inches are allowed at each end of both resistor bars for mounting purposes, thus leaving twenty inches on each bar for actual winding of resistance wire. The turns of wire are at 1/8" intervals, and to keep these turns from touching each other, notches 1/8" deep are cut at 1/8" intervals along the twenty-inch space on each edge of both resistor bars. These notches reduce the effective width of the bar, for the wire winding, from 2 3/4" to 2 1/2". Each complete turn of wire will then be 6" in length, and since there are 8 turns of wire per inch, and forty inches of winding space (twenty inches on each resistor bar), the resistor bars will accommodate 160 feet of resistance wire. In order to provide smooth dimming over the full 20-inch range of the operating handle, the total resistance of the dimmer cannot be distributed evenly throughout its traverse, but instead must be "tapered". The resistance per unit length of traverse must be relatively low at the "bright" end of the traverse, and relatively high at the "dim" end of the traverse. This is accomplished by varying the size of resistance wire, using thick wire at the "bright" end, and thin wire at the "dim" end, with several varying sizes of wire between these extremes.

For practical purposes, this "tapering" of resistance can most easily be achieved by dividing the 20-inch dimmer traverse into ten equal parts each two inches long. These traverse sections have been designated as ranging from "No. 1" at the "bright" end, to "No. 10" at the dim end. Each such traverse section will contain 16 feet of resistance wire, half on opposite 2-inch sections of each resistor bar. For a dimmer of any given capacity, sections 1 and 2 together have one size of wire, and sections 3 and 4 together, sections 5 and 6 together, sections 7 and 8 together, section 9 separately, and section 10 separately have successively smaller sizes of resistance wire. The exact sizes of wire to be used for each traverse section is given for dimmers of several useful capacities on the accompanying table.

The first step in planning a set of home-built dimmers, then, is to decide on what capacities will be most useful, and then chart the length of each size of wire needed for the complete job.

Before the resistance wire is wound on the resistor bars all necessary holes for assembly bolts, mounting bolts, terminal bolts, and anchor bolts should be drilled. Then the wire notches should be cut, preferably with a hacksaw. Then the anchor bolt should be inserted and one end of the section 1 and 2 resistance wire fastened under the bolt, leaving enough to loop over to the terminal bolt, where it is fastened under the first nut. This resistance wire should then be wound carefully and tightly for the full extent of sections 1 and 2. At this point the resistance wire for sections 3 and 4 should be spliced to the first wire with a running twisted soldered joint, and the winding continued, with a similar splice at each point where the wire size changes. All such splices should be placed on the outside of the resistor bar so as not to interfere with smooth travel of the slider that bridges the resistor bars. At the end of section 10 the wire can be fastened off at the anchor bolt.

The slider can be made by bolting together four 1/4"-thick pieces of asbestos wood and two pieces of thin phosphor bronze spring (about 0.007" thick). The bolts (No. 10-24 x 1" roundhead brass machine screws) make electrical connection between the two spring contacts, and thus serve as a link bridging the two resistor bars. The phosphor bronze spring contacts should be carefully shaped, and cut of such length and bowed in such a manner that, when properly mounted and placed between the two resistors, they will be under sufficient though gentle pressure to insure a good contact at all points along the dimmer traverse.

The two complete resistors should be fastened to a crossbar at each end which can be made by bending 1/8" x 1" strip iron. The slide bar for the slider, as well as the two mounting brackets, should be made of the same material. All these parts can be fastened together by means of 3/16" roundhead stove-bolts, lock-washers, and nuts. Each joint should be made with two bolts so as to insure rigidity of the entire assembly. For the dimmer terminal screws No. 10-24 x 1 1/4" roundhead brass machine screws, washers, and hexagonal nuts will be suitable.

Such a dimmer as has been described may be used as an individual dimmer if it is provided with an asbestos-lined housing made of 1/2" pine, as shown on the drawing. The exterior of this housing can be painted with flat black glyptal lacquer, and an index scale, reading from 0 to 10, can be painted alongside the slot through which the dimmer handle protrudes. A group of these home-built dimmers can be assembled with other electrical devices to form an inexpensive though very practicable small home-built stage switchboard, as is described later.

On the following page will be found several tables of data relating to the resistance wire used in home-built dimmer construction.

SIZES OF 'ADVANCE' RESISTANCE WIRE USED IN HOME-BUILT DIMMERS
(Sizes in B & S Gauge Numbers)

Dimmer Capacity	Dimmer Traverse Section									
	1	2	3	4	5	6	7	8	9	10
250-watts	21	21	23	23	24	24	26	26	29	31
400-watts	19	19	21	21	22	22	24	24	27	29
500-watts	18	18	20	20	21	21	23	23	26	28
800-watts	16	16	18	18	19	19	21	21	24	26
1000-watts	15	15	17	17	18	18	20	20	23	25

DATA ON 'ADVANCE' RESISTANCE WIRE

SIZE B & S Gauge	DIAMETER Inches	RESISTANCE Ohms per foot	FEET per pound
15	.057	.090	102
16	.051	.113	128
17	.045	.145	161
18	.040	.184	204
19	.036	.226	256
20	.032	.287	323
21	.0285	.362	400
22	.0254	.460	526
23	.0226	.575	667
24	.0201	.725	833
25	.0179	.919	1031
26	.0159	1.162	1299
27	.0142	1.455	1639
28	.0126	1.85	2083
29	.0113	2.30	2632
30	.0100	2.94	3334
31	.0089	3.68	4167

'Advance' resistance wire is obtainable from the Driver-Harris Company, Harrison, New Jersey, or from its sales-offices located in principal cities.

'Transite' asbestos wood is obtainable from the Johns-Manville Corporation, New York, or from its sales-offices located in principal cities.

HOME-BUILT STAGE SWITCHBOARD
(See Drawing No. 13)

The average small switchboard consists of a group of more or less standardized and easily available electrical devices, assembled in such a manner as to meet the specific control requirements of the conditions under which it will be used. It is possible for the experienced amateur to build his own switchboard if he is able to choose those particular devices, from among the wide range available, that best fulfill his individual needs and if he is able to assemble them in a manner that is efficient, durable, and safe.

The following description is meant to apply only to a small home-built switchboard which will be used with care and consideration at not too frequent intervals on a small stage with simple lighting requirements. The plans given need not be followed closely. They are presented as a suggestion of possible methods of devising home-built control equipment rather than as a specific solution for any particular set of control requirements.

This switchboard is planned for a total capacity of 60 amperes. It may be wired either for a 30-ampere three-wire circuit or a 60-ampere two-wire circuit. This main supply is controlled by an angle-type knife switch which is equipped with the necessary main fuses. This main supply is distributed to the circuits, eight of which have dimmers and two of which are constant or non-dimming. Each individual circuit has a single-pole switch, a plug fuse, and two line stage connectors acting as receptacles for the accommodation of stage lighting equipment. Eight home-built resistance dimmers are included, two of the 1000-watt size, and six of the 500-watt size.

Design and build eight home-built resistance dimmers, of the capacities mentioned above, in the manner previously described. Mount these preferably on a sheet metal baffle that is spaced at least 1" away from the asbestos-lined back panel of the switchboard as shown in the sketch. Provide a horizontal 1" x 3" clear pine batten on which should be mounted the cleat sockets for the plug fuses of the several circuits. These sockets should be so mounted that the top of each

plug fuse projects through a hole in the front face of the switchboard, for convenient replacement. Provide a length of 1" x 6" clear pine on which should be mounted the single pole knife switches for each circuit. These switches should be mounted at such an angle that the operating handles of the switch blades protrude through slots cut in the front face of the switchboard in the positions shown on the sketch. Provide the necessary receptacles in the form of 15-ampere line connectors mounted securely at the top of the switchboard, with their surface flush with the front face. Wire all these parts together, using No. 14 wire with asbestos or slow-burning insulation, in accordance with the wiring diagram on the sketch. Make all splices carefully, using the necessary solder and insulating tapes. The wiring diagram will, of course, have to be changed slightly if a two-wire 60-ampere current supply is used in place of the three-wire 30-ampere supply shown on the diagram. Great care should be taken in the construction of the switchboard so that adequate ventilation is provided for the dimmers, as these are capable of radiating a great quantity of heat while in service. The open ventilation spaces in the bottom, sides and back should preferably be covered by 1/2"-square open-mesh wire screening. Any wooden portions of the interior of the switchboard should be carefully protected against the heat from the dimmers by means of sheet asbestos paper lining and sheet metal baffles and spacers, as was done with the home-built spotlights, scene-projectors, and similar ventilated equipment. No "live" or current-carrying parts of the switchboard should be exposed where the operator of the switchboard can accidentally come into contact with them.

The front face of the switchboard should be made of 1/4" 3-ply fir panel with the necessary slots and holes, and lined with sheet asbestos paper. It can be made in several sections, so as to facilitate accessibility of the internal parts of the switchboard. When the switchboard has been assembled, the front face should be given a coat of flat black glyptal heat-resisting lacquer and the appropriate lettering, such as circuit designations, circuit capacities, and dimmer index scales, should be neatly lettered on it in white paint. A card holder can be mounted at each circuit location into which can be inserted cards noting such information as what equipment is connected to each circuit, and what lighting effect it controls. Provision can be made above the main switch for a clamp for holding cue sheets. A small operating light should be provided for lighting the face of the switchboard.

The entire switchboard can be mounted on a wall or other vertical

surface by means of two horizontal 2" x 4" pine mounting bars. Or the switchboard may be built into a portable case for traveling use. The switchboard can be built to similar design in sheet metal if facilities for fashioning this material are available.

HOME-BUILT PORTABLE STAGE SWITCHBOARD
with Small, Round-plate Resistance Dimmers
(See Drawing No. 14)

The small round-plate non-interlocking resistance-type dimmer is a relatively inexpensive type of manufactured dimmer and can be used to advantage in constructing home-built switchboards. The 1000-watt size is probably the most practicable size for use on the average small stage. The assembly of parts and general design and construction of a home-built switchboard that embodies these dimmers are very similar to those previously described for the switchboard with home-built dimmers. The manufactured dimmers are heavier and hence must be very securely mounted. The drawing shows a workable assembly that forms a portable switchboard of six 1000-watt circuits. The dimmers are covered by curved guards of sheet metal on which the dimmer index scales can be painted. The spaces between the individual curved metal guards form the slots through which the operating handles of the dimmers protrude. Adequate provision must be made for ventilating the dimmers, and the wooden parts of the switchboard adjacent to the dimmers should be lined with sheet asbestos paper. A cover can be provided for the entire switchboard, and with the addition of rubber-tired casters and heavy chest-handles, the switchboard can be easily handled and transported. A length of No. 8 three-conductor stage cable should be used to connect the switchboard to the nearest source of current supply, if a three-wire supply is available. If only a two-wire supply is available, this supply cable would have to be No. 4 two-conductor stage cable, and the wiring of the switchboard would have to be adjusted accordingly.

HOME-BUILT PORTABLE STAGE SWITCHBOARD
with Small Transformer Dimmers
(See Drawing No. 15)

The small variable transformers that are now available at reasonable cost can be used for stage lighting control purposes, and are particularly well suited for inclusion in home-built equipment. A dimmer of this type can dim completely and uniformly any lamp load that does not exceed the rated capacity of the transformer, and hence eliminates the need for "phantom loads." Also, it gives off practically no heat while it is operating, and it is relatively compact in construction.

The drawing shows a compact assembly that provides a portable switchboard of six 860-watt circuits. The circuit switches are also of a very compact type, with silver contacts, known as the "slow-break" switch. They are somewhat more expensive than a knife switch of corresponding capacity. The dials with which the transformers are commonly supplied are calibrated in terms of output voltage, and hence are not well suited to use as index scales for stage-lighting purposes, but these scales can be covered with heavy bristol board upon which can be inscribed the conventional 0 - 10 dimmer index scale. The switchboard as shown on the drawing can be provided with a cover, if desired.

HOME-BUILT TEASER COMBINATION
consisting of Teaser, Borderlight, and Spotlight Batten
(See Drawing No. 16)

A piece of equipment which has proved extremely useful on small amateur stages is the home-built teaser combination. The ordinary teaser is used as the adjustable masking piece that provides the upper limit of the stage opening. Immediately benind the teaser is usually found the first borderlight and a spotlight batten, each separately adjustable as to height. On a small stage these three elements - teaser, borderlight, and spotlight batten - can easily be combined into a single unit. This will require only one set of rigging lines, and only one operation will be necessary when the teaser height is changed. The borderlight and spotlights will always be masked regardless of the height at which the teaser is trimmed. This "teaser combination" is hence very compact, economical, and convenient. Its construction is relatively simple and inexpensive.

The teaser itself can be built according to the standard construction used for scenery flats. It should be covered with regular scenic linen or muslin and painted black for light-proofing. It can then be covered with velour, if desired, perhaps in a color to match the act curtain and the side tormentors. Vertical mounting pieces of 1" pine are then fastened to the teaser toggles. The borderlight unit is fastened to this vertical mounting piece and to the teaser thickness. Two sets of double brackets, upper and lower, are then fastened to each of the vertical mounting pieces, and the spotlight batten, consisting of two pieces of 1" x 3" pine screwed together on edge, is fastened to the lower set of double brackets.

The 1/2" manila rope lines from the gridiron or stage ceiling are fastened to bolts that span each of the lower set of double brackets. These lines pass between the halves of each of the corresponding upper set of double brackets. The upper brackets will be found useful for providing a convenient means of holding the gridiron lines in such position, by means of pegs or bolts across the brackets, that the teaser face is kept vertical for any given conditions of weight loading on

the spotlight batten. The teaser combination with its full set of equipment will be fairly heavy, and should be suitably counterweighted by a sand-bag for easy and convenient operation from the pin rail.

CONSTRUCTION MATERIALS AND SOURCES OF SUPPLY

Lumber

Two major types of lumber are needed. One type is clear, select pine. This should be straight and thin grained, and should be examined carefully for freedom from resinous grain and "pitch-pockets" from which gum will exude when the wood is subjected to heat. Pitch-free pine is characterized by its light weight, and hence the lightest pieces of pine should always be chosen. Two thicknesses of pine are needed - one inch thick and one-half inch thick. Where one-inch pine is called for the usual nominal one-inch pine (actually about 3/4" thick), as sold by lumber dealers, is meant. Where one-half-inch pine is called for it should preferably be of 1/2" actual thickness.

The other type of lumber is three-ply fir panel, which is needed in two thicknesses, 3/8" and 1/4". This should be of good quality, and preferably surfaced on both sides. A small amount of 1/8" thick bass plywood is called for in connection with the switchboards, but 1/4" three-ply fir may be substituted in the design if the bass plywood is unavailable locally.

Hardware

Only common items of hardware such as screws, bolts, nuts, thumb screws, wing nuts, and washers are called. These are available at any well-stocked hardware store.

Wire

The wire used for internal wiring of the lighting and control equipment should be of the "slow-burning" or the asbestos-insulated type. The "slow-burning" wire is cheaper but more difficult to handle. The asbestos-insulated wire is specifically designated as "No. 14 solid Deltabeston copper lead wire with 40-mil white felted asbestos insulation." The wire used for the flexible leads from equipment to a load connector should be insulated with woven asbestos. The designation of the best type to use is "No. 14 flexible Deltabeston moving picture machine cable." Both these types of wire are available through any local branch of the General Electric Supply Corporation.

Stage cable should be flexible and durable. The designation of the best size for small stages is simply "No. 14 two-conductor stage cable." For the main current supply of the home-built portable switchboards heavier sizes and often three conductors are needed. Stage cable is available from dealers in stage lighting equipment. If full coils of 250 feet can be used, it is more economical to buy it from a manufacturer such as the General Cable Corporation, which has branch offices in many large cities.

The resistance wire used for the home-built dimmers is "Advance" resistance wire, and may be obtained in various sizes, in quantities of one pound or multiples thereof, from the Driver-Harris Company, Harrison, New Jersey. Full data on this wire is given in the description of home-built dimmers.

Sockets

The cleat sockets called for in connection with home-built equipment may be of porcelain or of molded plastic. A good porcelain medium socket is catalog No. 598 of Pass and Seymour, Inc. Its counterpart in the mogul size is catalog No. 516 of the same firm. A good molded plastic socket is catalog No. 50721 of the Monowatt Electric Corporation. If it is desired to use pre-focus sockets for the spotlight and the scene projector, catalog No. 3740 of the Bryant Electric Co. can be used for the medium size, and catalog No. 3842 of the same firm can be used for the mogul size. The sockets listed are available through any local dealer or jobber in electrical material, such as the General Electric Supply Corporation or the Westinghouse Electric Supply Co. It is good practice to solder all wire connections to the terminal screws of sockets, especially of those sockets which will be concealed in a trough or wiring channel.

Switches

The open knife switches that are used as the circuit switches on the switchboards, as well as the angle-type knife switches that are used as the main switches, are available from the Trumbull Electric Manufacturing Co., Plainville, Connecticut. The compact "slow-break" toggle switches used on the switchboard with transformer dimmers are available from the Hart Manufacturing Co., Hartford, Connecticut. These toggle switches are slightly noisy in operation, but if they are dismantled and the sharp corner on the tripping cam rounded off with a sharp file, or with a small emery wheel, they will operate quite noiselessly.

Dimmers

The small round-plate non-interlocking resistance dimmers such as are shown on the switchboard sketch on Drawing No. 14 are available from the Ward-Leonard Electric Co., Mount Vernon, New York. Similar dimmers are manufactured by the Cutler-Hammer Manufacturing Co., Milwaukee, Wisconsin.

The small variable transformers that have been used as circuit dimmers in the switchboard shown on Drawing No. 15 are available from the General Radic Co., Cambridge, Massachusetts. This firm has issued several interesting bulletins on the use of these dimmers for control of lighting on small stages.

Sheet Metal

For the baffles and ventilating channels in home-built equipment No. 28 Gauge sheet iron plain or galvanized, is suitable. If the galvanized iron is used it should be given a vinegar wash to roughen its surface so that paint may take a firm hold.

For the various reflecting surfaces, bright charcoal tin plate, in a thickness known as "IC", is suitable. Coke tin plate is duller and hence not so satisfactory as a reflector.

Asbestos

For protecting wooden surfaces from the direct heat generated by lamps, a lining of sheet asbestos paper 3/32" thick can be used. This is available at most local hardware stores.

The best material to use as a base on which to wind the resistance wire for home-built dimmers is "Transite" asbestos wood, which is available from the Johns-Manville Corporation, New York. Information as to dimensions is given in the description of home-built dimmers.

Paint

Some units of home-built equipment need a coat of flat white paint inside to serve as a reflecting surface, and others need a coat of flat black paint to absorb light. Whichever is needed, the paint should be of the heat-resisting type. Ordinary paints will quickly disintegrate under the heat generated by the lamp. Perhaps the best paint for this purpose is that in which the vehicle consists of an

alkyd resin solution in mineral spirits. This is available from several paint manufacturers, among which is Hanline Brothers, Baltimore, Maryland. Under the trade name of 'Glyptal' lacquer it is available from the General Electric Supply Corporation.

Lamps

Incandescent lamps used in home-built equipment are commonly available from a wide variety of sources. Lamps that are not in common use, such as 250-watt and 400-watt G-30 spotlight lamps for use in the home-built spotlight, the 1000-watt G-40 spotlight lamp for use in the scene projector, the 500-watt T-20 bulb C-13 filament spotlight lamp for use with step-lens spotlights, and various sizes of natural-colored lamps, will probably have to be ordered through electrical jobbers or lamp agencies.

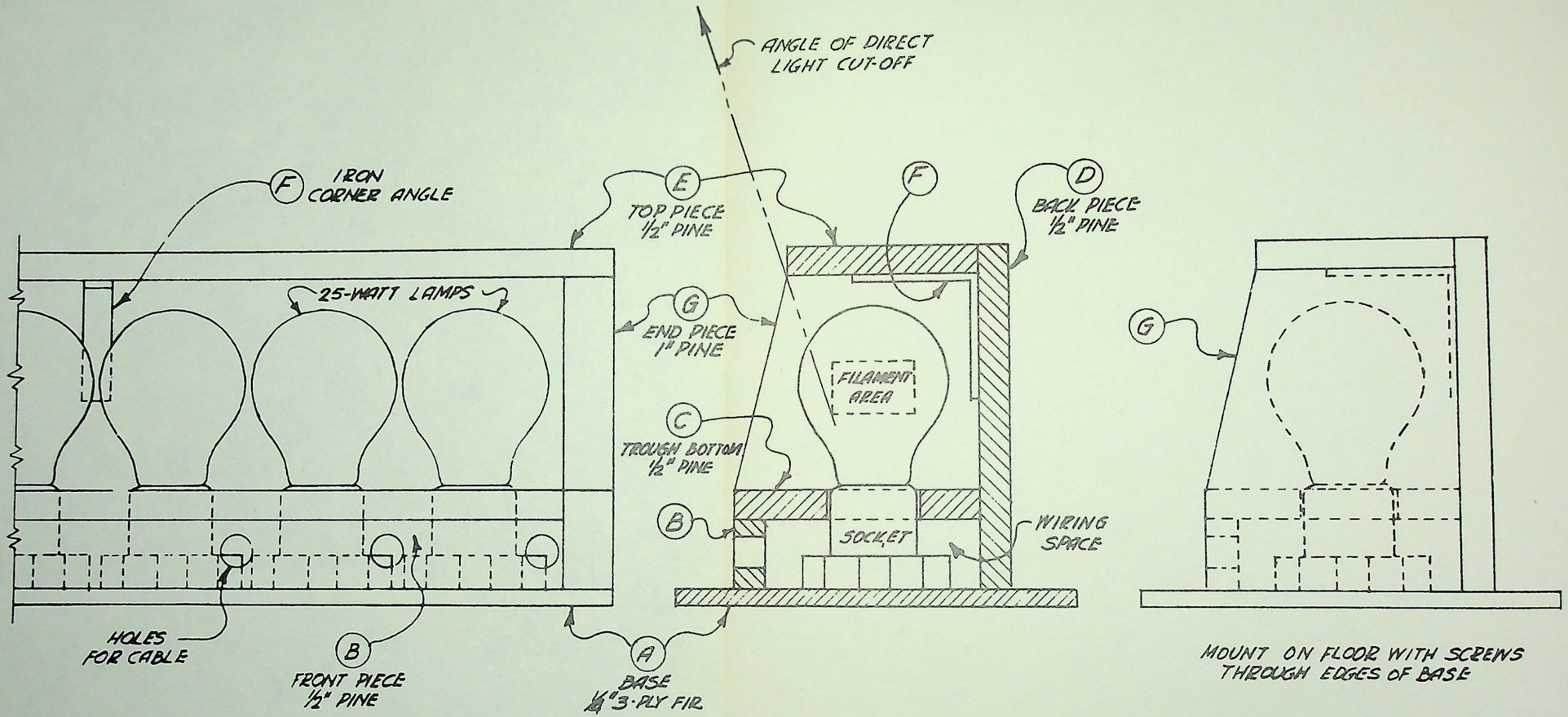
It should be noted that common A-bulb lamps larger than 25 watts in size cannot be color-dipped. If it is desired to use 60-watt color-dipped lamps in borderlights, striplights, or elsewhere, it will be necessary to order 60-watt S-21 vacuum type lamps, which operate at a low enough temperature to permit lamp dip to remain on the bulb without disintegrating.

Miscellaneous Stage Lighting Supplies - lenses, reflectors, connectors, mounting clamps, leather washers, lamp dip, gelatin and so forth.

Materials of this nature are available from such firms as Kliegl Brothers, 321 West 50 Street, New York; Century Lighting, Inc., 419 West 55 Street, New York; or Display Stage Lighting Co., 617 Tenth Avenue, New York. Colored gelatin in a wide variety of tints and shades is available from the Brigham Sheet Gelatine Co., Randolph, Vermont. This firm issues an excellent gelatin color sample booklet which is available upon request.

Miscellaneous Electrical Supplies and Materials

Material of this general nature, as well as many items already mentioned specifically, is available from jobbers in electrical equipment, such as the General Electric Supply Corporation and the Westinghouse Electric Supply Company. These firms have branch offices and storehouses in all the principal cities of the country.



FRONT VIEW

SECTION VIEW

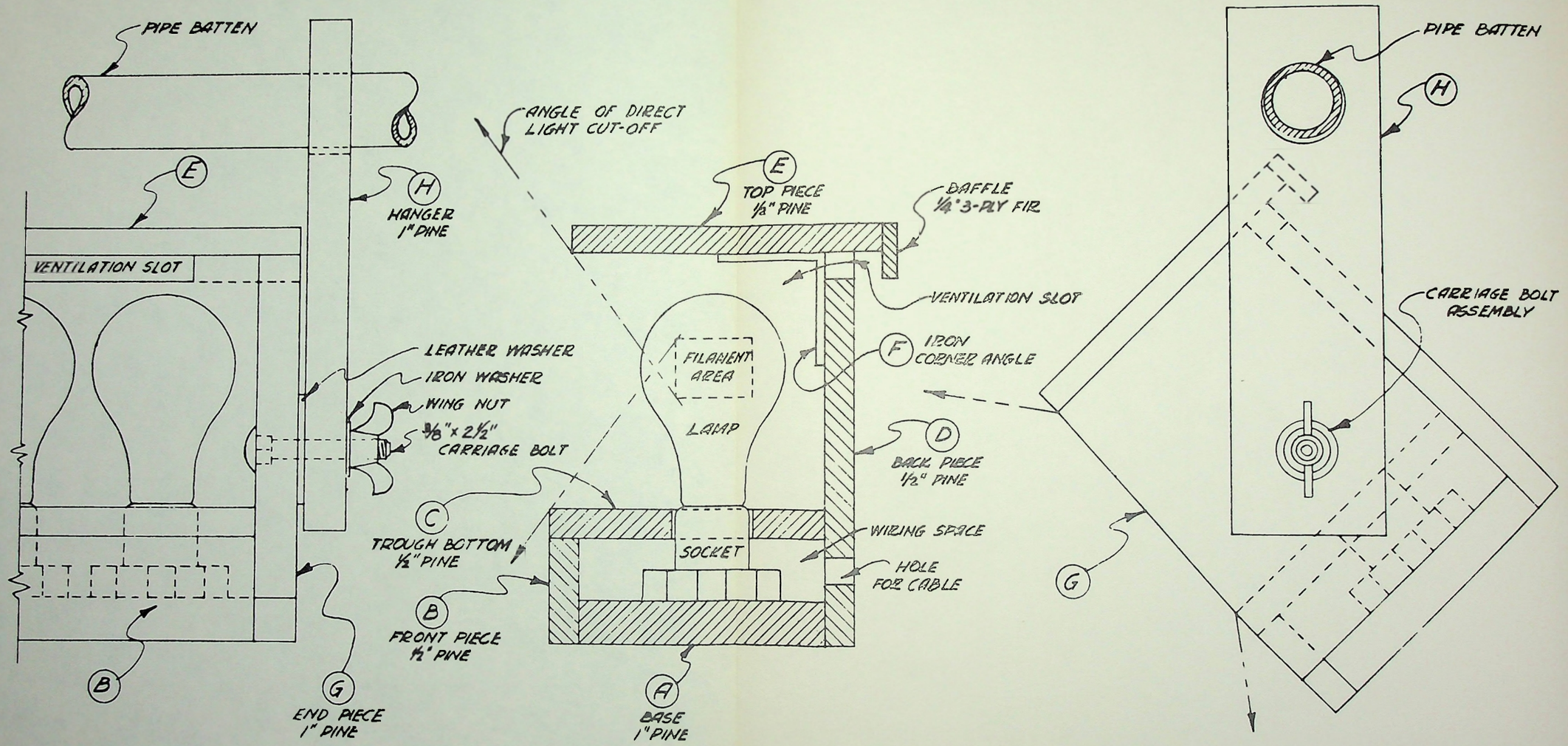
SIDE VIEW

HOME-BUILT FOOTLIGHTS

ONE-HALF ACTUAL SIZE

FOR USE WITH ACCOMPANYING INSTRUCTIONS

DRAWING Nº 1



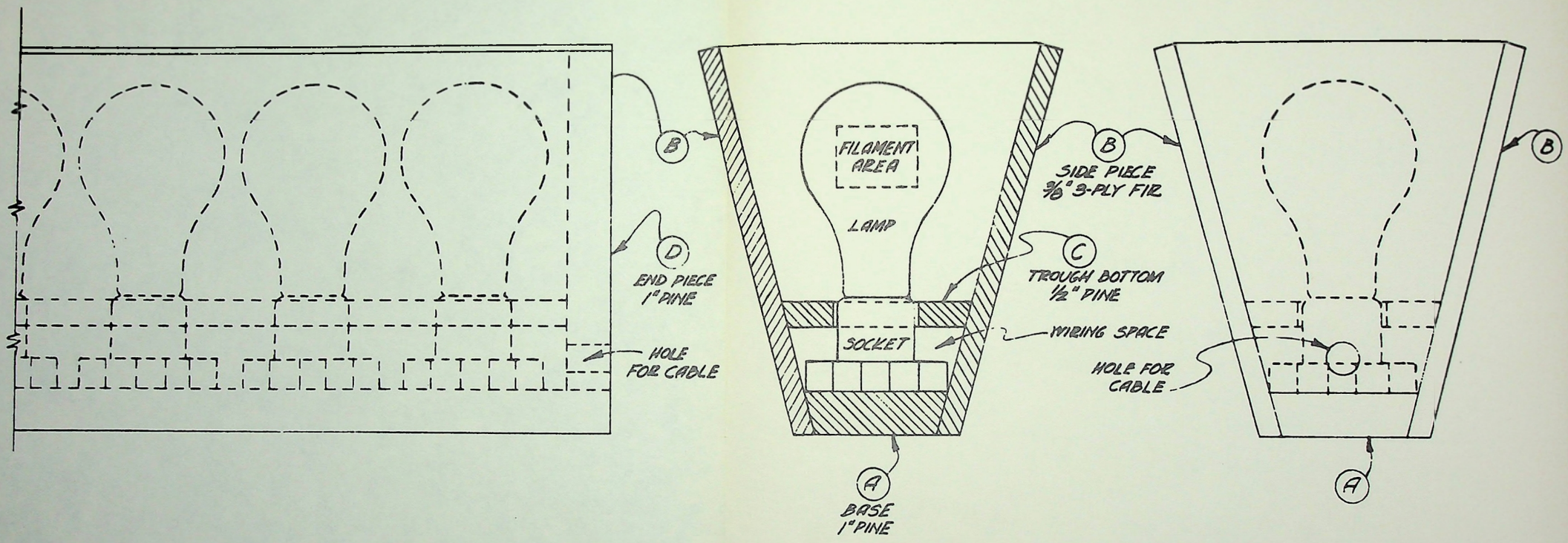
NOTE: ASBESTOS LINING OF TROUGH NOT SHOWN

HOME-BUILT BORDERLIGHTS

ONE-HALF ACTUAL SIZE

FOR USE WITH ACCOMPANYING INSTRUCTIONS

DRAWING No. 2



SIDE VIEW

SECTION VIEW

END VIEW

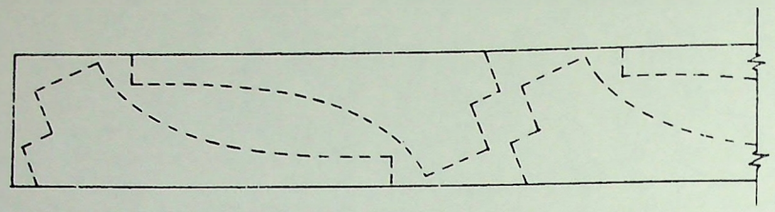
HOME-BUILT STRIPLIGHT

ONE-HALF ACTUAL SIZE

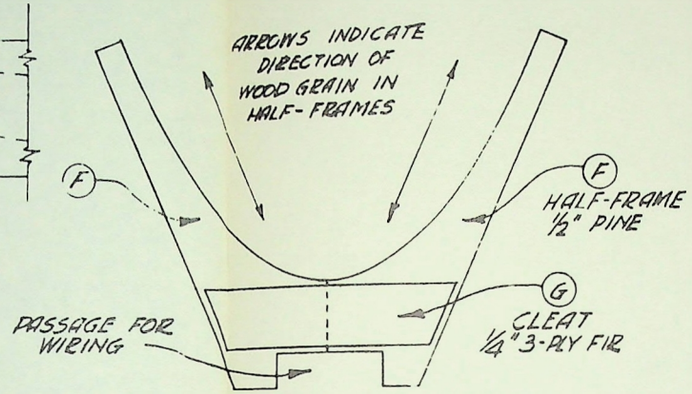
FOR USE WITH ACCOMPANYING INSTRUCTIONS

NOTE: ASBESTOS LINING OF TROUGH NOT SHOWN

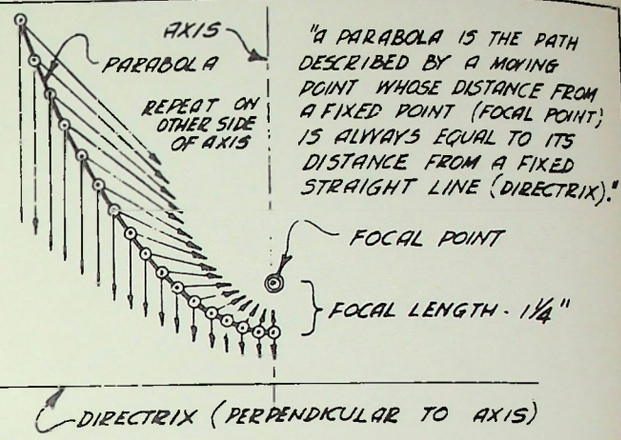
DRAWING Nº 3



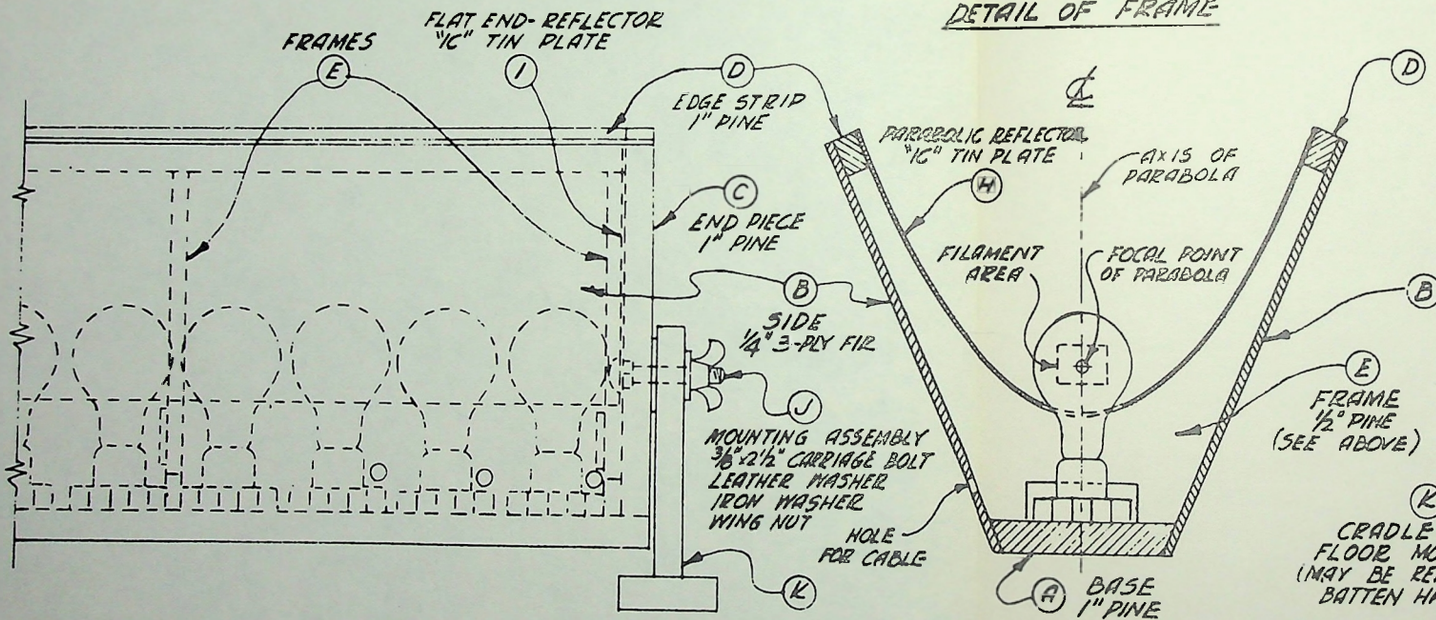
LAYOUT OF HALF-FRAMES BEFORE CUTTING



DETAIL OF FRAME



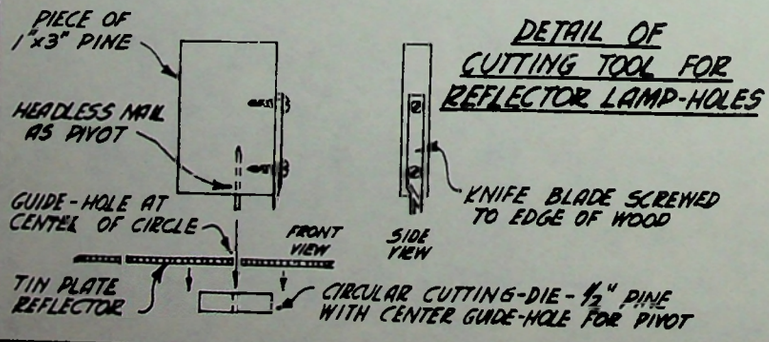
PLOTTING THE PARABOLA



SIDE VIEW

SECTION VIEW

END VIEW



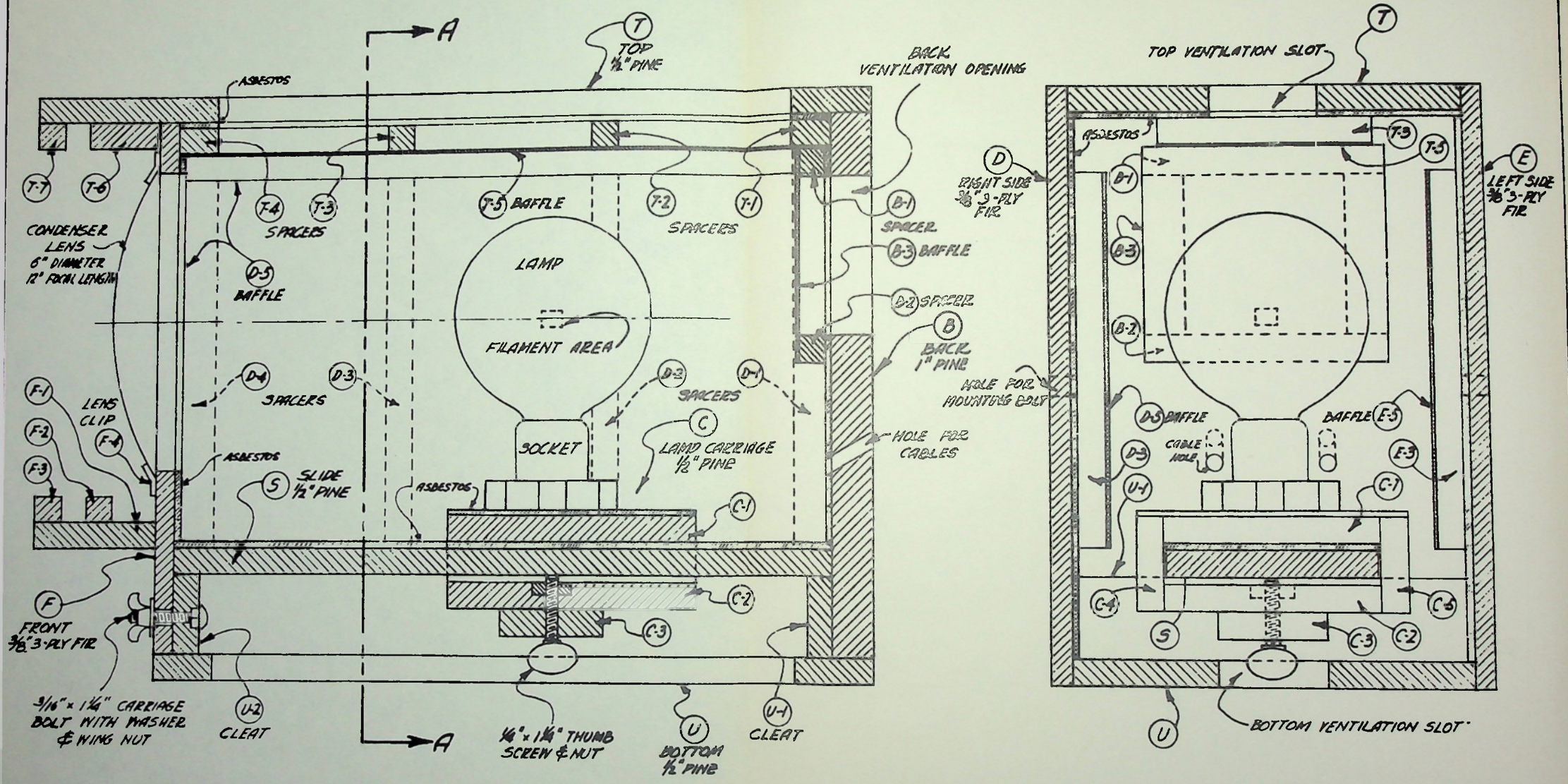
DETAIL OF CUTTING TOOL FOR REFLECTOR LAMP-HOLES

HOME-BUILT PARABOLIC STRIPLIGHT

ONE-QUARTER ACTUAL SIZE

FOR USE WITH ACCOMPANYING INSTRUCTIONS

DRAWING Nº 4



LONGITUDINAL SECTION

CROSS-SECTION ON "A-A"

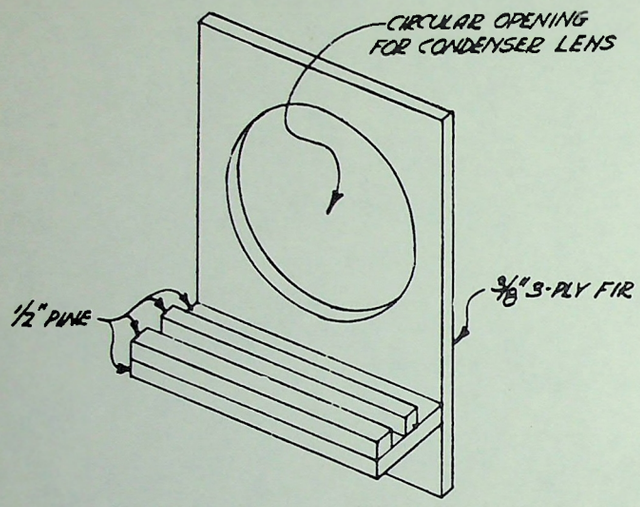
HOME-BUILT SPOTLIGHT

ONE-HALF ACTUAL SIZE

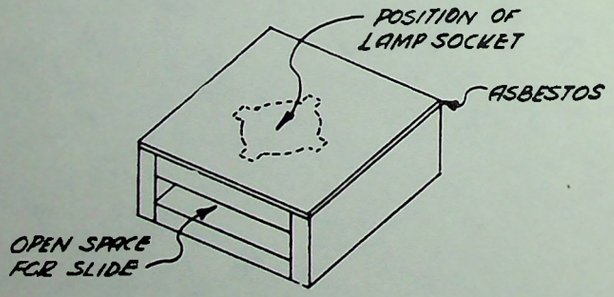
FOR USE WITH ACCOMPANYING INSTRUCTIONS

SEE DRAWING Nº 6 FOR DETAILS OF LAMP CARRIAGE, FRONT, AND YOKE MOUNTING

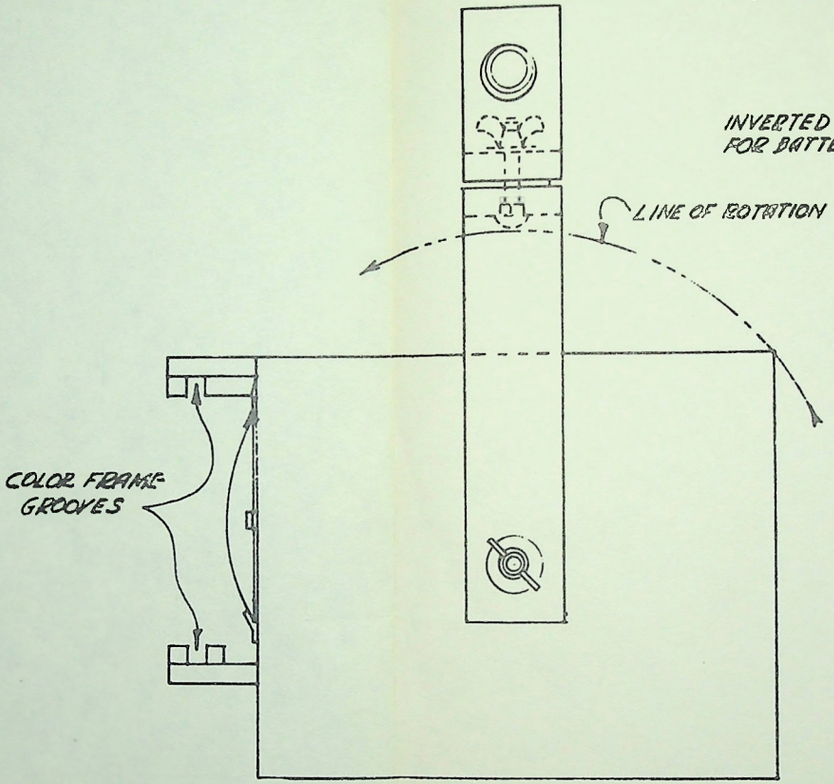
DRAWING Nº 5



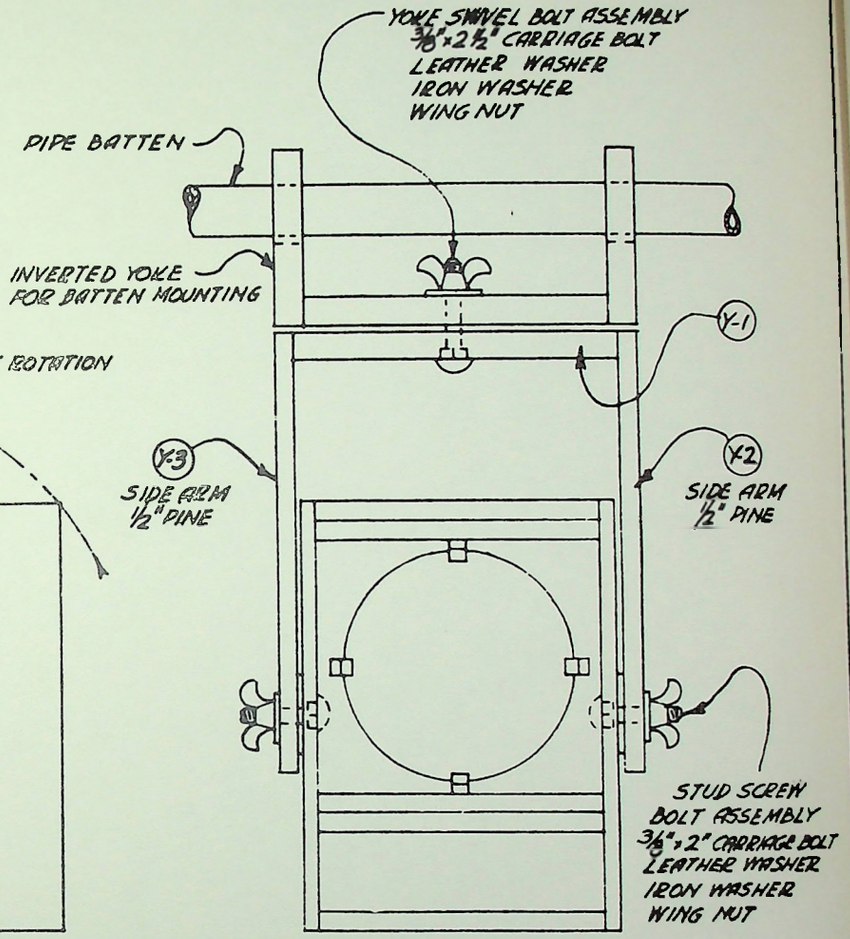
ISOMETRIC VIEW OF REMOVABLE FRONT (F)



ISOMETRIC VIEW OF LAMP CARRIAGE (C)
1/2" PINE



SIDE VIEW



FRONT VIEW

DETAILS OF YOKE MOUNTING

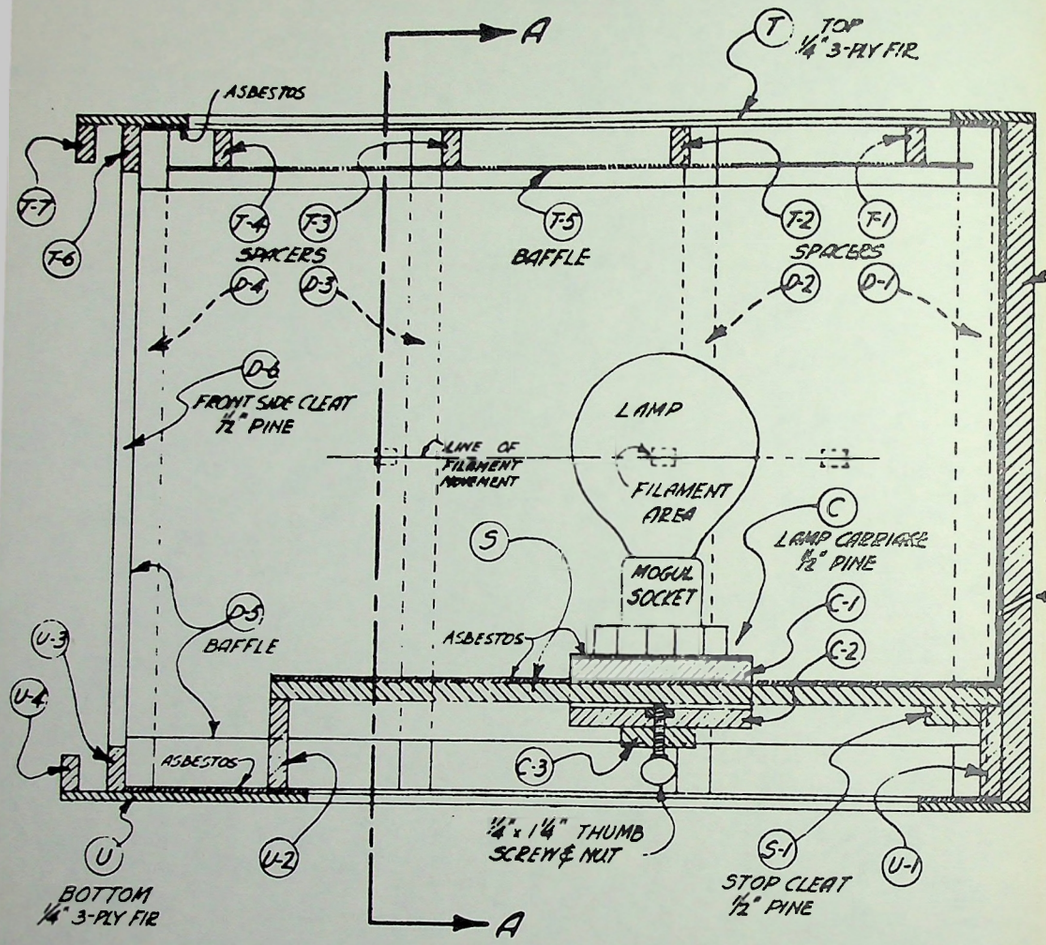
HOME-BUILT SPOTLIGHT

ONE-QUARTER ACTUAL SIZE

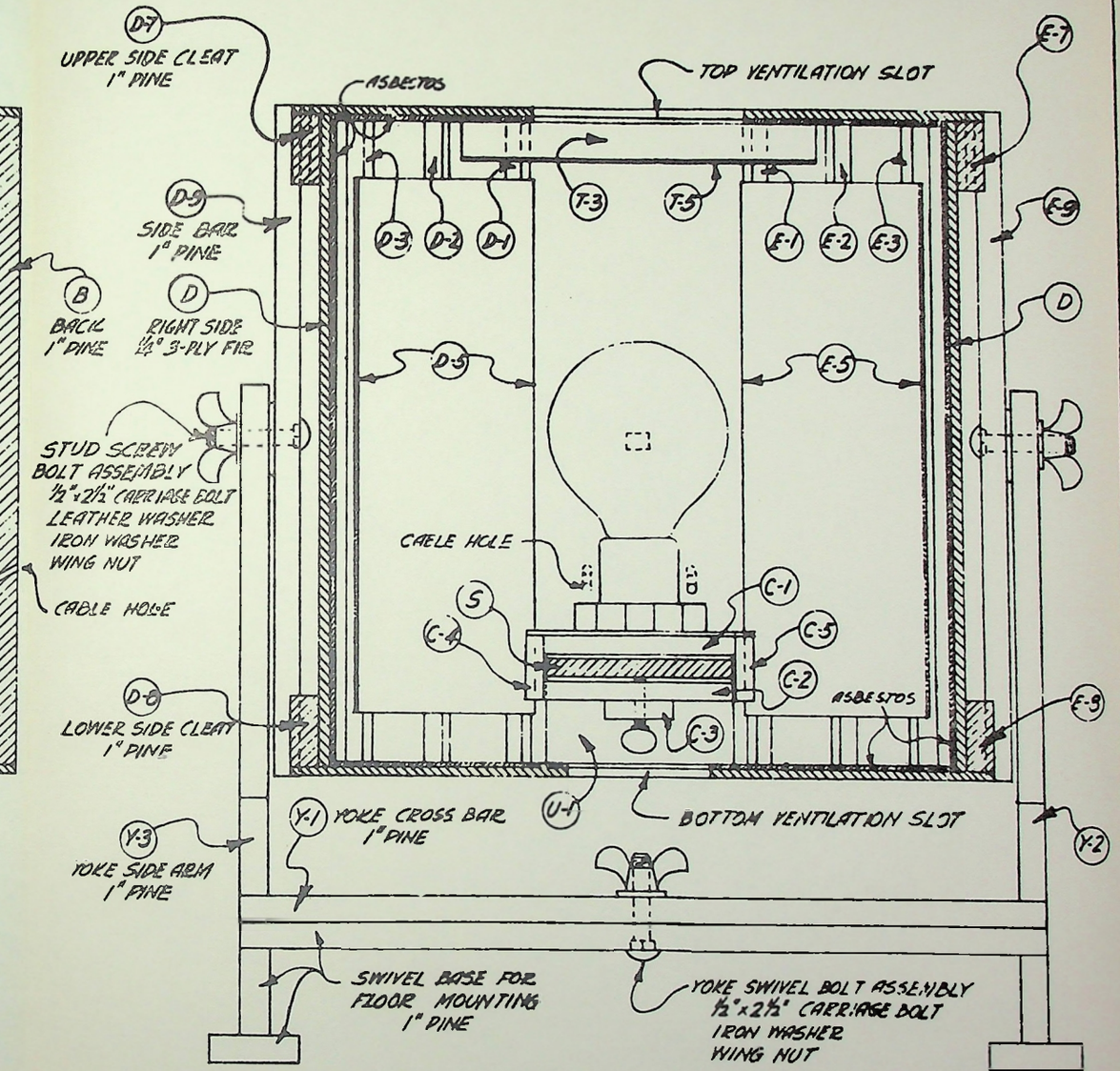
FOR USE WITH ACCOMPANYING INSTRUCTIONS

SEE DRAWING NOS FOR PRINCIPAL DETAILS OF CONSTRUCTION

DRAWING Nº 6



LONGITUDINAL SECTION



CROSS-SECTION ON "A-A"

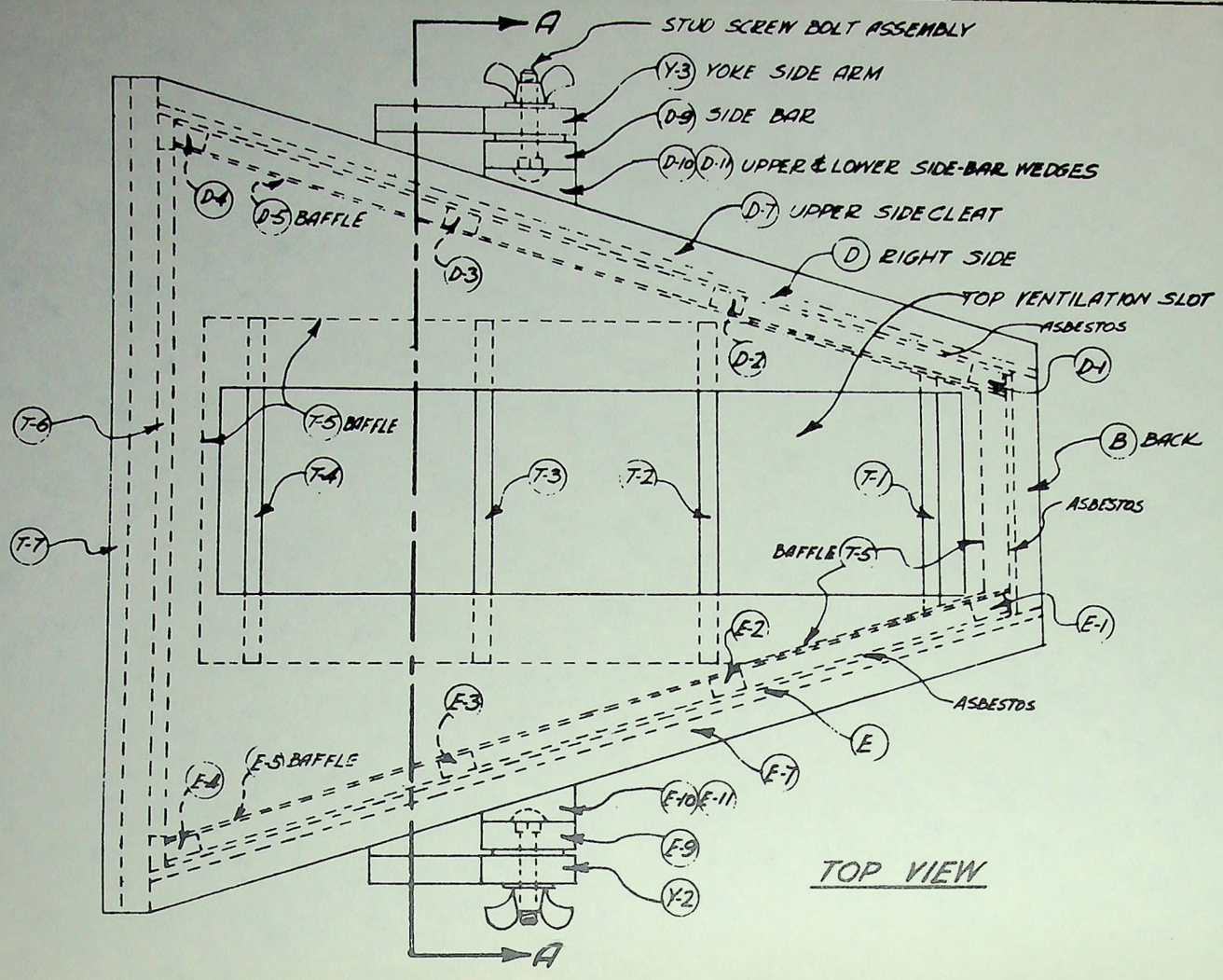
HOME-BUILT SCENE PROJECTOR

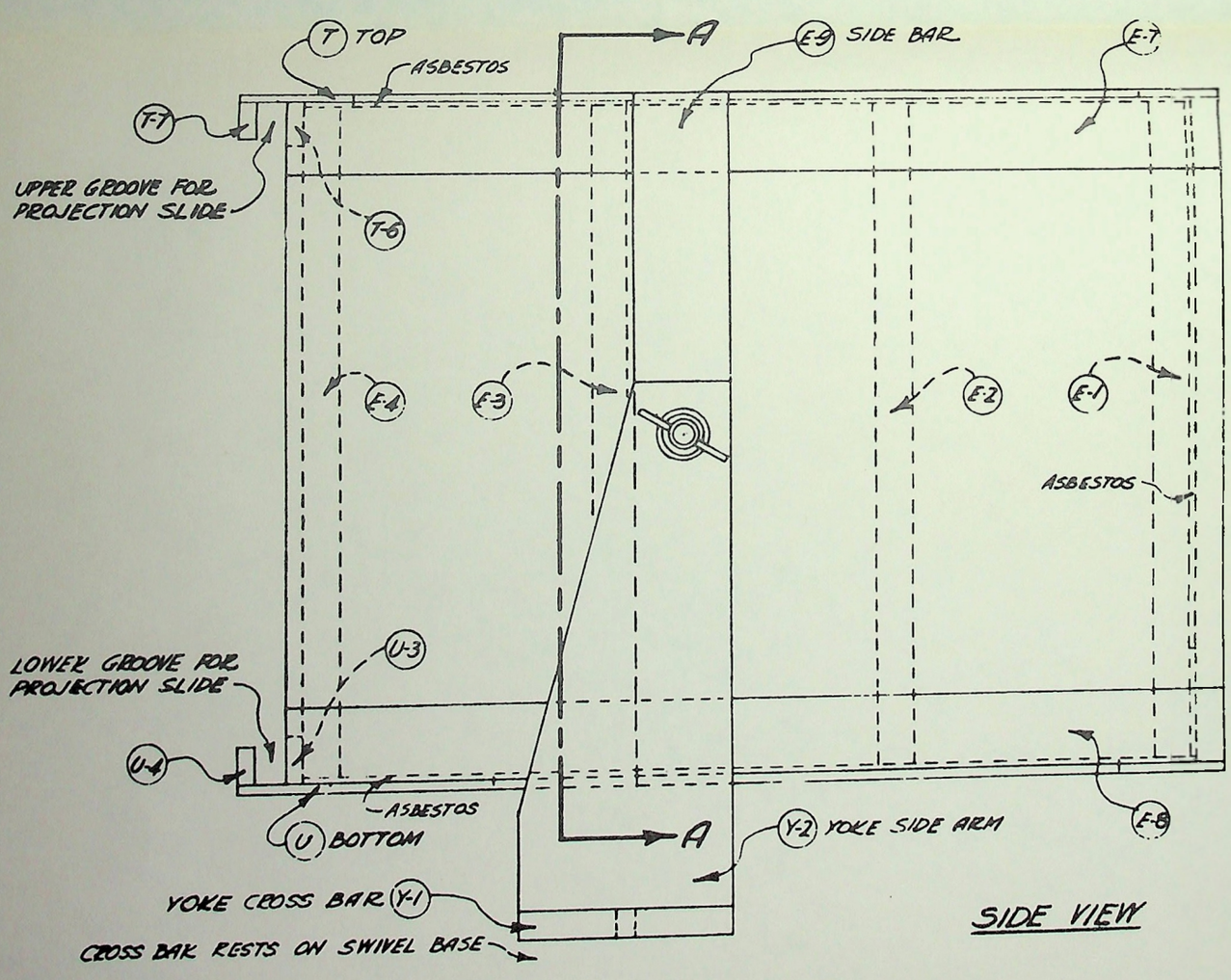
ONE-QUARTER ACTUAL SIZE

FOR USE WITH ACCOMPANYING INSTRUCTIONS

CROSS-SECTION ON "A-A" SHOWN ABOVE IS NOT UNIFORM THROUGHOUT LENGTH OF SCENE PROJECTOR. SEE DRAWING Nº 8 FOR FURTHER NECESSARY DETAILS

DRAWING Nº 7





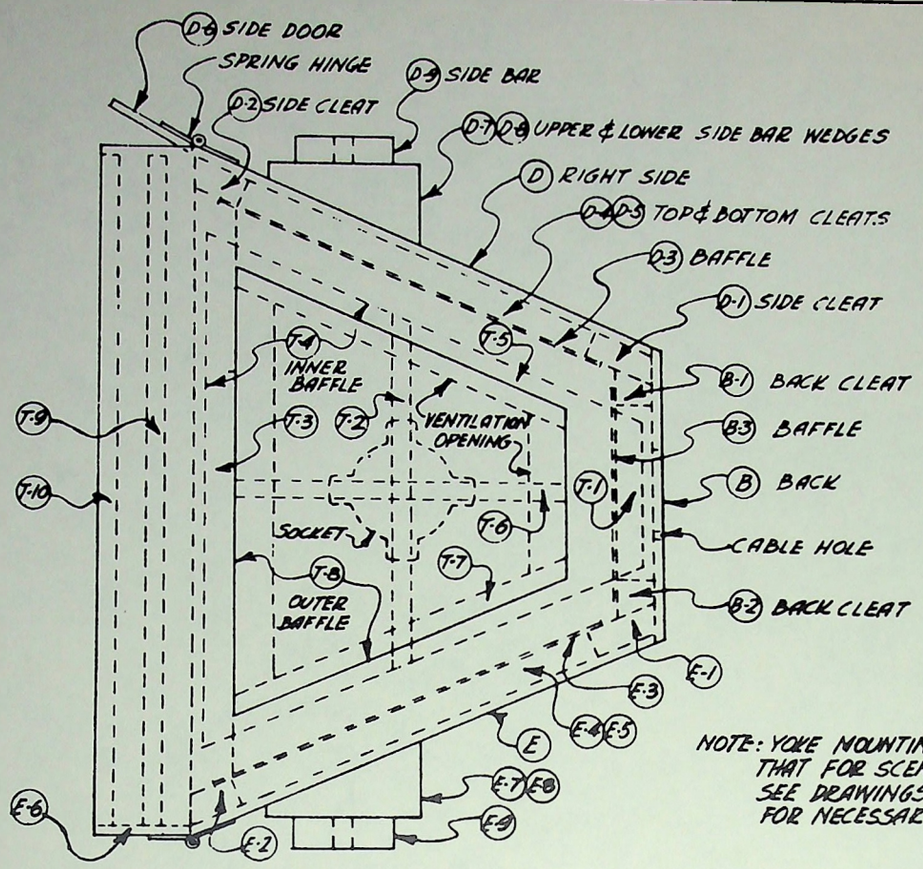
SEE DRAWING Nº 7 FOR CROSS-SECTION ON "AA", LONGITUDINAL SECTION, AND OTHER CONSTRUCTION DETAILS

HOME-BUILT SCENE PROJECTOR

ONE-QUARTER ACTUAL SIZE

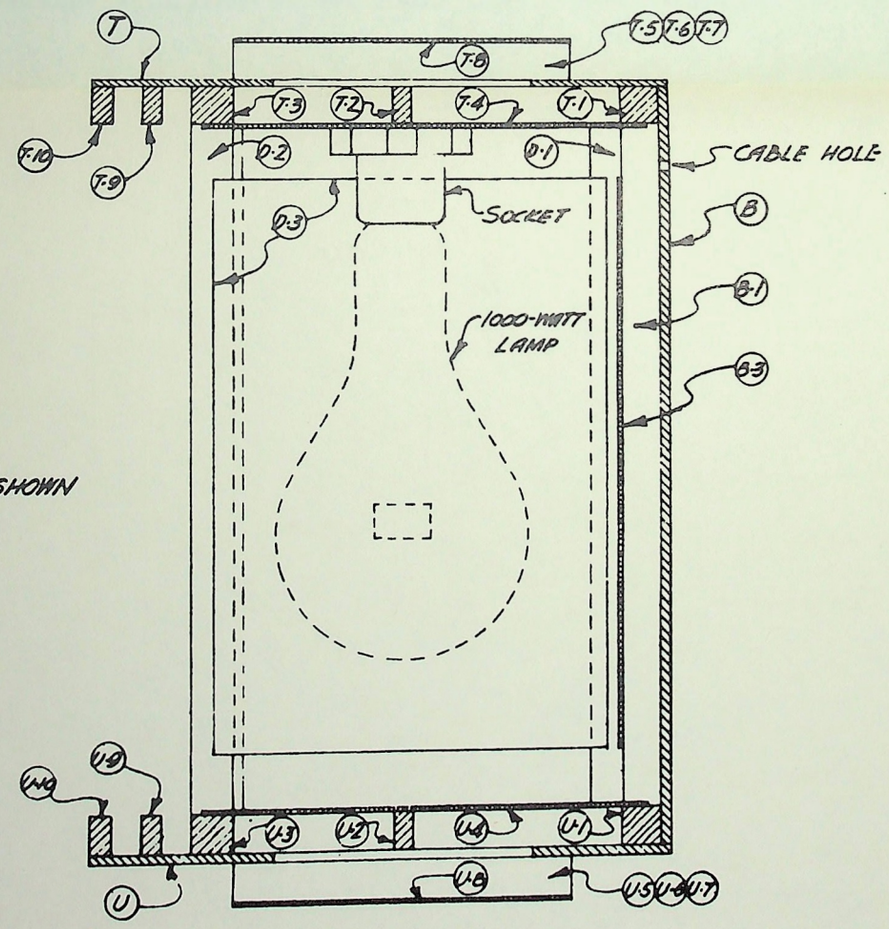
FOR USE WITH ACCOMPANYING INSTRUCTIONS

DRAWING Nº 8



NOTE: YOKE MOUNTING SIMILAR TO THAT FOR SCENE PROJECTOR. SEE DRAWINGS Nos 7 AND 8 FOR NECESSARY DETAILS

TOP VIEW



ASBESTOS LINING NOT SHOWN

LONGITUDINAL SECTION

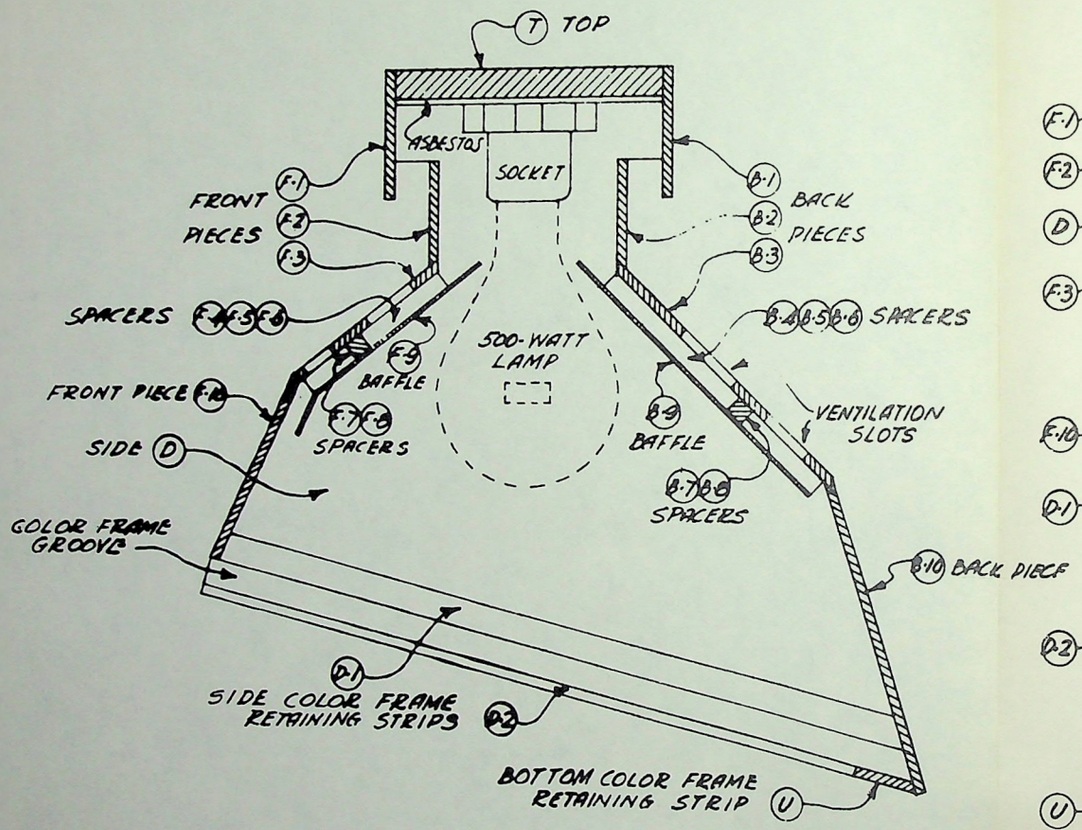
HOME-BUILT OLIVETTE

ONE-QUARTER ACTUAL SIZE

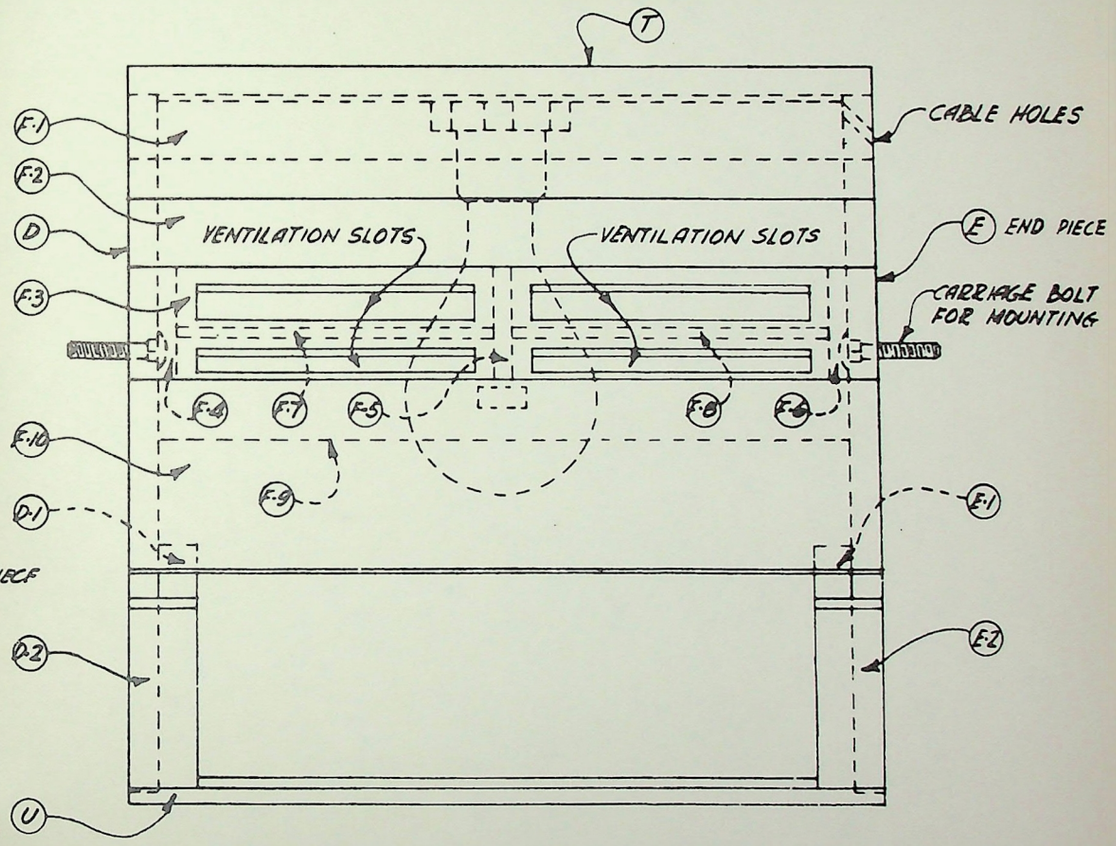
FOR USE WITH ACCOMPANYING INSTRUCTIONS

DRAWING Nº 9

NOTE: MOUNTING MAY BE EITHER:
YOKE TYPE, SIMILAR TO THAT DESCRIBED FOR SPOTLIGHT ON DRAWING Nº 6, OR
HANGER TYPE, SIMILAR TO THAT DESCRIBED FOR BORDERLIGHT ON DRAWING Nº 2



CROSS-SECTION VIEW



FRONT VIEW

HOME-BUILT SUSPENSION FLOODLIGHT

ONE-QUARTER ACTUAL SIZE

FOR USE WITH ACCOMPANYING INSTRUCTIONS

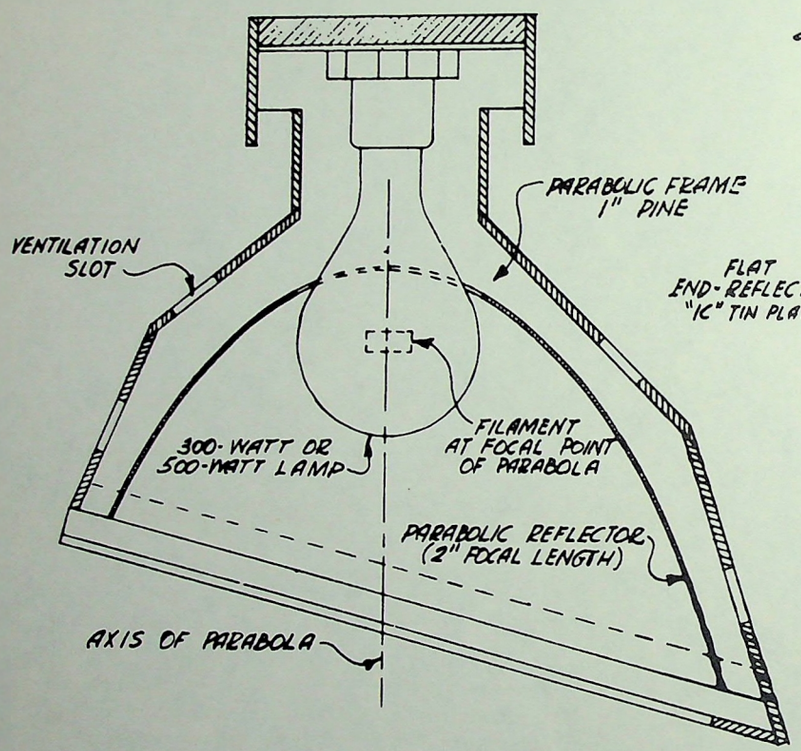
DRAWING Nº 10

NOTES

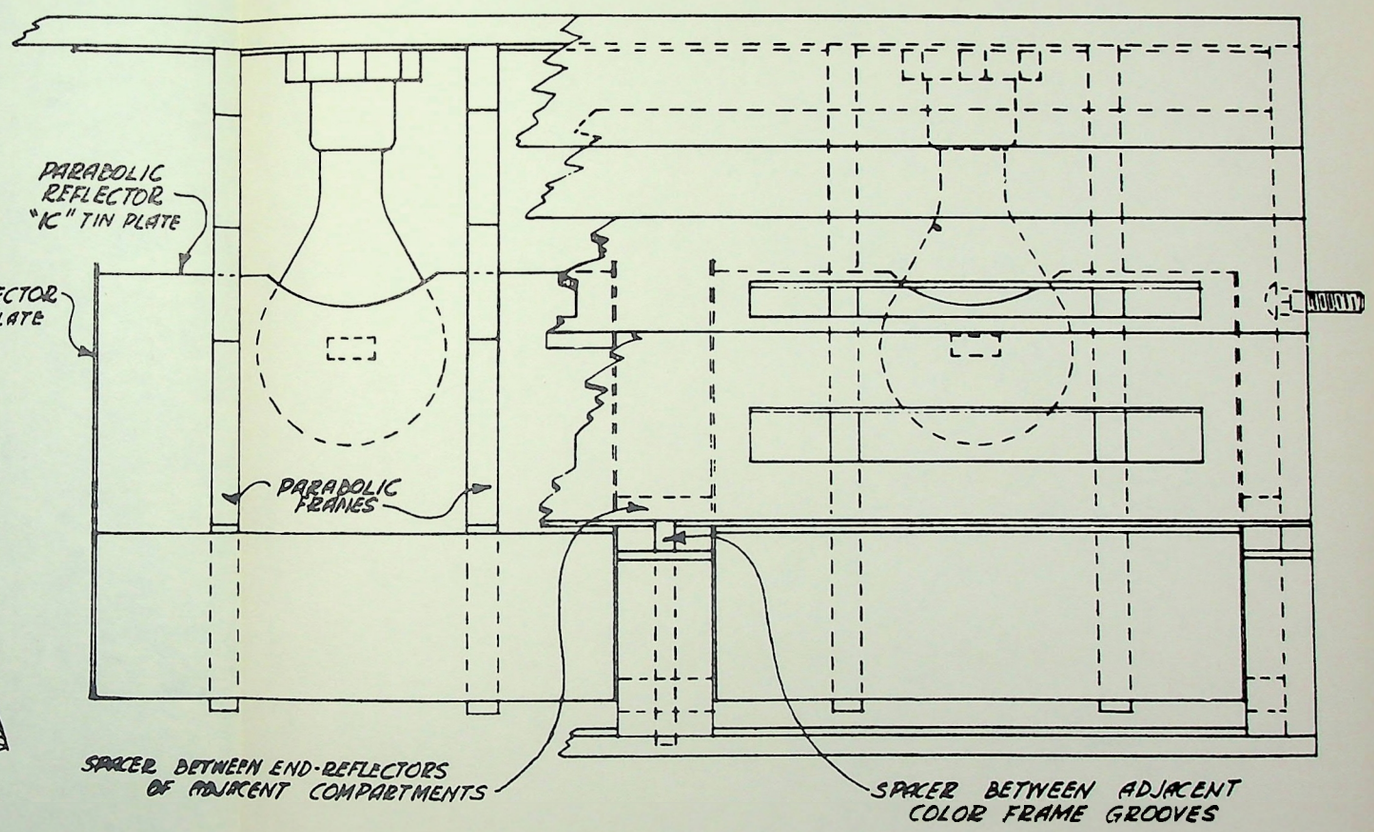
DESIGN AND CONSTRUCTION OF PARABOLIC FRAMES SIMILAR TO THOSE DESCRIBED FOR PARABOLIC STRIPLIGHT ON DWG. Nº 4

DESIGN AND CONSTRUCTION OF HOUSING SIMILAR TO THAT DESCRIBED FOR SUSPENSION FLOODLIGHTS ON DWG. Nº 10

UNIT MOUNTED ON PIPE BATTEN BY HANGER AT EACH END, SIMILAR TO METHOD DESCRIBED FOR BORDERLIGHT ON DRAWING Nº 2



CROSS-SECTION THROUGH CENTER OF COMPARTMENT



FRONT VIEW OF LEFT END

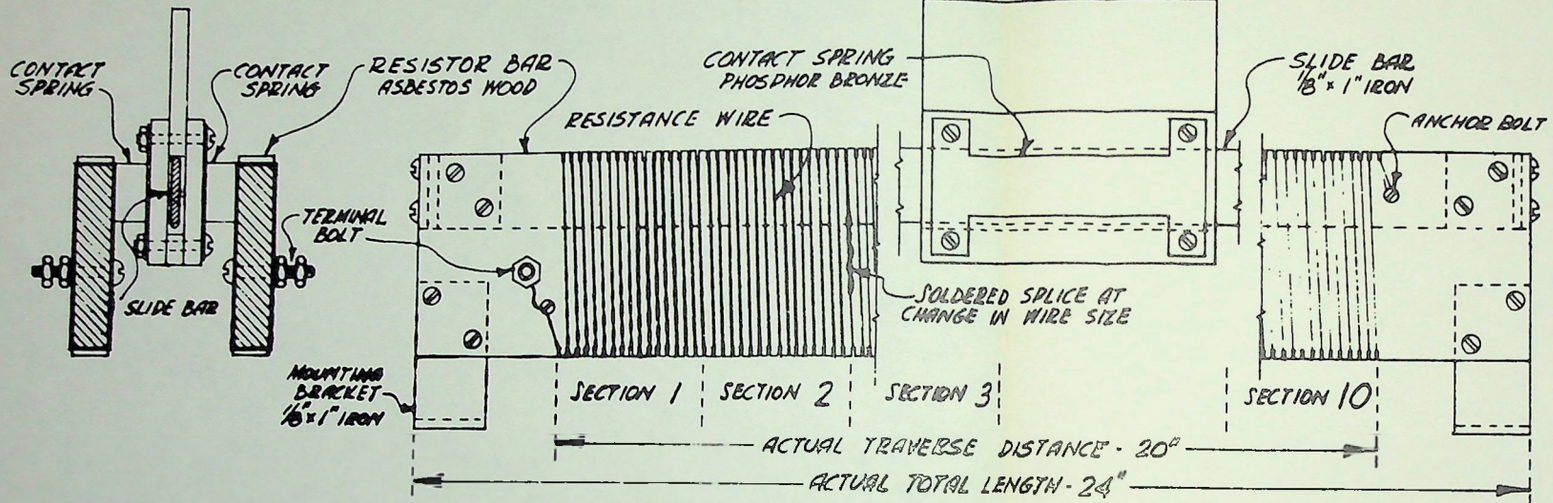
HOME-BUILT CYCLORAMA LIGHTING UNIT

(PARABOLIC COMPARTMENT TYPE)

ONE-QUARTER ACTUAL SIZE

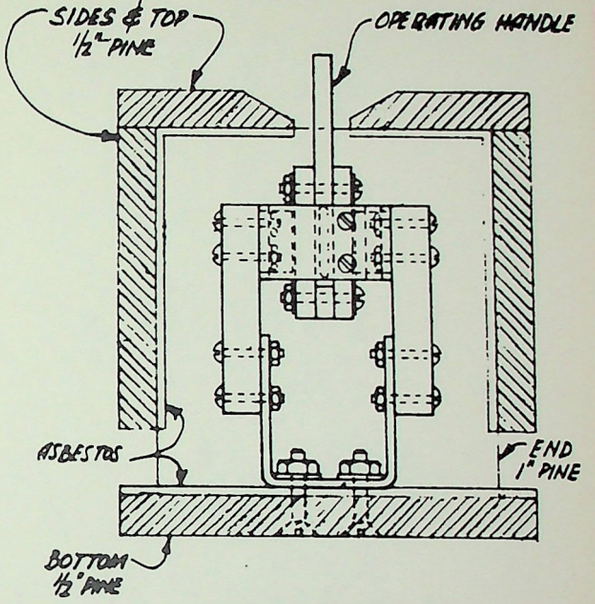
FOR USE WITH ACCOMPANYING INSTRUCTIONS

DRAWING Nº 11



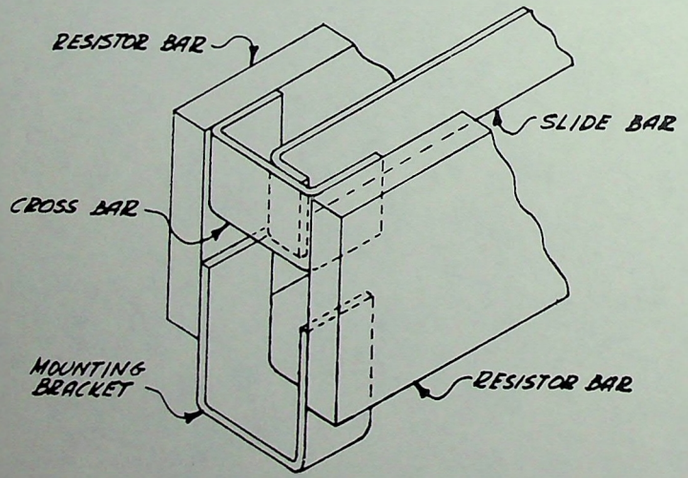
CROSS-SECTION VIEW

SIDE VIEW

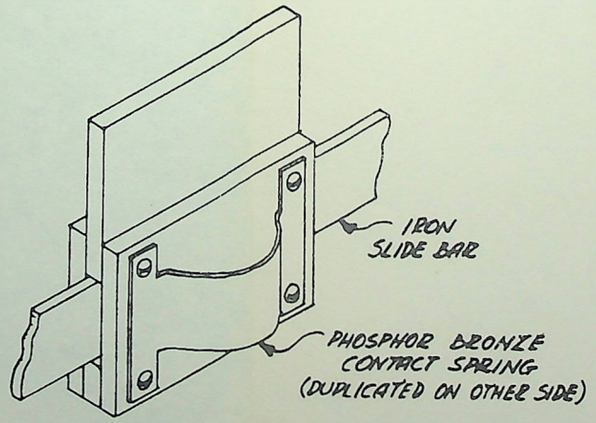


END VIEW

SHOWING DETAILS OF ASSEMBLY AND MOUNTING, AND INCLUDING CROSS-SECTION OF HOUSING FOR SINGLE DIMMER



ISOMETRIC VIEW OF END
(BOLT FASTENINGS OMITTED)



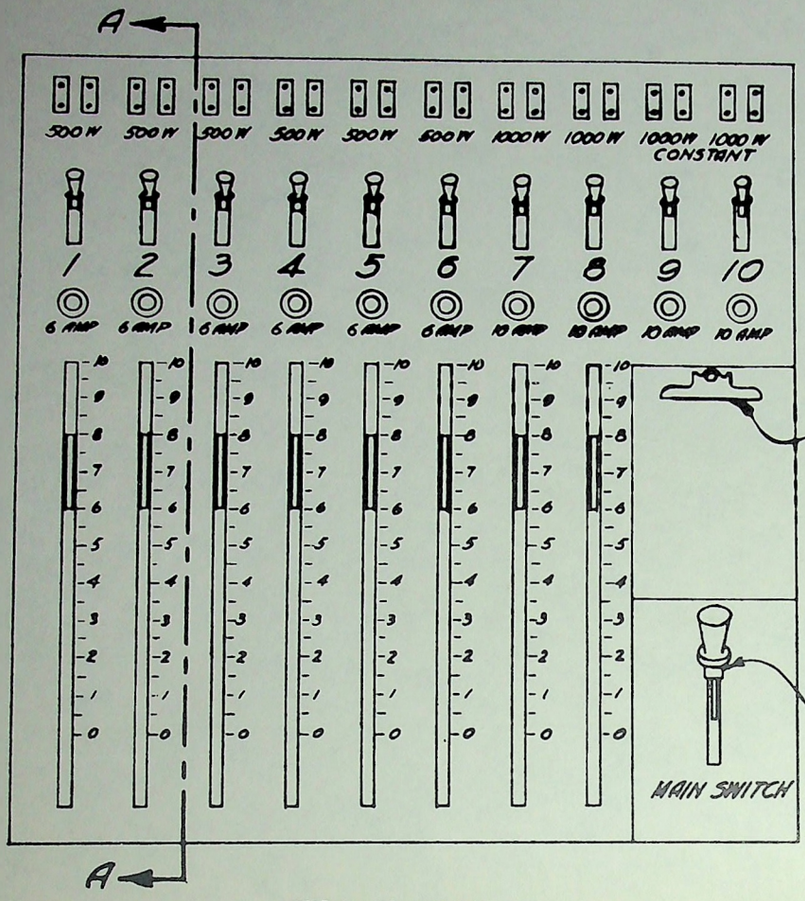
ISOMETRIC VIEW OF SLIDER

HOME-BUILT RESISTANCE DIMMER

ONE-HALF ACTUAL SIZE

FOR USE WITH ACCOMPANYING INSTRUCTIONS

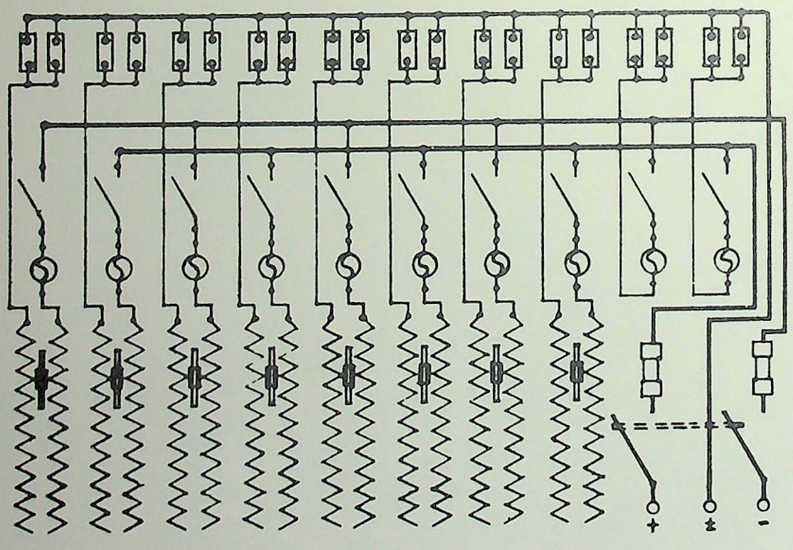
DRAWING Nº 12



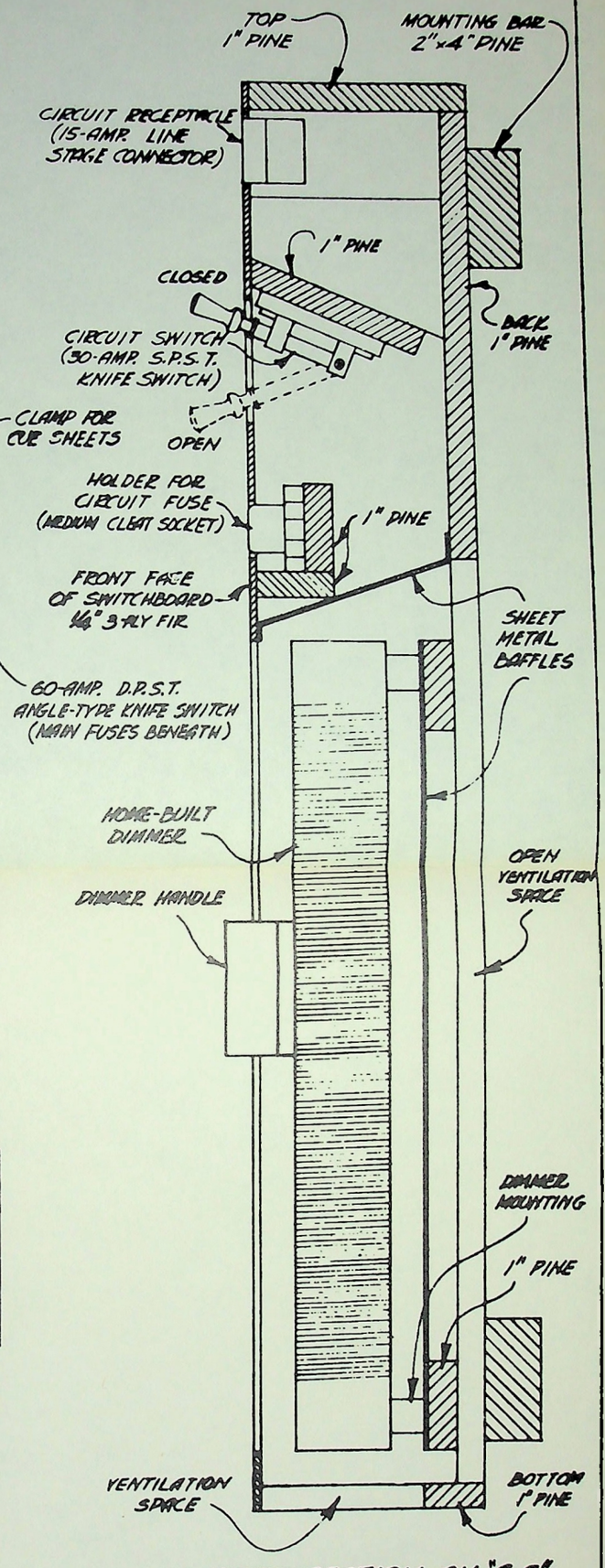
FRONT VIEW

ONE-EIGHTH ACTUAL SIZE

SHOWING CIRCUIT DESIGNATIONS & DIMMER SCALES



SCHEMATIC WIRING DIAGRAM



CROSS-SECTION ON "A-A"

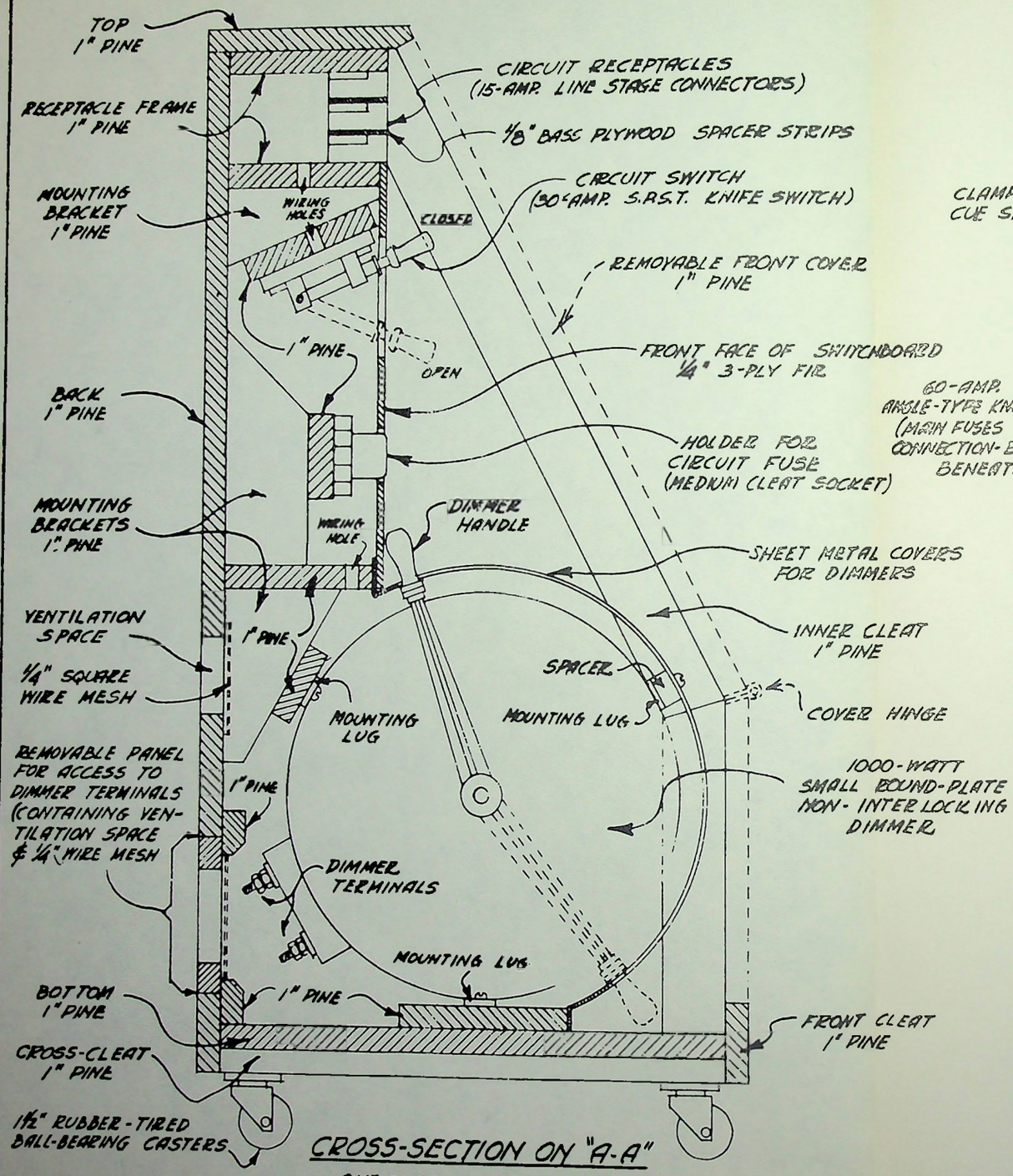
ONE-QUARTER ACTUAL SIZE

(ASBESTOS LINING NOT SHOWN)

HOME-BUILT STAGE SWITCHBOARD

FOR USE WITH ACCOMPANYING INSTRUCTIONS

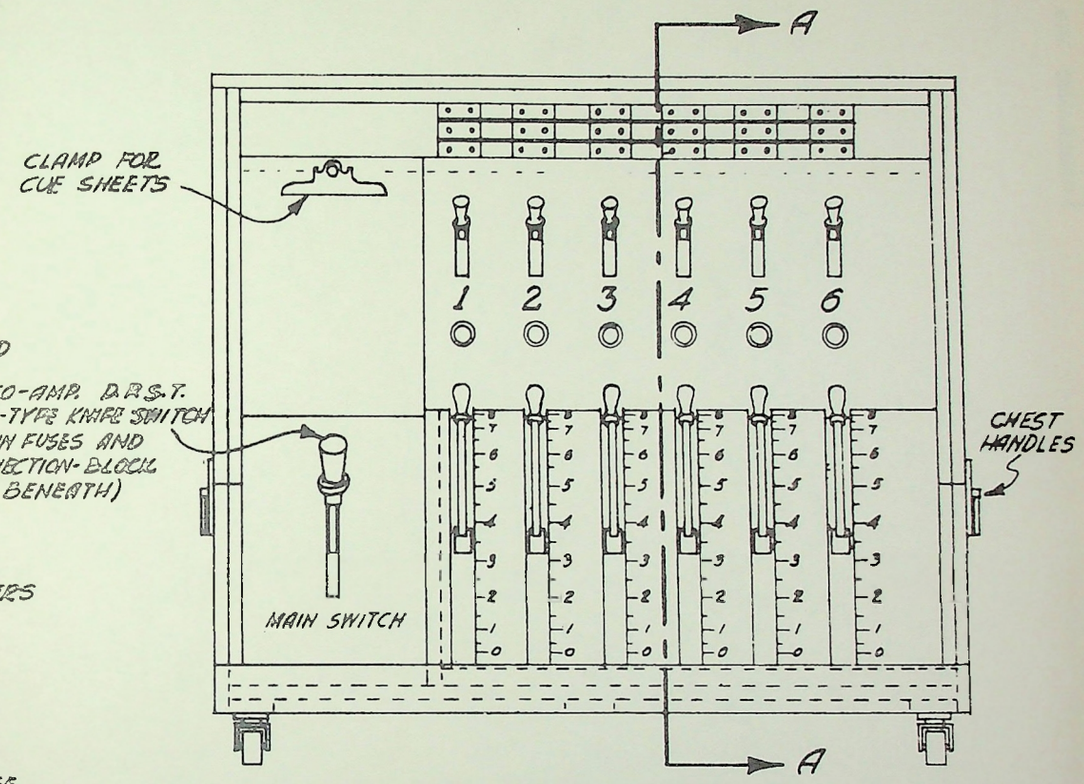
DRAWING Nº 13



CROSS-SECTION ON "A-A"

ONE-QUARTER ACTUAL SIZE

(ASBESTOS LINING NOT SHOWN)



FRONT VIEW

ONE-EIGHTH ACTUAL SIZE

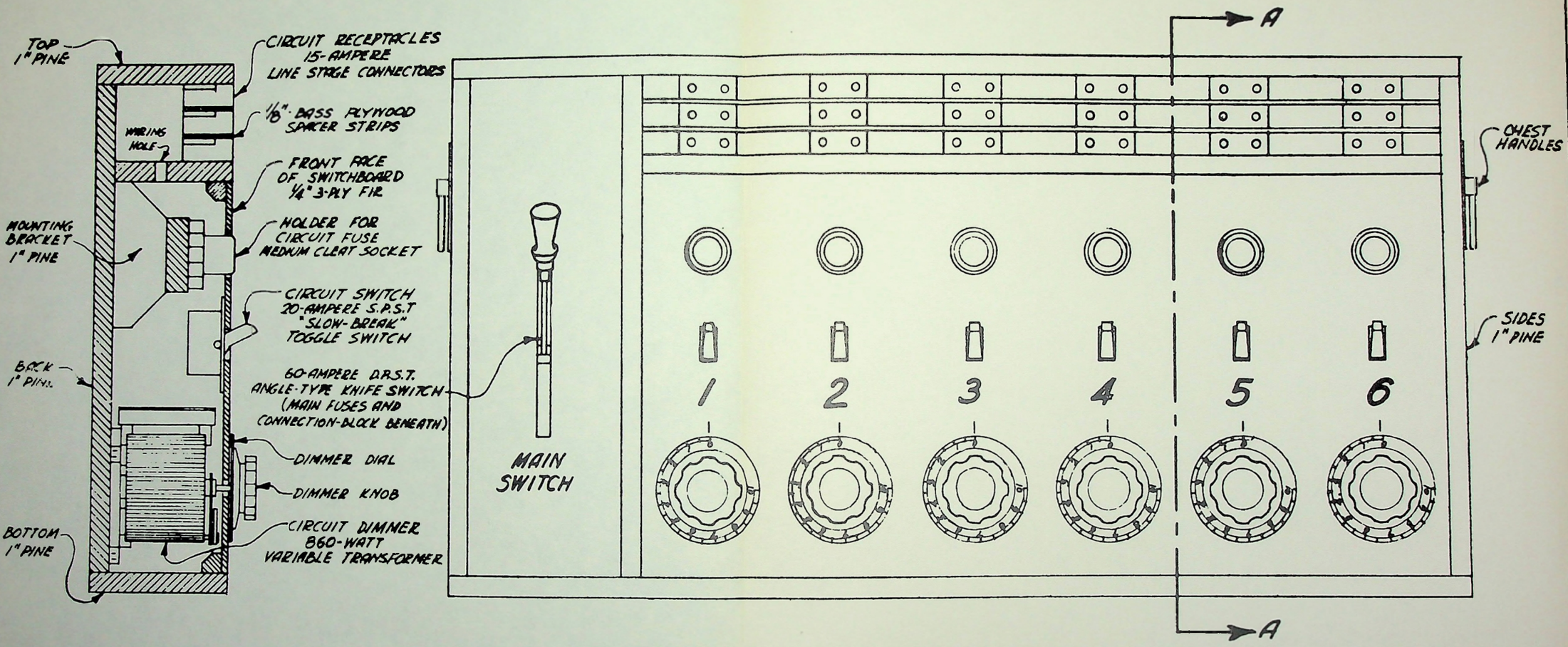
SHOWING CIRCUIT DESIGNATIONS & DIMMER SCALES

HOME-BUILT PORTABLE STAGE SWITCHBOARD

WITH SMALL ROUND-PLATE RESISTANCE DIMMERS

FOR USE WITH ACCOMPANYING INSTRUCTIONS

DRAWING Nº 14



CROSS-SECTION ON "A-A"

FRONT VIEW

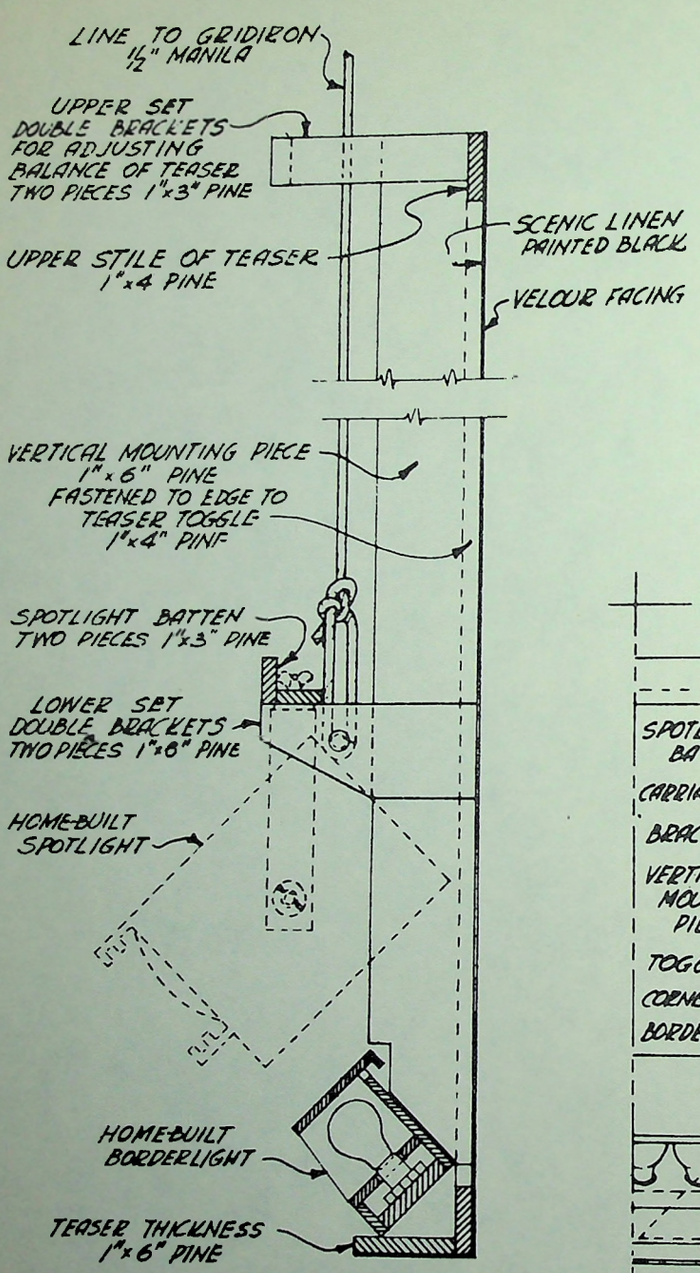
HOME-BUILT PORTABLE STAGE SWITCHBOARD

WITH SMALL TRANSFORMER-TYPE DIMMERS

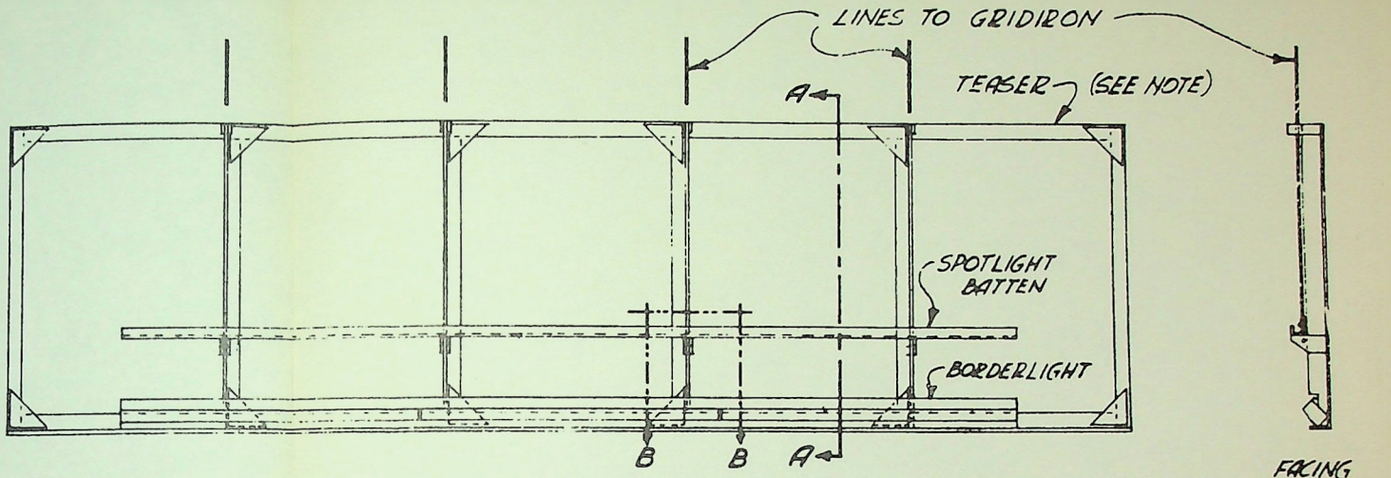
ONE-QUARTER ACTUAL SIZE

FOR USE WITH ACCOMPANYING INSTRUCTIONS

DRAWING Nº 15

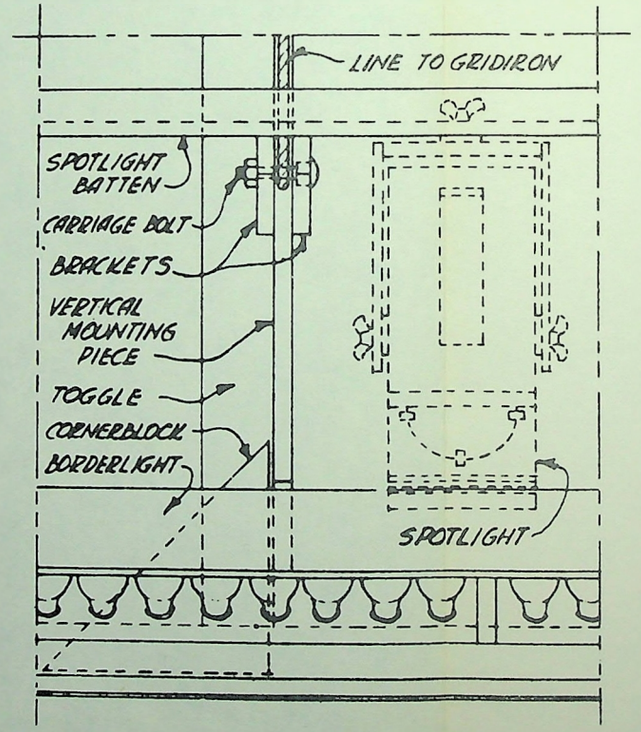


CROSS-SECTION ON "A-A"



ELEVATION VIEWS OF TYPICAL MEDIUM-SIZE UNIT - 30'-0" LONG x 8'-0" HIGH

SCALE ¼" = 1'-0"



DETAIL ELEVATION OF AREA "B-B"

ONE-EIGHTH ACTUAL SIZE

HOME-BUILT TEASER COMBINATION

(TEASER, BORDERLIGHT AND SPOTLIGHT BATTEN)

FOR USE WITH ACCOMPANYING INSTRUCTIONS

NOTE: TEASER DIMENSIONS DEPEND UPON SIZE OF PROSCENIUM OPENING. TEASER CONSTRUCTION SIMILAR TO STANDARD SCENIC FLAT CONSTRUCTION, WITH LIGHT-PROOFED LINEN COVERING AND VELOUR FACING TO MATCH ACT CURTAIN

DRAWING Nº 16