Building the Museum Group

BY ALBERT E. BUTLER

Associate Chief, Department of Preparation and Exhibition

GUIDE LEAFLET SERIES, No. 82

THE AMERICAN MUSEUM OF NATURAL HISTORY

NEW YORK, N. Y., 1934

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The Habitat Group, which first made its appearance less than forty years ago, has, in the past twenty years, become a recognized factor in arousing the public interest in Museums. Even the smallest museum has adopted this method of displaying specimens, and the frequent calls from these, as well as from individuals, for information on the procedure of Group building has led the writer to prepare this pamphlet. The information presented herein, while brief, is sufficiently broad to give the uninitiated or the comparatively new worker a basis upon which to proceed. It is the author's desire to pass on the results of a long and varied experience in this field, giving such information as has been found to produce excellent results with economy and simplicity.

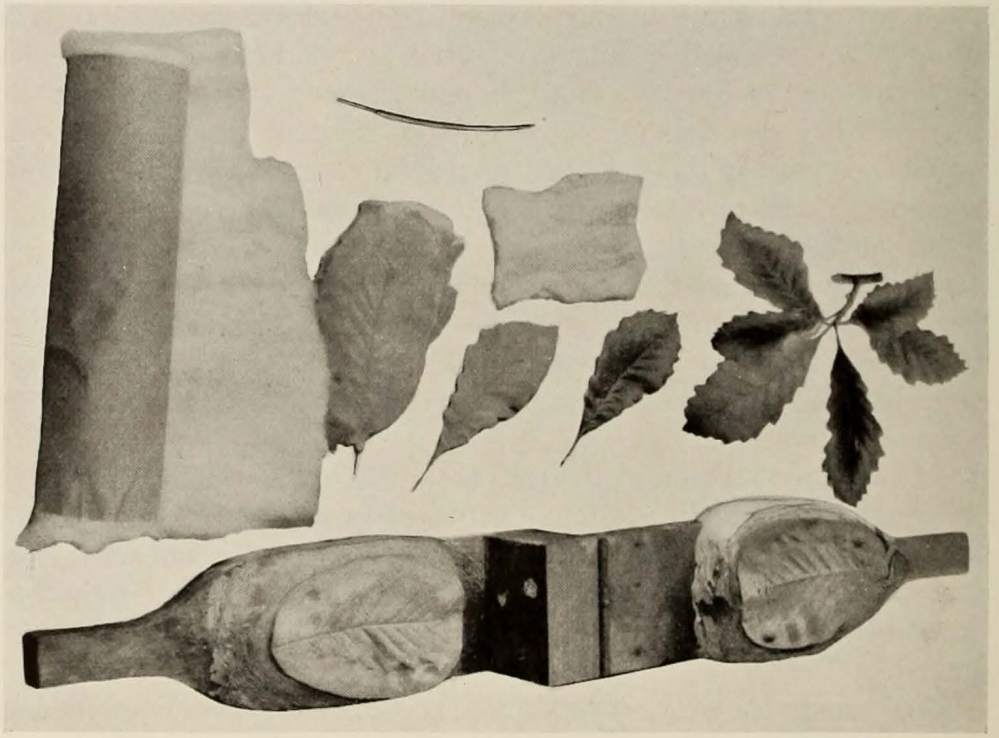
A successful Group requires the consideration and coöperation of the Curator, the Artist, the Taxidermist and the Accessory-man. This insures a plan which will not only be comprehensive and accurate, but will bring the utmost in interest to the museum visitor. This paper concerns chiefly the Accessory-man's work, which is the building and housing of the setting.

The successful worker in this field must possess ability to model, draw and color, and, in addition, have some knowledge of Botany and a mechanical sense. The plant life and other accessories should convey the same degree of accuracy and beauty as the subject of the Group, and this is possible only when the worker possesses all of the qualifications named.

I. Perhaps the simplest task in the accessory field is the reproducing of foliage. But even this, at times, may present difficulties.

a. In reproducing a simple leaf, such as an apple leaf, a plaster mold is first made. For this purpose a fresh leaf, or one preserved in its fresh form, is posed face up on a bed of soft water clay, which can be molded to support the contour and undulations without pressing on the surface of the leaf and thereby destroying its detail. When satisfactorily posed, after cleaning the leaf surface with a soft brush and water, a clay dam is built around the leaf, leaving a margin of about three-quarters of an inch. Plaster of Paris, mixed to a creamy consistency, is poured over the surface to a depth of about one inch. Spraying the surface lightly with water before pouring plaster will prevent bubbles; or brushing on the first coat of plaster will bring the same result. When the plaster is "set," lift it from the clay and remove the leaf; ream out two or three

"keys" on the margin of the mold and, after soaking thoroughly in water, brush the whole surface with heavy soap water, a soft mixture of stearine and kerosene or with lard oil to prevent sticking. Build a clay dam about this and again flow with an inch of plaster. When this is set, you will have a two-piece mold with surfaces in perfect contact. Where the under side of a leaf will show in the Group, the leaf should be left on the first mold and the second layer of plaster flowed over this. However, the leaf is removed preferably where at all possible, because a thinner wax impression will result from molds with surfaces in perfect contact.



Molds mounted in a clamp. Materials used and successive stages in leaf making.

It will be necessary to gouge out the plaster where the midrib occurs on the half representing the back of the leaf, and in some cases the more prominent lateral ribs should be accentuated by the same means.

Where many leaves are to be made, the molds should be mounted in hinged clamps in perfect alignment. This will eliminate unnecessary wear and imperfect impressions. A plaster mold should stand about fifty impressions. Where a great number of leaves are to be made, it will be found more satisfactory to use type-metal molds. (See Directions for Making Metal Molds.) *b*. Wire is used to support the leaf, and should be cut into lengths about an inch longer than the leaf from tip to end of

petiole, and of sufficient size to support the leaf without sagging. The wires should be tapered by tying into bunches and dipping into nitric acid and draining alternately until the desired taper is obtained. Wash off the acid and rub with fine sandpaper to remove the rusty deposit. Wind each wire with a film of cotton, and, if the mold is undulated, bend to the contour of the midrib before beginning to press.

c. Jeweler's, or Johnson's, absorbent cotton forms the base for the leaf, and should be torn into thin slabs, each piece just large enough to cover well the leaf surface.

d. Beeswax, never paraffin, is used to give the leaf body and detail, and should be liquified by heating in a double-boiler.

When the molds are soaked in water as hot as the hand can stand, the preparation for pressing is now complete.

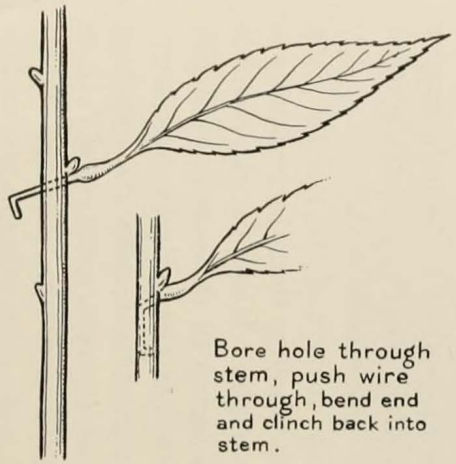
e. A cotton-wound wire is placed in the groove which represents the midrib, a sheet of cotton placed over this and a sufficient amount of the hot wax poured over this to insure the leaf surface being wholly covered. The clamp must be closed as speedily as possible after pouring the wax, as this alone is the secret of making thin leaves. Very little pressure is required. If two or three clamps are manipulated in series, the first impression will have cooled properly for removing by the time the second or third is poured. Moisten the mold surface after each impression.

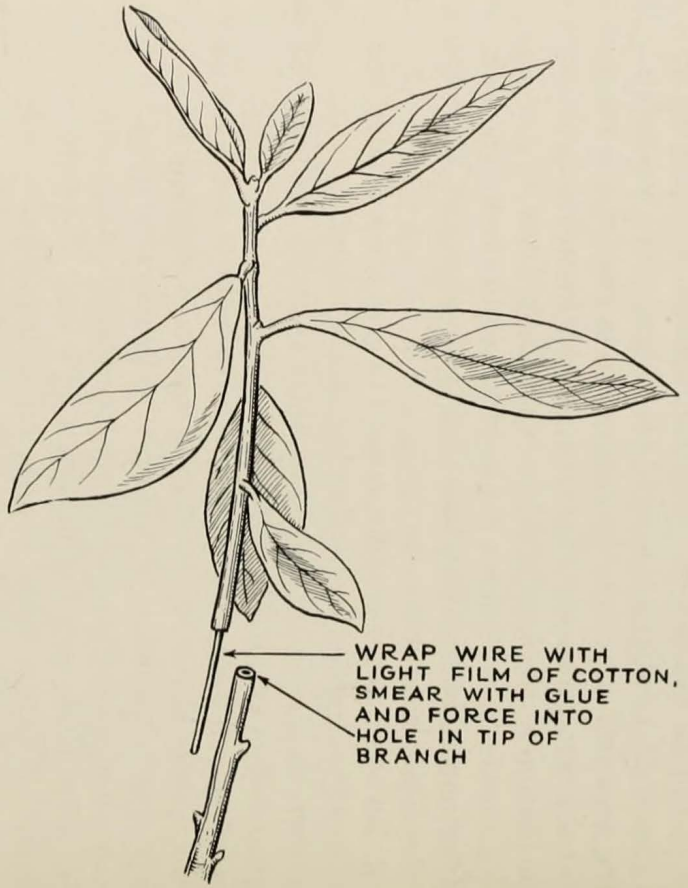
The hot wax may be given a body color by dissolving oil color in it. Care should be used not to overload with the paint, which may cause the wax to emulsify and make it unfit for use. Use Flake or Permalba white; never zinc. Wax, once melted, should be kept on a very low fire, with water barely simmering. This gives the proper temperature for pressing.

Experience and a careful study of results will soon show the proper amount of cotton and wax required for perfect results. A good general rule is, "Use a maximum of cotton and a minimum of wax."

f. The excess wax is trimmed from the margin of the leaf by using slightly warmed scissors. If the margin is smooth, then the trimming is accomplished by a sliding motion of the scissors. If serrate, the result is effected by a choppy motion. There is a knack in this operation which will be acquired only through considerable practice. Every Accessory-worker has, I believe, at some time attempted to simplify the serrating operation by inventing a special tool, but its very mechanical nature defeats the object, which is to gain a natural finish. The amount of finishing required on a tool-trimmed leaf more than offsets any possible saving of time in trimming.

The edges of the finished leaves should be thinned sufficiently to give a natural appearance, and this is best done by pinching the barest margin between the thumb and fore-finger. A sliding motion of the thumb on the





METHODS FOR SECURING LEAVES OR BRANCH TIPS TO REAL BRANCH

back of the leaf and the natural warmth of the hand accomplishes the result.

g. In most cases, leaves are built into clusters after the character of the plant, and these "tips" secured to the real branch. If the plant be a small succulent one, then the whole assembly is built onto a wire stalk, which is modeled and bent, as the assembly progresses, to give the character of the plant.

Too much stress cannot be given the importance of lightness all the way through. Keep all materials to a minimum, so that the finished branch will rigidly support the weight placed upon it.

II. Materials other than wax may be used in leaf making, such as celluloid and paper. Celluloid possesses advantages in special instances, and there are two methods in common use. The first requires a plaster mold of the upper surface of the leaf and sheet celluloid of a thickness suitable to the subject to be reproduced. The celluloid is dipped into diluted acetone, or other solvent, then dipped into water and applied to the water-soaked mold surface with a backing of water clay to hold it in contact until "set." When removed, a tapered wire is dipped into celluloid or acetone solution, and applied to the back along the midrib.

The second method requires metal molds, set in clamps. (See Metal Molds.) A piece of sheet celluloid placed between the molds and clamped tightly under very hot water will take the impression. For making petals of flowers such as the Dogwood or Magnolia, this process has a distinct advantage in that it has the required rigidity without the use of wire. However, in leaf work, neither process is practical where many leaves are to be made because of the inflexibility of the material. To obtain a desirable variation of form and size, many molds would be required, and there is a stiffness in the finished work which cannot be entirely lost. Wax, on the other hand, requires few molds because each impression may be varied in form, and slightly in size, without losing the character of the leaf. Further, wax permits of alteration even after assembling.

III. The use of paper in making leaves is confined to occasions where an effect is best obtained by its use and the position of the plant in the Group permits it. As an example, a banana plant well back in the Group space where small imperfections would not be seen might be made by using a plaster mold of the surface of the leaf and applying wet paper, after the manner of making paper forms of dolls, globes, etc. Apply each successive layer with a paste made of flour and a little liquid Plaster of Paris added before applying. This gives a stiffness and "set" in a short time. A midrib of split bamboo or flattened wire should be placed in position between the layers during the process of building. When dry, this form

may be given a coat of varnish and color, producing a very satisfactory effect with little labor. Another paper method may be illustrated in the making of a pinnate palm leaf. Here the leaf form is drawn out on a sheet of cardboard of suitable thickness and quality. The cutout is best made with a razor blade, and when a tapered piece of split bamboo is applied along the midrib to near the tip and all secured with Du Pont's cement, the result is a leaf with a droop very like that of a palm. The detail may be suggested by scratching the upper surface with sandpaper. Similarly, bamboo lends itself to this method, using a tough paper in place of the cardboard. The finished cutouts are pasted to the real bamboo branches. In either case, the cutouts should be coated with liquid celluloid. Paper is also an excellent medium for reproduciug long lanceolate leaves, such as occur on reeds or small cat-tails. For long cat-tail leaves and similar subjects, wood (straight grained pine or basswood) is very satisfactory. It should be cut into very thin strips and shaped to desired form. Sandpaper will produce the detail.

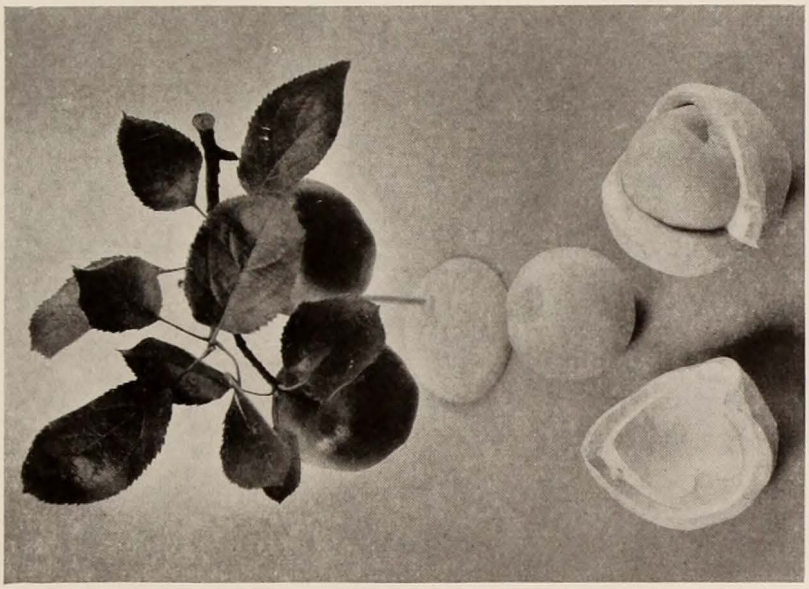
The methods used in making artificial flowers and foliage for commercial use are adaptable in many cases to the requirements of Group accessories, particularly where a large number of impressions are to be made. As has been stated, nothing is of greater importance than choice of just the proper material and method for the subject to be reproduced, and paper or cloth will often produce more satisfactory results than either wax or celluloid.

a. The equipment required for the commercial method may be obtained from any artificial Flower Tool Company, and is as follows: Cutting dies, veining dies, cutting block, stamping press and mallet. The last three are permanent equipment, and will last for many years. The dies vary in cost, but will always be found to more than offset this cost wherever the impressions to be made run well into the hundreds. All prepared cloths for this work are starched, and it will be found necessary to dip the material in hot wax to give it a thin protective coating, which will prevent warping. For very small leaves or petals no waxing is necessary. Paper should be sealed from atmospheric changes by coating on either side with liquid cellulose. If a waxy texture is desired, the paper may also be given a coat of wax. Experience in this field to date points to paper as the preferred medium, because of its lower cost and the variety of textures and quality available. Further, it will stand up better than cloth.

IV. Objects, such as fruits, should be cast while fresh since these will a not preserve satisfactorily in solution. It is usually necessary to make "piece mold" of such things. An apple, for instance, would require a mold of two pieces, or perhaps three. A more irregular object might

require several pieces in order to insure the mold releasing without breaking because of undercuts. Agar is sometimes used for casting objects where a piece mold is required. Hot wax may be used in an agar mold, and for the novice the process is perhaps simpler. (See Agar Formula.)

V. Petals of flowers are most often made in wax, using the same process as in leaf-making, except that wire is seldom used in petals. In other words, only such flower petals as will reproduce in wax without wire support are made by that method.

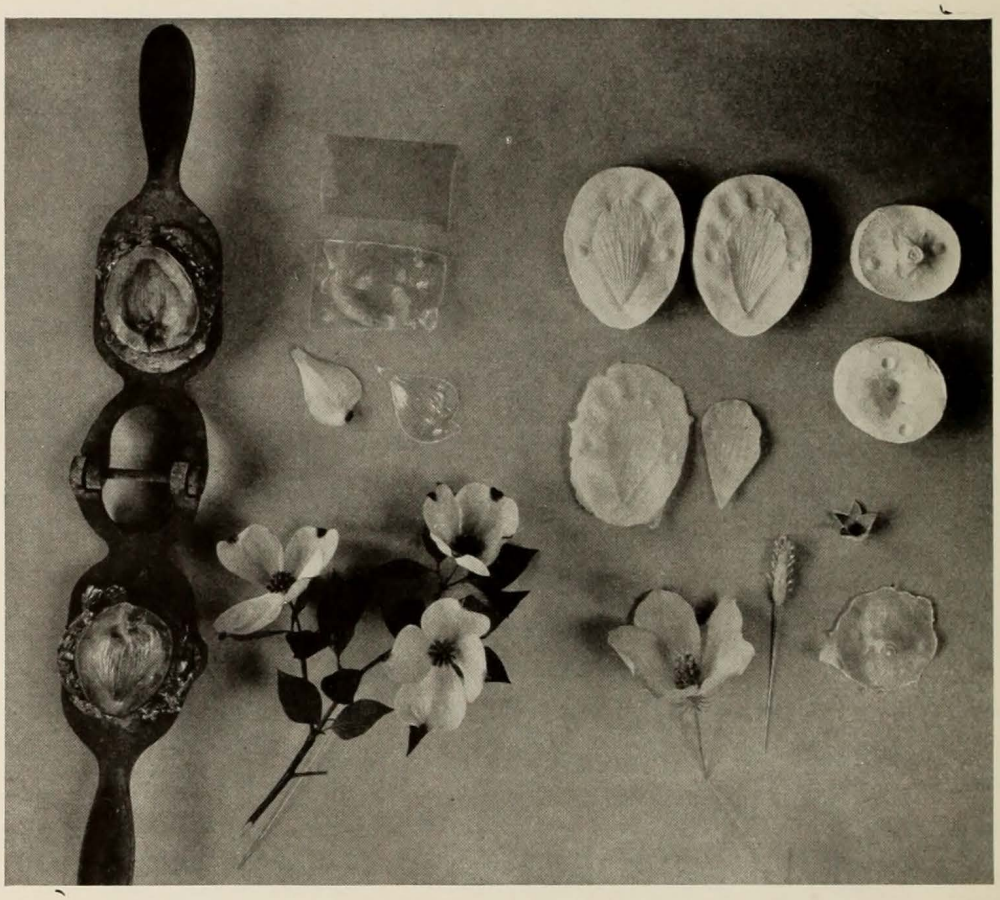


Piece mold showing how an apple is cast.

a. A flower of the dandelion or wild aster type may be closely imitated by using mousseline dipped in wax of the color desired. This is cut into strips slightly wider than the length of the petals, and then cut fringe-like, with each segment the width and length of the petals. When this fringe is wound tightly about the tip of a wire, it resembles the composite structure of the flower.

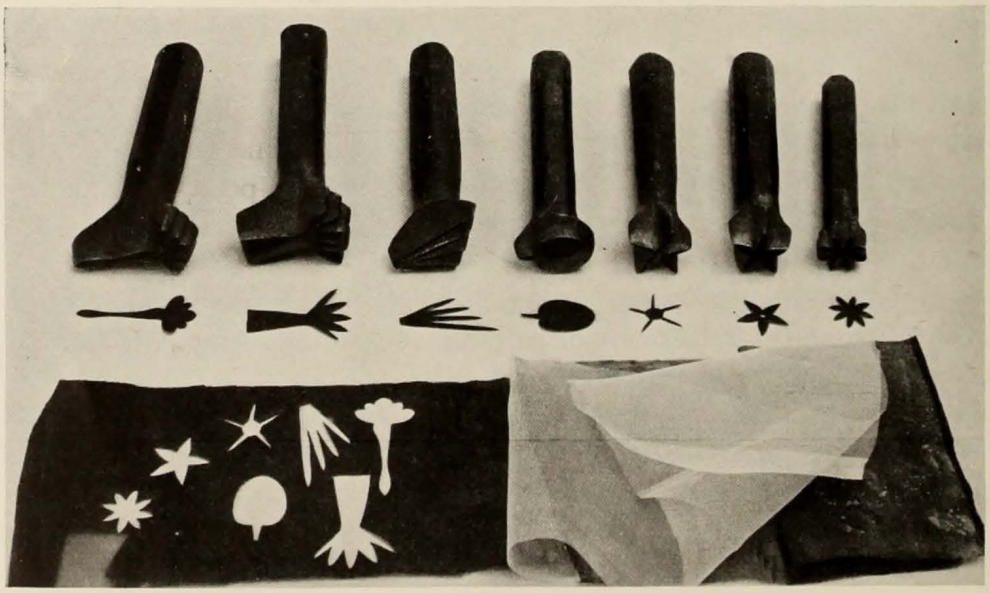
b. Most small flowers are best reproduced by the use of wax-saturated cotton made in squeeze molds with flat contacting surfaces. This gives a tough, thin material, which will easily mold into shape in the palm of the hand with the aid of a tool. The petal forms should be cut to a carefully drawn pattern. A wooden tool, shaped for the particular job on hand, and kept moist, will be found most satisfactory for molding the wax petals.

c. The celluloid processes, already mentioned, cover all other petal reproduction. The fine, frost-like texture characteristic of some flowers is readily imitated by dipping the celluloid petals in hot wax.



Flowers made of sheet celluloid pressed in metal molds.

Flower made of cotton and wax in plaster molds; pistil of wax on tip of wire stem, with stamens of wax-tipped thread.



Steel dies may be used for stamping out flower parts, or leaves where the commercial method is used. The material may be waxed cloth, paper or celluloid.

d. The calyx may be cast in wax by the same process as that used in making leaves. Or, if many are to be made, the form may be stamped out of wax-saturated cotton or waxed mousseline with a steel die made to pattern. *e.* Stamens are commonly made by drawing thread through hot wax and, after cutting into proper lengths, dipping the tips into hot wax until a little ball, the size of the anther, appears. For more accurate work the stamens may be made in glass by drawing to proper thinness in a blow-flame and shaping the tip, while malleable, to form the anther. The pistil is usually modeled on the tip of a wire, which is to form the flower stem. The stamens and other parts are secured to this with wax applied with a heated metal tool.

f. Success in making artificial flowers comes rapidly with experience, for when one has learned how to handle wax, he quickly recognizes its possibilities and limitations and can readily judge which process is best suited to the subject at hand. Ability to judge the best medium for each problem is as important as ability to attain a technically satisfactory result.

VI. The finished coloring of both leaves and flowers is best done with an air brush. Where this is not available, the coloring may be applied with a brush by hand, or by spattering from a brush. The latter method may be developed to a remarkable degree of fineness. Coloring of the veins requires a fine line brush. It is often desirable to coat the wax with French varnish before coloring. This will prevent wax from absorbing the color.

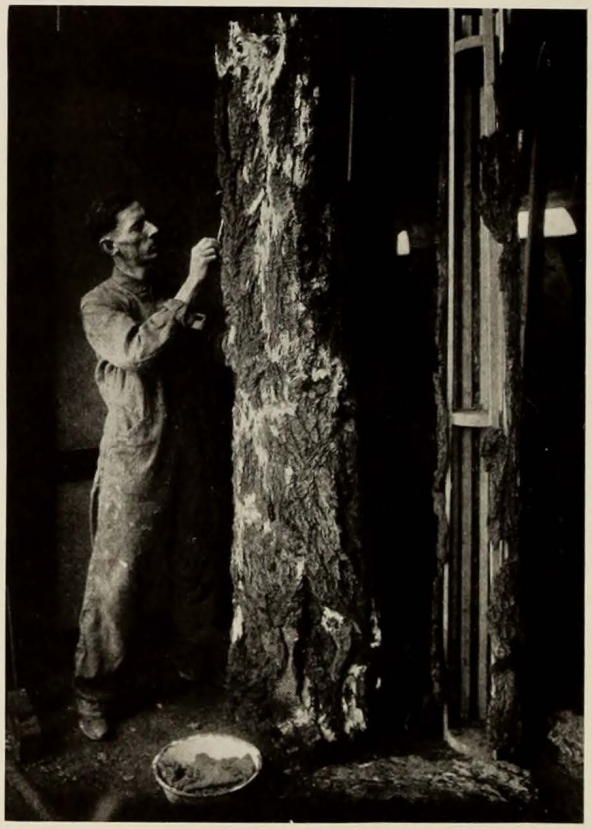
The soft, downy hair sometimes found on leaves is represented by blowing fine cotton flock over the surface after applying a thin coat of varnish. Likewise, the hair on a leaf stem is very well imitated by either silk or cotton flock. These materials may be obtained in several degrees of fineness.

There are several ways in which a tree trunk may be represented in a Group. It is seldom practical to use the real tree. Wherever this is done, however, the wood should be thoroughly poisoned or otherwise treated to make sure the insect life in it has been destroyed.

VII. Wherever the bark can be readily removed, this is undoubtedly the most satisfactory for the purposes of reproduction. (See Photo Plate No. 5.) This should be poisoned by dipping in or painting with arsenic solution to prevent development of any insect life which may be in the bark. With the aid of good photographs of the original, the bark can be fitted to a wood frame with such accuracy as to make it undistinguishable from the original. Where it is impossible or impractical to take either the tree or its bark, then a complete set of photographs from all angles, together with a sample of the bark, will insure a faithfully reproduced

tree in the laboratory. For this method a wood frame, made slightly under the measurements of the tree, is covered with wire mesh, burlap and plaster. This is given a coat of shellac and the detail applied with slow-drying papier maché. (Formula—Dextrine Maché.)

VIII. Most grasses are easily preserved (See Formula for Glycerine and Formaline Solution) and in most cases, this is the best procedure. This, as well as other material preserved in this solution, loses its color and



Trees are reproduced by using original bark, wherever possible, as shown above, but more often must be entirely modeled in maché or plaster from photographs.

emerges darker. When all excess moisture is evaporated, the grass should be wiped carefully to remove dust, and a coat of oil color applied, preferably with an air brush. This first coat should be much lighter in tone than the final color, and contain some body white. When this is thoroughly dry, apply the finish coat with transparent, or nearly transparent, color. Oil paint is heavy, and should be used as sparingly as possible on delicate preserved grasses, or they will sag into unnatural position. In drying, it is good practice to hang the grass clumps upside

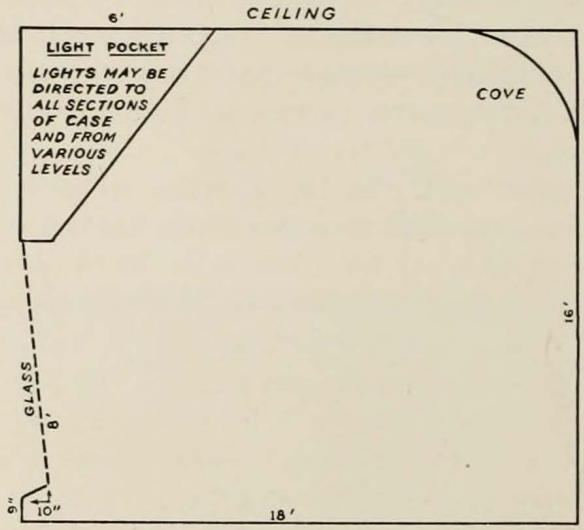
down. Sometimes it may be desirable to artificially produce grass. This is accomplished by cutting wax-dipped mousseline, or very thin celluloid, into grass-shaped strips and securing these to a wire. Fresh Spring grass will not preserve, and should be reproduced by the latter method.

Mosses preserve readily in the glycerine solution. This is done either by immersing the fresh moss for about twenty-four hours, or by spraying several times a day for a few days. Both mosses and grasses may be restored even after dried from age by first soaking in very warm water, and then immersing in solution for about a day. In fact, in most cases these things preserve better after having dried first. Mosses are colored after the manner of grasses, or by dusting on dry color.

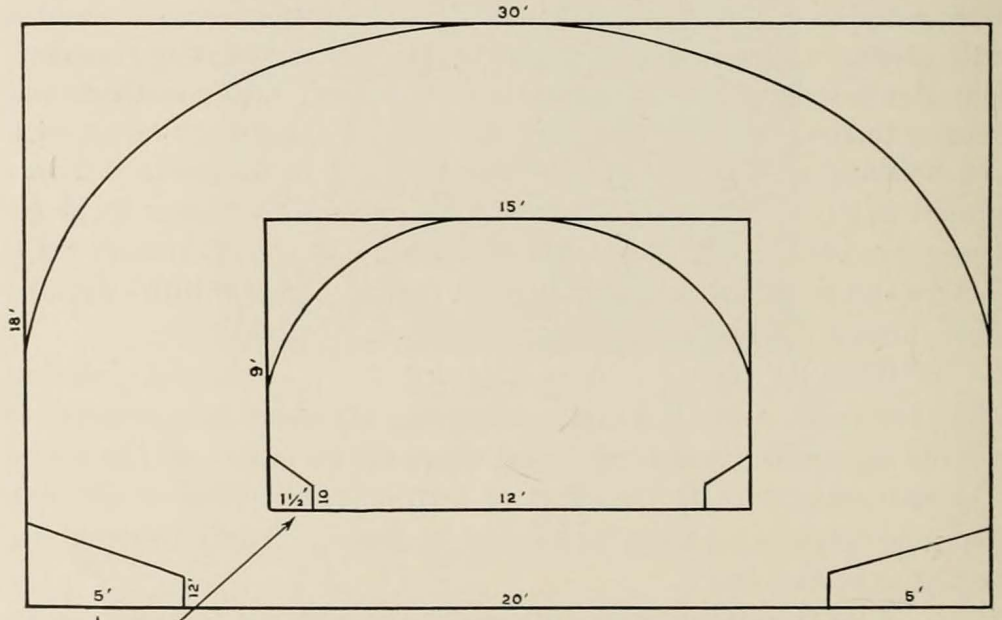
IX. Rocks of any appreciable size are never used in Groups. Either they are reproduced by making plaster molds from the original, or by carefully modeling after photographs. A combining of the two processes may be found most practicable where there is a great amount to be made. *a*. To make a plaster mold from a rock, the subject must first be well oiled, so that the plaster will readily release from it when set. *b*. If the work is to be done by modeling alone from photographs, then a form of wire mesh is molded after the contour of the rock, and this is covered with burlap dipped in plaster. The details of modeling and texture are added with plaster. *c*. A wet sponge, dipped in thin plaster, if skillfully handled, will give a rock texture of considerable variation. Other methods will suggest themselves to the resourceful worker. Ground cork mixed with the finishing plaster coat will be found useful in obtaining a coarse granite texture. Dry color is sometimes mixed with plaster to give a base color, but the author does not recommend its use. It is more satisfactory and much less expensive to paint the white plaster with Diamond Dyes, after it has set.

d. When the plaster is thoroughly dry, give it a light coat of shellac, and then paint with oil colors. Spattering the color from a brush is usually more effective than spraying, especially on granite or like rocks. The spattering adds to the effect of texture. Dry colors mixed with Dextrine Solution are ideal for coloring rockwork. Apply Dextrine size to plaster surface first.

e. A large section of rockwork may be reproduced to perfection by making piece molds of the original and setting these up in position and building into the mold a mixture of cement and dry color with fine ashes (1 cement to 4 ashes). When the plaster mold is chipped away, the result is a completely finished, colored rock. Cement has a natural texture similar to rock, as well as a gray base color, which is desirable.



CROSS SECTION OF 18'X30' GROUP WITH 16' CEILING, LIGHT POCKET AND OPENING.

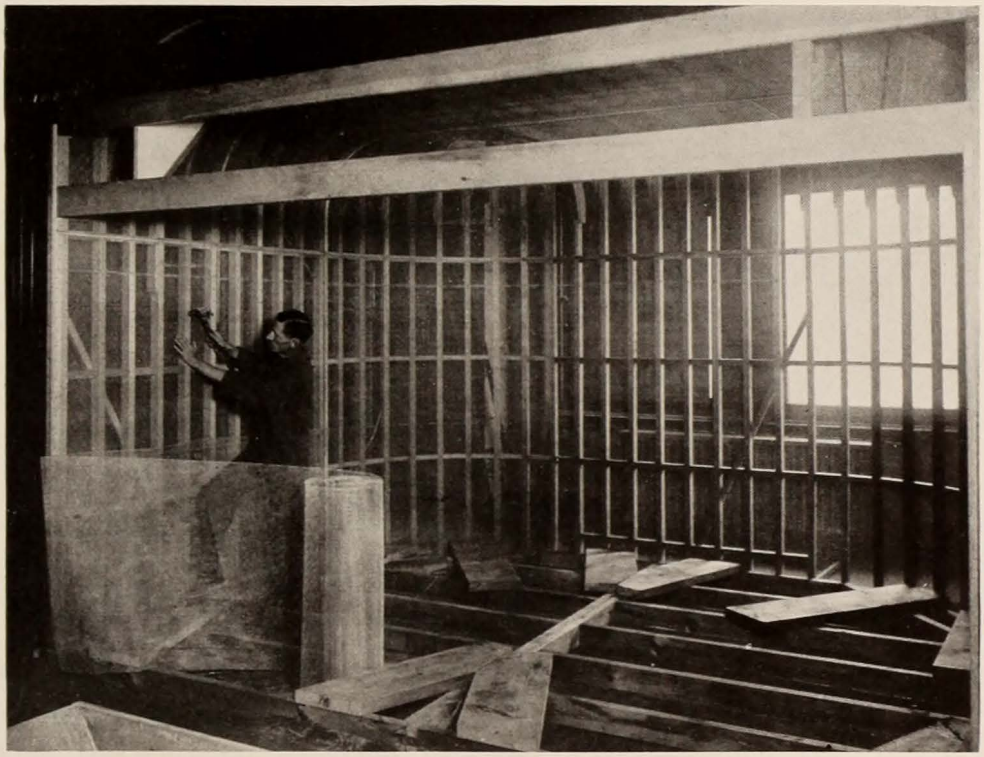


CORNER SPACES MAY BE USED FOR LABELS, SMALLER GROUPS, MINIATURE GROUPS, OR ADDITIONAL LIGHTS IF DESIRED.

SHOWING WELL PROPORTIONED GROUP AREA, CURVE OF BACKGROUND AND OPENINGS IN GROUPS 18'X30' AND 9'X15'.

X. Dry leaves for the ground may be preserved by soaking in fairly hot water and then immersing in glycerine solution for a day. When thoroughly drained and excess moisture is evaporated, the leaves will be sufficiently flexible to stand handling without breaking.

XI. The curved panoramic background, which is now in universal use for museum Groups, may be adapted to almost any architectural condition with more or less success. *a*. However, for best results, any hall of Group exhibits should be laid out on paper to determine requirements in advance of the drawing of the architectural plans. It does not follow



Under structure for a background. Metal may be substituted for wood.

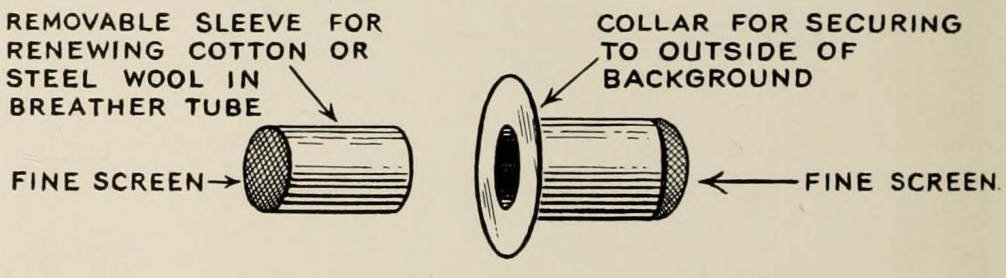
that an already existing Hall may not be suited to Group exhibits. Indeed, it may be admirably so. Much depends upon the size of the Groups desired. *b*. For instance, in a Hall of North American Mammals, where there must be shown buffalo, moose, elk and other large animals, the Group area should be from approximately 18×30 feet for the largest animals to perhaps 10×15 for the Virginia deer. Smaller animals would require a proportionately smaller area, always keeping the horizontal depth at about 60% of the width. Not less than a 16 foot ceiling can give a wholly satisfactory effect to a Group of 18×30 feet. Therefore,

even the smaller Groups in the same Hall will have an equal height, which is rather an advantage than otherwise.

c. The curve of the background should be continuous, but not a perfect arc. A sharp break in the shoulders of the curve should be avoided. In others words, do not make the form a horse-shoe. *d.* It will be found advantageous, though not absolutely necessary, to cove the background, not too sharply, slightly below the ceiling line, especially in open Groups where much of the sky shows. This will carry the eye beyond the frame as the Group is approached, and give a feeling of greater area.

e. Methods of constructing backgrounds for Groups are so variable that it seems advisable to give details only of those which are obviously practical from the point of view of durability and low cost.

Preferably the Group case should be fireproof. Therefore, wherever possible, the framework should be made of light metal, covered with



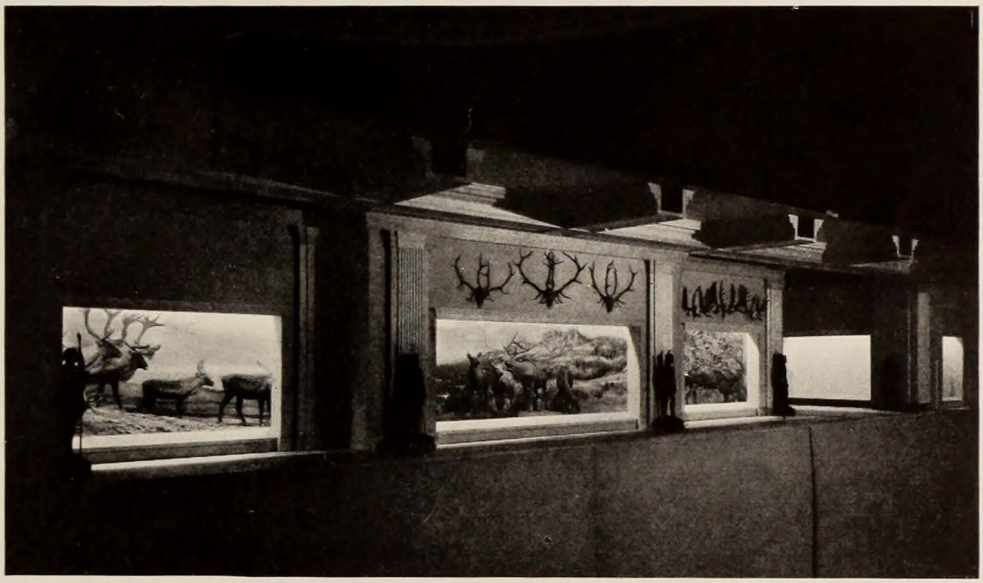
"BREATHER" TUBE

metal lath or galvanized wire mesh. Apply to this a hair and mortar mixture, just as for ordinary wall finish. When thoroughly dry, coat the back with asphaltum and the front with shellac. *f.* Apply the canvas to this surface with a mixture of spar varnish and white lead of thick creamy consistency. However, if wood is used for the framework, the back should be covered with sheet asbestos. The canvas covering may be omitted, in which case the mortar is given the usual plaster smooth coat. This, when dry, is coated with shellac, and this followed with two coats of white lead, the first brushed on, and the second stippled. This will give a canvas-like texture. In any case, the background form should be free floating; that is, not secured to either ceiling or floor. With such construction, no cracking should ever develop. *g.* The floor and ceiling lines should be well calked to insure against dust entering the Group.

h. A "breather-tube" installed near the base of the background will further insure against dust. Such a tube is made in two sections, so

that the cotton or steel wool filler, which is used in it to catch the dust, may be replaced from time to time. The tube forms a "point of least resistance," which takes care of contraction and expansion within the Group due to temperature changes, and thus prevents cracks which might otherwise develop.

XII. The opening in the case front varies with the size of the case, the size of the animals to be shown and the character of the exhibit. For entirely satisfactory results it is necessary to lay out on paper the whole hall plan. This insures symmetry of the architecture in the inner hall, and a favorable relation of the Groups, one to another. The 18×30 foot Moose Group mentioned should have an opening approximately 8 feet



Scale model of a hall. This layout assists materially in deciding best possible arrangement of groups.

high×20 feet long (here the great width influences the size of the opening because of the difficulty and hazard of handling large glasses), the top of the glass being about 9 feet and 3 inches from the floor. These dimensions may be shaded some to meet the requirements of the hall as a unit.

In the case of a Group of foxes, where the floor area might be approximately 6×10 feet, a better picture effect will result if the groundwork is raised to about 2 or 2½ feet from the floor. In this instance, the glass area would be 7 feet×6 feet 9 inches, if the top line were to be maintained to that of the Moose Group. These proportions obviously would be better if the top line could be dropped to 8 feet, giving a glass 7 feet×5 feet 9 inches. If the entire hall plan is laid out before proceeding with any one Group, the problems are known, and it will be possible

The above photographs show the miniature model and the finished group. While the original character of the model has been maintained certain changes were necessary to achieve the desired effect.

to keep a balance architecturally and at the same time display each Group to best advantage. To avoid reflections, it is desirable to install the glass on a slant, as shown in Cut No. 1.

XIII. Miniature group models are helpful in planning a Group if carefully worked out in scale. However, the usual procedure of modeling carefully the required animals to scale, and then sticking in anything to represent the trees, etc., without regard to scale, is misleading and a waste of time. A good Accessory-man will be able to portray character in a scale model of a tree or other accessory so that it will bear a proper relation to the animals. Leaves for trees in scale work are easily made by cutting the forms, many at a time, from a sheet of folded paper and the veining indicated by scoring with a tool over a blotter. These are readily attached to the minature tree branches by the use of Du Pont's cement. Branches of small shrubs may often be used to represent branches of scale trees. Smaller plants are readily mimicked by paper cut-outs secured to broom straws or any slender frond which answers to the scale and character required. Scale grass of various heights, in most cases, is best imitated by excelsior. It is obtainable in several degrees of fineness, and is easily manipulated to give grass character.

Galvanized sheet metal is ideal for backgrounds of miniature Groups, as it will readily bend to the required curve. The surface to be painted on should be washed with vinegar, and then coated with two or three coats of white lead, all coats stippled on, except the first.

A scale model, in which every part has been worked out in proper relation, will give all concerned some conception of the effect and character of the finished Group. However, one should keep in mind that in making the scale model he has himself remained full scale, and should therefore be prepared to make any deviation from the model that may seem advisable or necessary in the course of assembling the finished Group. In other words, be guided by the working out of the Group, rather than by the model.

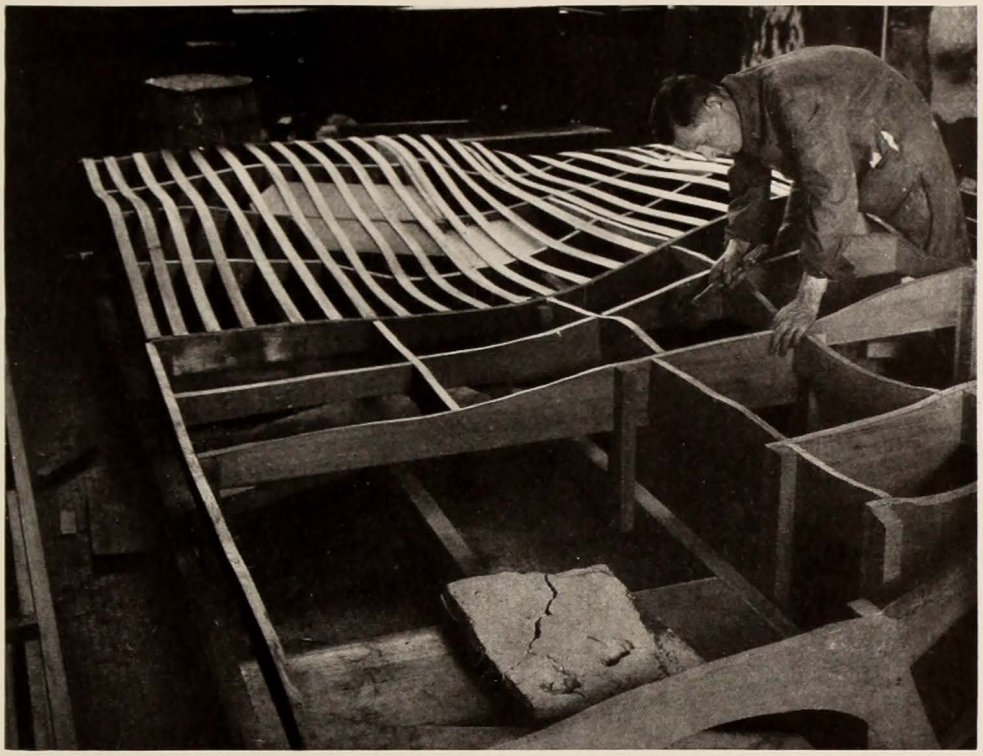
XIV. The lighting of a Group is done mainly from the space directly above the window where an enclosure is built, for the purpose of excluding the heat of the lamps from the Group proper. A ventilator tube should be installed at either end for carrying off the heat. The enclosure will be as wide at the base as the opening of the Group will permit, and slant outward into the case as far as possible and yet not be seen from within two or three feet of the Group. Provision for reaching the lights for replacing must be made. Such a light pocket makes possible the lighting of the entire foreground, either directly or indirectly, as required. However, it is desirable at times to place lights in other parts of the case, but, if avoidable, none ever should be so placed as to make it necessary to

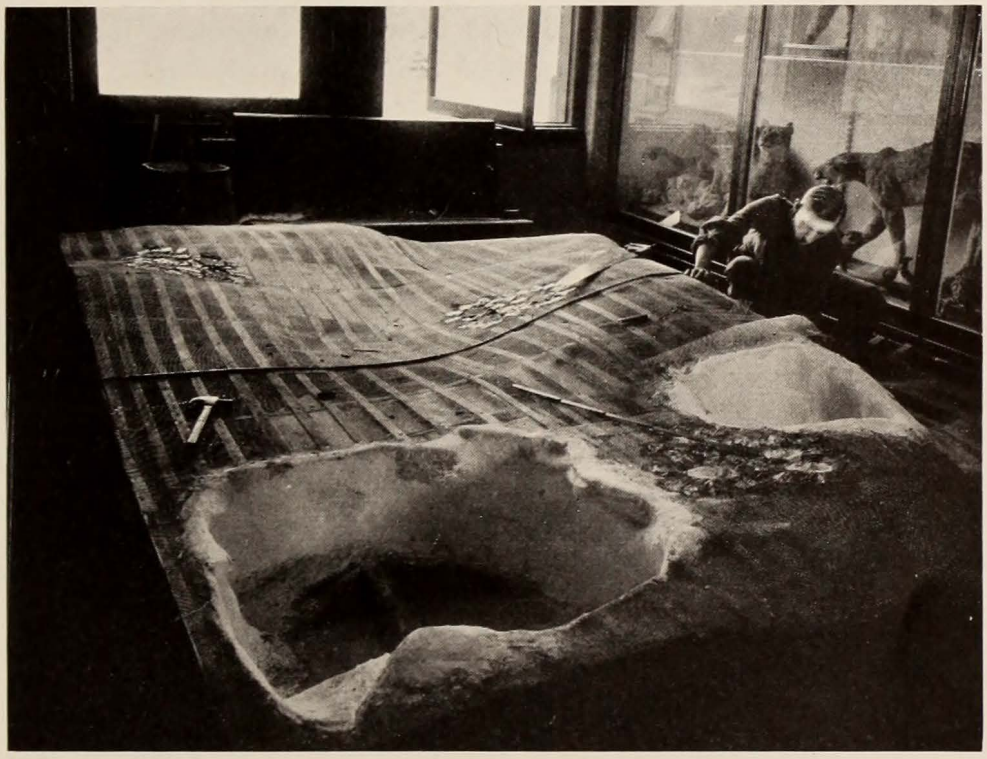
enter the case for replacement. For the average Group, a pleasing effect is obtainable from the latitude of the front light pocket, as outlined. Sunlit spots are very effectively simulated, either by the use of spot lights or reflected light from a mirror.

XV. A case front can be, and should be, constructed so that it is removable, for it will be found that the inner surface of the glass needs cleaning at last once a year. To go into the Group space for this cleaning will, in time, seriously damage the groundwork of the Group and whatever accessories are near the front. If the front is mounted on casters, and so designed that it can be readily detached, a wheeled truss, constructed so that it can be attached to the front, will make a complete unit which can be moved easily and with safety.

XVI. The base on which the groundwork of the Group is to be constructed is made according to the character of the setting, the size of the Group and the construction of the case front. Wherever possible, the Group front should be left entirely open, a dummy front being used during installation whenever necessary. This permits the building of the base in one piece. If the case front is installed, it becomes necessary to build the base in three sections, the centre section wedge-shaped, since it will be found desirable to remove the base frequently during assembly. Swivel roller-bearing casters should be installed on all base sections, to permit easy handling. The framework lumber should be proportionate to the load it is to carry. Frequent uprights are nailed to this, following the determined contour of the Group base. Iron wire mesh is nailed over the uprights, and this surface covered with burlap dipped in plaster. This should be made sufficiently strong to support one's weight. Reinforcing the underside will accomplish this. Or, where greater strength is required, sisal fibre may be substituted for the burlap. Where large rocks occur, these should be built as a part of the groundwork structure. Large trees and necessary anchorage for animals must be placed before laying the wire mesh. Usually, it is best to permanently place the animals before the accessories are installed. It is also best, in assembling, to place the material nearest to the background first, in order to enable the artist to connect his painting with the foreground without walking over any finished part. Naturally, if the case front has been left open, there will be no difficulty in joining, since the groundwork may be removed whenever necessary.

The surface of earth, twigs, dry leaves, etc., is the last operation in finishing any part of a Group. A mixture of cement and sifted ashes, about one to four, with dry color added if desired, is applied to the plaster surface, and the earth, etc. worked into this sufficiently to hold it in place and obtain a natural effect. Dry, preserved leaves may be scat-





The base for groundwork should be made strong and follow closely the finished contour. In this case the form was slatted to give the flowing form of drifted snow.

tered over this loosely; or, if necessary to secure them, dip into a diluted solution of glycerine and gelatine before applying. The solution should be of such consistency as to leave no gloss on the leaves when dry, yet retain sufficient adhesive quality to hold the leaves in place.

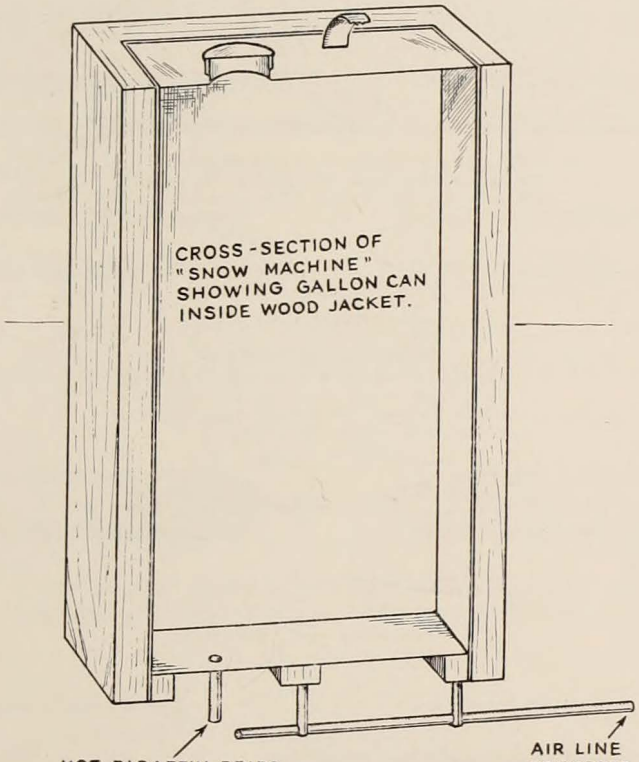
The "tieing-up" of the foreground to the background and the successful portrayal of the character of a setting are so greatly influenced by the placing of the horizon line in the painting, that it should be considered along with the business of building the foreground. It should be kept in mind that we are building dimensional "pictures." Size, character, dimensions and placement of Groups are all factors in determining the placing of the horizon. Let the requirements and specifications of the individual Group determine the most effective point for the horizon, and never be influenced by "actual eye level," a thing which cannot exist in a Group picture because of the great variation in height of the Museum visitors for whom the exhibits are produced.

In building a Group base where water is to be shown, the procedure is as follows: The under-water portion is worked out up to the water level, where a sheet of glass is installed. The shore-line above water is built separately from the main Group base, so that it may be removed as often as necessary in working out the under-water effect, including the installing of whatever forms are to appear as projecting from the pool. The glass usually requires some additional treatment. Painting or flowing the surface with celluloid (colored as desired) gives a watery texture. Or, the effect may be obtained as described in "Gelatin-Glycerine Formula." A slight clouding of the under-surface of the glass will produce a deceptive effect of depth, or of cloudy water.

Snow is best represented by spraying hot paraffin onto a white plaster base, which has been carefully modelled to the desired finished contour. Any coarse atomizing apparatus may be used for this. The plaster must be dry, and the first spray applied with the paraffin well heated and the spray nozzle fairly close to the surface. As the spray is thrown further, it will deposit in fine, snow-like particles. For coarser textures, use the paraffin less hot. Varying results may be obtained by regulating the heat of the liquid and the flow of air. The soft puffs of snow sometimes seen on branches may be reproduced by securing a fluffy bunch of cotton to the branch and spraying with paraffin. In small Groups, the paraffin may be spattered from a small hand scrub-brush to give the same effect as atomizing.

XVII. The equipment for collecting Group material should be carefully planned, and to do this it is essential to have as definite an idea of the Group plan as possible and a knowledge of the locality in which the collecting is to be done.

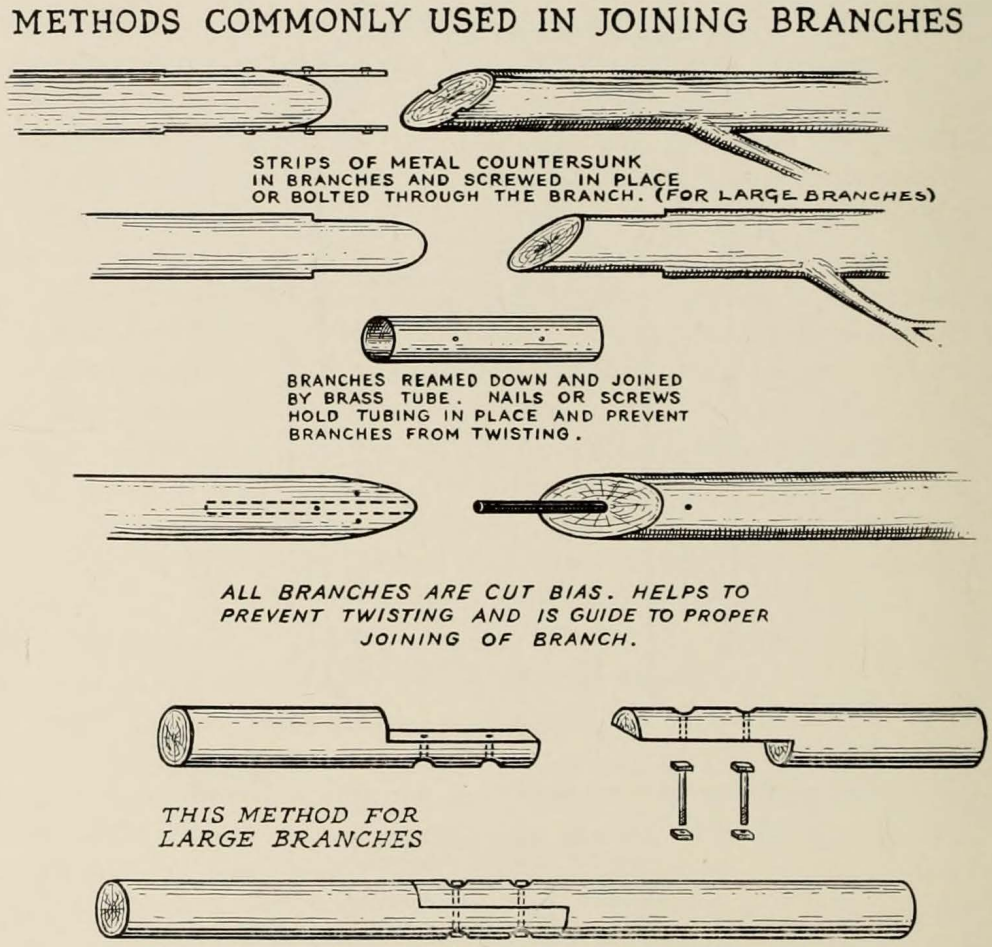
Excessive equipment is as annoysome in the field as a lack of it. Simple tools, such as saw, hammer, screw-driver, pliers, hand-ax, solder-iron and knife, should always be included. Ordinary materials which are commonly needed on any expedition are: plaster of Paris, plasticene, formaline, solder, solder-paste, burlap, cheese-cloth, twine (medium and heavy, with large spaying needle), water colors and brushes, stencil outfit and adhesive tape. The tanks for preserving leaf and other material



should be cylindrical. Material is more apt to jam in square tanks. Where more than one tank is required, the sizes may be graded so as to pack one inside the other. Much of the other equipment can be packed inside the innermost tank and in the corners of the box in which the tanks are packed. Thus, virtually the entire equipment may be taken into the field in one unit.

XVIII. The first work of an expedition is that of selecting the locality which is to form the basis for the Group. The plant life and other

accessories selected will be only such as are common to that particular locality. Those forms most typical and, at the same time, most practical for reproducing are chosen. Fresh leaves and flowers, together with small branches, or plants entire, are put into a solution of 3% formaline. Leaves carefully chosen for variety of character and size are stacked, card-like, and wrapped in cheese-cloth and dropped into the solution. All tender parts or plants should be wrapped in the cloth before placing



in the tank. Short, brittle grasses require the same treatment. All this material, after remaining immersed for a few days, may safely be drained, leaving only a quart or two of solution in the tank. If the tank is well soldered, this will remain in good condition indefinitely, and the lightened tanks will transport more easily. As an additional precaution, plaster molds of leaves and petals are made in case anything should go wrong with the tank material. Water color notes should be made of all plants while fresh. Careful pattern drawings of flower petals and parts should be made.

Tree or shrub branches should be taken, as far as is practical, and cut suitably for packing, keeping always in mind that these are again to be joined in the laboratory. Long grass will ship in very good condition if strapped to a board or slab of bark for stiffener and wrapped snugly in burlap.

The necessary operations in taking records of rocks and trees have been covered in another section. Dry leaves and twigs should be taken from an area corresponding in size with the Group area. These will ship safely if wrapped in burlap and packed in a box. If the ground is more or less bare, a good amount of the surface silt should be taken—a sufficient amount to cover the floor of the Group. Always a goodly sample of the earth is taken; this will be ample for the worker to properly match at home for use in the Group. Too many notes and photographs cannot be taken.

Finally, all material should be inspected immediately upon arrival at destination. All dry material should be preserved or poisoned, and the material in tanks should be examined to make sure it is in good condition.

Agar Agar

XIX. To 6 oz. Agar add 1 qt. water. When thoroughly soaked, boil in double boiler and add 3 lbs. glycerine. Continue cooking until water is well evaporated. Add a few drops carbolic acid. Allow to stand until evaporation is complete. The resulting rubbery mass should be cut into small cubes and is ready for use. Heat, as before, until liquified and, after cooling somewhat, pour over the object to be cast. Harden the inner mold surface by coating with alum water before pouring hot wax into it. It may be used for casting objects in either wax or plaster.

Gelatin-Glycerine Solution for Water and Other Uses

To 1 lb. of gelatine add 1 qt. of water. When all water has been taken up, boil in double boiler until about 1 qt. of bulk remains. Add 13 fluid oz. of glycerine and 10 drops of carbolic acid. This solution should be made in advance of requirements, so that all water will have evaporated. It may then be flown over a glass base to give a water effect, or be flown into a mold which has been made from a surface representing disturbed water. This slab, when set, may be laid on a glass surface. In either case, the gelatine surface should be varnished when thoroughly set.

This solution may also be diluted for immersing leaves to be fastened to a Group base.

Glycerine Solution for Preserving Leaves, Branches, Grasses, Etc.

33 parts glycerine
2 parts formaline
65 parts water

Dextrine Maché for Modeling or Pointing up Tree Bark

4 measures Dextrine } boil
4 measures cold water }

Add

5 measures dry paper pulp
1 measure manikin sawdust
7 measures whiting } mixed thoroughly together first
7 measures plaster }

The "set" may be varied by using more or less plaster.

In mixing plaster, fill the pan with water to about half the bulk of plaster required. Sift the plaster into this until it stands dry above the water level. Let stand until the whole is wet, then mix thoroughly with the hand until smooth and creamy. If too thin, the plaster will be weak; if too thick, it will not flow easily.

Never remove plaster from the object being cast until the mixture has become quite warm. At this point it has sufficient "set" to be removed without breaking.

Always wet a plaster surface where a fresh plaster coat is to be applied.

Metal Molds

Any metal casting process may be used for making metal molds, but it will suffice to give here one of the simpler methods.

First, make a plaster mold as already described. When this is thoroughly dry, build a dam close about the margin with molding sand, and pour heated type-metal over the mold surface. When cold, smoke the surface with a sooty deposit and enclose in a dam, as before. Pour metal onto this, and the result is two metal molds in perfect contact.

XX. Common Troubles and Their Causes

Leaves stick to the mold—
- Wax too hot
- Molds not thoroughly soaked

Leaves do not fill out—
- Too little wax
- Wet cotton

Leaves too thick—
- Too slow in closing clamp after pouring wax
- Wax too cold
- Mold too cold
- Wire rib out of midrib groove
- Midrib groove not deep enough for wire

Leaves tear easily—
- Too little cotton

Leaves slip from midrib wire—
- Cotton on wire is wet
- Too little cotton on wire

Molds wear too fast—
- Not in alignment
- Soaking in too hot water
- Wax too hot.

XXI

Agar Agar	Any wholesale druggist
Air Brush	Spray Products Co., 756 Tenth Ave., New York City.
Burlap	Hoffman-Lion Mills, 542 West Broadway, New York City.
Calking Compound	Any building materials store.
Celluloid (Liquid)	Celluloid Corp., 290 Ferry St., Newark, N. J.
Celluloid (Sheet)	Celluloid Corp., 290 Ferry St., Newark, N. J.
Clay (Water)	Ettl Studios, 227 West 13th St., New York City.
Color (Dry)	Behlen Bros., 10 Christopher St., New York City.
Color (Oil)	Windsor Newton, at any artists' supply store.
Compressor and Tank Unit for Air Brush Work	General Air Brush Co., 129 Lexington Ave., New York City.
Cotton (Jewelers)	Dennison Mfg. Co., 220 Fifth Ave., New York City.
Cotton Flock	Mark Jacobs, 20 East 17th St., New York City.
Dextrine	Behlen Bros., 10 Christopher St. or Ehrmann-Strauss Co., 200 W. Houston St., New York City.
Duco Cement	Patterson Bros., 27 Park Row, New York City.
Formaline	Any drug store.
Glycerine	Wholesale drug store, for large quantity
Green Soap	Ehrmann-Strauss Co., 200 W. Houston St., New York City.
Paraffin	Asiatic Petroleum Co., 80 Broad St., New York City.
Plaster of Paris	Any building materials store.
Plasticene	Schneider & Co., 128 W. 68th St., New York City. or any artists' supply store.
Sand, Moulders	Any Bronze Foundry
Scissors	Kny-Scheerer Co., 21–27 Borden Ave., Long Island City, N. Y.
Silk Flock	Mark Jacobs, 20 E. 17th St., New York City.
Stearine	Ehrmann-Strauss Co., 200 W. Houston St., New York City.

Steel Dies	New York Die Co., 245 Centre St., New York City.
Steel Wax Tools	Ettl Studios, 227 W. 13th St., New York City.
Wax	Theo. Leonhard, Paterson, N. J.
Whiting	Behlen Bros., 10 Christopher St., New York City.
Wire (Galvanized)	Any hardware store.
Wire (Iron Mesh)	Estey Wire Works, 34 Cliff St., New York City.