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BUILDING WITH LOGS

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BUILDING WITH LOGS

FOREWORD

This treatise on log construction is the result of many years of observation and experience.

To the many foresters and others in the National Forest Service who, from time to time, have contributed practical ideas and suggestions, grateful appreciation is expressed.

Their names are too numerous to mention here but to them individually the authors make grateful acknowledgment for their unwitting, yet invaluable assistance.

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BUILDING WITH LOGS

INTRODUCTION:

The western pioneers of America did not have boards with which to build such shelter as they found necessary, nor did they have any means with which to make boards. Round logs were so plentiful in the forested areas of our country that the pioneer, with his resourceful ingenuity, built his home with them in conformity with those principles of log construction which, down through the years, have remained much the same. The early pioneer had only an ax for a tool and, consequently, anything that could not be hewn out of wood was not made. Later, as new and better tools became available, many refinements in log construction were made possible.

Many Americans have an inherent desire to own a log cabin located in the woods and, preferably, to build it personally. Furthermore, it is still customary to live in log cabins in many parts of the country. It is for them that this booklet is prepared.

The art of log construction is relatively simple and easy to acquire, once a few basic principles are understood. To do a first-class job of log construction the worker must become familiar with the use of either the double-bitted or single-bitted ax, and the broadax, saw, adz, chisel or slick, ship auger, and draw knife.

In the following treatise it is assumed that the reader is familiar with the ordinary frame building methods employed where wood is the principal material of construction.

IN GENERAL:

A building should have a good foundation, and a log structure is no exception to the rule. For the sake of economy in labor and material it is sufficient, in some instances, to place small buildings on piers of concrete or rough native stone, but it will be found more satisfactory to use continuous walls of stonemasonry or concrete to provide uninterrupted support for the logs and thus avoid any tendency to sag. These, however, should be provided with small openings for the circulation of air to prevent the wood from dry rotting which otherwise takes place. Furthermore, the continuous foundation wall has the additional advantage of preventing rodents from getting under the building. In no case should the logs be placed directly upon the ground since wood tends to decay when in direct contact with the earth.
It will be found desirable to make the two end walls of the exterior foundation higher than the side walls. This is done to offset the difference in level of the logs on adjacent walls; the end wall logs being half their thickness higher than those on the side walls.

In building a log wall the chief problem is how to close the opening between each pair of logs. There are various ways of doing this, but only several of those found to be the most satisfactory will be described herein. The width of such openings is affected by several different factors:

1. The manner of placing the logs upon each other.
2. The type of corner used where two walls meet.
3. The making of necessary openings for doors and windows.
4. The natural shrinkage of wood in the process of drying.

PREPARING LOGS FOR USE:

The selection of straight, smooth, even-sized logs is the prime consideration. Top diameters should be as uniform as possible; not less than 10 nor more than 12 inches. However, slightly smaller or larger sizes may be used. The taper should be as little as possible. For logs longer than 40 feet the top diameter may be less in order to avoid an excessive diameter at the large or butt end.
Cedar, pine, fir, and larch, in the order named, are the most desirable species to use. All knots, limbs, or bumps should be trimmed off carefully at the time the log is peeled. Logs should be cut in the late fall or winter for two important reasons. If cut in the spring or summer they peel easier but, on the other hand, they crack or check to an undesirable degree while seasoning. Insect activity is dormant during the winter months and, therefore, if the logs are cut and seasoned then, they are less liable to be damaged by either insect or rot fungus. Logs should be cut, peeled, and laid on skids well above the ground for at least 6 months before they are placed in the building. While this may not always be possible it is, nevertheless, a good rule to follow. The logs should be stored in a single-decked manner with 2 or 3 inches between them for complete exposure to the air. Logs having a sweep or curve should be placed with the curve uppermost so that its weight will tend to straighten it while drying. Where the skidding space is limited the logs may be double-decked, using poles between each tier. Unrestricted air circulation very materially aids their seasoning.

Logs should be carefully sorted before construction starts so that the better ones may be used in the front or any other conspicuous walls of the building. If the logs are not uniform in size the larger ones should be placed at the bottom of the walls.

**DIMENSIONS:**

For practical reasons the dimensions of a log building are the inside measurements taken from one log to the corresponding log in the opposite wall. Outside dimensions vary somewhat with the size of the logs which accounts for the use of inside measurements. Logs should be cut at least 6 feet longer than the inside dimensions of the building where projecting corners are desired. Exceptions to the projecting corner are the dovetail, the upright, and similar corners, as hereinafter illustrated. In erecting the walls the logs should be kept even or plumb on the inside faces. This is necessary where it is desired to finish the interior of the building with wallboard or plaster. The difficulty of doing this is increased very much if the inside wall faces are not vertical.

**TYPES OF CORNERS:**

One of the most important features in log construction, upon which the appearance and stability of the structure is principally dependent, is the corner. There are a number of different
The notch or saddle corner showing notch cut in top log before placing it in position. This is an example of an unusually fine job of scribing and fitting logs together. The square cut log ends have yet to be dressed and shaped with the axe to give them an appropriate, pleasing appearance not had if allowed to remain in this unfinished condition.

FIG.1. THE ROUND NOTCH OR SADDLE CORNER
types of corner construction in use and each of them has several
variations due to local building customs or individual ideas. The
round notch or saddle corner, shown in Fig. 1, is generally con-
sidered to be the most satisfactory from every standpoint.

Appearance - It gives the most distinctive appearance because the
logs project sufficiently beyond the corner so as not to appear to be dubbed off as is the case with some other corners.

Mechanics - It is a good, self-locking, mechanical joint for
holding the logs rigidly in place and is relatively simple to construct.

Permanence - Since, in cutting the saddle, the material is all
taken out of the under side of the upper log without disturbing the top surface of the bottom log, all the moisture drains out at the corner and, consequently, the wood is much less subject to decay.

Shrinkage - It is the outer area of the log's circumference that
produces most of the shrinkage which tends to open up the space between the logs. In the round notch corner, one-half of this shrinkage is allowed to remain in the corner. Therefore, the separation will not be as much as if each log had been cut down to the heartwood, a disadvantage common to most other types of corners.

The tools required to make the round notch or saddle corner to the
best advantage are: a pair of log dogs to hold the log in place, a pair of 10- or 12-inch wing dividers with pencil holder and level bubble attachment, a sharp ax, a 2-inch gouge chisel with outside bevel, a crosscut saw, a spirit level, and a plumb board.

The various steps employed in framing this corner, as shown in Fig. 2, should be relatively easy to follow.

The bottom logs on opposite sides of the foundation are first set in place. A flat face of 2 to 3 inches in width should be hewn on the under side of the log where it rests on the foundation so it will lay in place. Then the bottom log on each end wall is placed and accurately centered so that the inside face of all four logs is to the exact interior dimensions of the building. They should be dogged in place so they will not move while being marked for the corner notch. The wing divider is now set for one-half
1. Take half the diameter of the lower log.

2. Begin on the bottom of the upper log.

3. Move divider upward with a circular motion.

4. Top of quarter circle.

5. Now move to opposite side of under log and repeat. Then repeat same operation on the opposite side of upper log.

6. Take depth of space between two side logs, then repeat as before.

Point A follows line B around log while point C starts under log and follows line D, holding bubble E in the level, parallel at all times. The purpose of the level is to keep the point of the pencil in the same vertical plane as the point of the compass. S is starting point for the scribe.

The secret of a good fitting notch is to keep the bubble centered during the act of scribing.

FIG. 2. METHOD OF MARKING SADDLE CORNER
the diameter of the side log. With the lower leg of the divider resting upon the side of the under log and the other leg, with the level bubble uppermost, resting against the bottom of the upper log and directly above the lower log, start moving the divider upward and with a side motion so that the lower leg follows the curvature of the under log. The pencil point of the upper leg makes a mark on the surface of the upper log which will be the intersection of the surfaces of the two logs when the notch has been cut from the upper one. Repeat this operation four times to mark all four sides of the corner. A little practice will soon make one adept at keeping the points of the divider perpendicular to each other at all times while making the marks.

After the notch has been marked in this manner at both ends of the log, then turn it over on its back. It is a good idea to intensify the divider mark with an indelible pencil so it may be more easily followed. Chop the notch out roughly with the ax, as illustrated in Fig. 3, then chip down as closely as possible to the mark, giving the notch the finishing touches with the gouge chisel. The notch should be cupped out just enough to allow the weight of the log to come on the outside edges of the notch in order to insure a tight joint.

When the next side log is rolled into place, the dividers should be set apart for the width of the space between the top of the first side log and the bottom of the next side log, and the marking repeated as before.

If it is desired to have the upper log "ride" the lower log a little so that an especially tight joint between the logs may be secured, the dividers should be set a little wider apart than the space actually requires.

FIG. 3. CHOPPING THE NOTCH
SOME OTHER LOG CORNERS:

Although the round notch or saddle corner is considered the most satisfactory for all purposes, there are other types in general use, of which the most common are described as a matter of information. The prospective log cabin builder will have to decide for himself which he prefers.

DOVETAIL OR BOX CORNER:

This is a strong corner but it requires considerable experience with the ax to make a neat-looking mechanical job of it. It has several undesirable features, however: (1) the logs are apt to develop a wider crack because the corner is framed from the part of the log in which the least shrinkage occurs, and (2) since the logs are hewed down to form the corner, the wood has a tendency to collect and retain moisture which soon results in decay. Also, this type of corner detracts very noticeably from the "loggy" appearance which is so characteristic and desirable in log structures. The accompanying drawings illustrated in Fig. 4 show the practical methods to be followed in marking and framing the dovetail or box corner.

FLAT OR PLAIN TENON CORNER:

This corner, shown in Fig. 5, is the one most commonly used in building log structures and may be made in either of two ways. In one, only the bearing surfaces are framed, while in the other, all four sides of the tenon are framed flat. The plain tenon corner does not possess the highly desirable feature of being self-locking like the corners previously described. Being simple and easy to make, it is the most economical and, therefore, especially suitable for temporary structures. The logs must be pinned together as shown in Fig. 8. All the framing for this type of corner can be done on the ground before the logs are put in place and, when carefully fitted, it makes a particularly neat looking job.

UPRIGHT OR GROOVE-AND-TENON CORNER:

It is not known where this type of corner originated but it is used to a considerable extent in the vicinity of West Yellowstone, Montana, the west entrance to Yellowstone National Park. The upright or groove-and-tenon corner has several very desirable features from a mechanical standpoint: (1) the weight of the
The log is dogged in place first and then the spirit level is used to mark end cuts.

The bearing surface of the tenon has a two-way bevel which locks, or keys, the alternate rounds, or tiers, of logs in place. The dimensions given for the various cuts are indicative only because the depth, or thickness, of the wedge-shaped tenon varies and both sides need not be absolutely symmetrical.

Marking perpendicular guide lines at each end of log.

Tenon shapes vary somewhat.

FIG. 4. DOVETAIL OR BOX CORNER
FRAMING THE PLAIN TENON CORNER

Exact length required for log in wall

- A - 20'

Skid

Turn log on skids until back is up if there is any curvature. Square one end, A; then measure exact length required and saw opposite end square, B.

Spirit Level

Board

Determine thickness of the tenons based upon the average top and butt diameter of the logs. Then take a piece of board 18' long and the same width as the thickness of the tenons. For logs 16' long and 6' or 10' in diameter the board should be about 4½ wide. Drive a nail through the center of the board and into the center of the log. Place the level on top of the board, moving it until perfectly level, then mark a line on the log at top and bottom edges of the board. Next, mark the sides using either the plumb side or the level or carpenter's square. The width of the tenon varies with the diameter of the logs; 8' to 10' diameter will produce 6' to 7' wide tenons.

Pattern board

Saw down to dashed line

Nail a 1' x 1' cleat on the pattern board to make marks C and D and make saw cuts on each end, cut chip off and smooth the surface. Turn log over and repeat on the other side. Next frame up the sides of the tenon and the log is ready to be put in the wall. Some fitting between corners will be required but, if the logs are fairly straight and smooth, the work will be minimized.

FIG. 5. FLAT OR PLAIN TENON CORNER
FIG. 6. UPRIGHT OR GROOVE & TENON CORNER

- Use a 1\(\frac{1}{2}\)" groove plane to make groove
- 2\(\frac{3}{4}\)" wide x 2\(\frac{1}{4}\)" deep
- Use board as a straight edge
- Chisel out the center after grooves are cut

Plumb and brace posts

Allow 2" to 4' here for settlement due to shrinkage
Rafter notches

METHOD FOR GROOVING CORNER POST

2\(\frac{1}{2}\)" x 2\(\frac{1}{2}\)"
building is carried on the full length of the logs and does not rest only on the corners as in other types, and (2) it always makes a tight wall because no openings will ever develop between the logs. Although it is not difficult to construct, it does require considerable mechanical skill and accuracy to build it. A good mechanic can frame the entire building on the ground before any logs are placed on the foundation, after which it can be erected in a very short time. Next to the round notch corner, it probably has the best appearance of any.

Door and window jambs should be framed just the same as the corners except that only the back is grooved. The door side, or face, may be rabbeted or left smooth so that a separate wood door stop may be nailed in place. If the logs are reasonably dry, from 3 to 4 inches should be left at each corner for the settlement due to shrinkage; otherwise, the allowance should be more or less as conditions require. In about 6 months the cap log will come down that much and close this gap. The same is true over door and window openings where similar provisions should be made for settlement. The accompanying illustrations show how this corner is framed, Fig. 6.

**FLOOR JOISTS:**

As soon as the first round or tier of logs is laid, the floor joists should be set in place, notching them into the bottom side logs. If the building has a continuous masonry foundation, then the joists may be set on top of it just as they are in a frame building.

In order that the ends of the joists may have sufficient bearing on the wall it is necessary either to notch the ends into the side logs or else hew the latter off on the inside. The simplest method is to cut the notches in the side logs before they are rolled into place. Pole joists should be from 4 to 8 inches in diameter and hewed level on the upper side to provide a solid bearing for nailing the flooring. Several ways of framing the floor joists may be seen in the accompanying illustrations, Fig. 7.

**WALL LOGS:**

In laying the successive rounds of logs in the walls, several details must be observed to keep them lined up so that the top logs form a level seat for the roof framing. The corners should
Framing Sawed Floor Joists

Framing Pole Floor Joists

Framing Second Floor Joists

End A of Pole Joist Above

Pole Joists Cut Like This at Each End

FIG. 7. Framing Floor Joists
be kept as level as possible as each round is laid. This can be
done by measuring vertically from the top of the floor joists,
from time to time, as a check. A variation of an inch in height
will not cause any serious difficulty. The height of the corners
is regulated in two ways: (1) by increasing or decreasing the
depth of the notch at the corner, and (2) by reversing the top and
butt ends of the logs in laying them in the wall. The logs should
be fitted together as tightly as possible to reduce the space
between them to a minimum. In the case of somewhat irregularly
surfaced logs it may be necessary to smooth off certain portions
of the under side of the upper log to secure a tight fit. Only in
exceptional instances, however, should this be done to the top of
the lower log.

The face of the logs on the inside of the building must be kept
plumb; that is, in the same vertical plane. An ordinary carpenter's or spirit level may be used for this purpose, but a 6- to
8-foot long plumb board is considered more satisfactory because
of its greater length.

The logs should be pinned together with either a
wooden pin or a large
spike. Spiking is done by
boring a 3/4-inch hole
half way through the upper
log and continuing with a
7/16-inch hole through the
remainder, or bottom half.
Then a 10- or 12-inch
spike is driven into place
or until it penetrates
half the next log below,
as shown in Fig. 8. The
spikes should be staggered
in alternate rounds, or
tiers, of logs. If wooden
pins are used, fir or oak
are preferable species.
Neither wooden pins nor
spikes offer any interfer-
ence to the settlement of
the walls.
The spike method is the easiest and quickest, and just as satisfactory as the wooden pin. The logs should be pinned approximately 2 feet from each corner and at each side of window and door openings. For small structures, where the alignment of the walls is not so important, pinning may be eliminated, but for larger buildings it is essential to align them accurately in order to prevent individual logs from springing out of place which, under certain conditions, sometimes occurs.

Where the use of logs having a decided curve, or sweep, is unavoidable they should be set in the wall with the bow or back up. Such logs may be straightened by making just enough saw cuts in the upper side of the curve to allow them to become straight. The cuts should be from one-third to one-half the depth of the log, or more, if necessary: Fig. 9.

![Fig. 9. Straightening a curved log](image)

**FIG. 9. STRAIGHTENING A CURVED LOG**

**WINDOW AND DOOR OPENINGS:**

Early log structures, compared to those of today, were characterized by relatively dark interiors due to the fact that originally the window openings were small and spaced far apart for the purposes of protection. Since this feature is no longer a consideration, the window frames may be of standard size and located where most suitable for adequate day-lighting.

As soon as the first round of logs and the floor joists are laid in place, permanently mark the location of door and window openings on the inside face of them, then saw out the door openings and chop out the notch in the door sill log to within an inch of the true or finished line, as shown in Fig. 10. Leave the finishing or final cutting of the openings to the exact dimensions until the window and door frames are to be placed in position so as to insure a good finished wood surface. Also, determine the height of the openings above the floor line and mark them in figures on the bottom log so they may be referred to from time to time. The necessary cuts in the log directly over each opening should be
DETAILS FOR PREPARING OPENINGS TO RECEIVE THE FRAMES

FIG. 10. CUTTING OPENINGS
made before placing it in position. When the log which carries the window frame is reached, a notch must be made for it in the same way as for the doors.

To provide the necessary doors and windows in the building, openings must be cut in the walls for them after the logs have been placed in position. As soon as a log in the wall is cut in two the problem of how to hold the loose ends in place arises. Also, the doors and windows require the proper kind of frames to insure an air tight closure between the door or window proper and the ends of the wall logs. The sides or jambs of the door and window frames must set at right angles to the wall logs. The most practicable and satisfactory scheme to meet these conditions is to frame a vertical notch in the ends of the wall logs, into which can be fitted a spline attached to the back of the jamb or side pieces of the door and window frames. This method of framing holds the wall logs in place, allows them to shrink and settle without hindrance, and makes a weather-tight joint between them and the door and window frames. The vertical notch in the end of the wall logs is framed by first boring a 2-inch auger hole in each log as it is laid in place. The auger hole should be located so that, when the wall logs are sawed out for the opening, the saw cut passes down through the edge of the hole nearest the opening. It is then a simple matter to frame the notch to take the spline. The inside face of the notch can be left rounded and the spline chamfered to fit. To keep the holes in line from log to log, use the plumb board as illustrated in Fig. 11.
FIG. 12. WINDOW FRAMES

CASEMENT WINDOW FRAME USING LOG JAMBS

DOUBLE-HUNG WINDOW FRAME USING SAWED MATERIAL
WINDOW AND DOOR FRAMES:

There are several ways to make the window and door frames. They may be either in three pieces, two side jambs and one head jamb; or in four pieces, two side jambs, one head jamb, and a sill piece.

When a three-piece frame is used, the bottom log of the opening is cut or shaped to make the window or door sill and the jamb pieces are then fitted to the sill. If the jambs are framed from pieces of log slabbed on two opposite sides, a very good looking frame in keeping with the log character of the structure is secured. The window or door face of the jamb pieces may be rabbeted for the windows and doors, respectively, or they may have separate wooden pieces, known as stops nailed on. The spline on the back of the jamb may be rabbeted out or a 2" x 2" piece of straight-grained wood may be nailed on it. The head jamb is framed in the same way except that it does not require a spline on the back. Each side jamb has a dowel framed on each end. The bottom dowel fits into a mortise in the sill and the top dowel fits into a similar mortise in the head jamb.

When a four-piece frame is used, the sill log is cut with a slope, in the customary way, and the jambs are fitted in the same manner as described for a three-piece frame. The accompanying drawings, Fig. 12, illustrate the installation of three- and four-piece window frames.

When, in the course of construction, the head jamb or top log which fits over the opening is reached, the frames should be ready for installation. The opening is now cut out, the sill fashioned, the vertical spline slot framed, and the head jamb log cut out to fit over the opening. At this point the amount of settlement resulting from the shrinkage of the wall logs, as they dry out, must be determined and a corresponding allowance provided in the opening for it. This allowance is made between the upper side of the head piece of the frame and the bottom of the log directly over the opening, and should be from 2½ to 4 inches for a door 6 feet 8 inches to 7 feet in height, or 1½ to 3 inches for an ordinary double hung or double run window. The log over the opening should be notched out on the bottom side so that it can be dropped in place after the frame has been set in position.
When the type of window or door frame herein described is used, neither outside nor inside casings, sometimes called wood trim, are required. The logs selected for the jamb material should be from 2 to 3 inches larger in diameter than the wall logs in order to fit properly in place and, if well seasoned, they will be much easier to work, Fig. 13. Also, see log frame in Fig. 12.

Standard mill-work frames may be used, if desired. In this case, false side jambs of sawed material, usually 2-inch plank, are fitted in the openings to hold the logs in place. For a wall having 10-inch logs, a 2" x 10" plank should be used for these jambs and, after providing the necessary allowance for the wall logs to either shrink or settle, then the standard frame is fitted in place between them. The head casing will ordinarily cover the space allowed for shrinkage.

Some form of insulation material which will take compression, such as crumpled newspapers, asbestos wool fibre, or rock wool is used to fill the space over the head which has been allowed for settlement. It must be installed loosely so as not to take any of the weight as the head log gradually settles.

When the log type frame is used a piece of copper or galvanized steel flashing is fastened to the bottom of the cut in the top log, leaving the lower edge of the flashing free to slide on the face of the log head jamb. As the wall settles, the bottom of the flashing can be trimmed off if it covers too much of the face of the head jamb. This makes a weather-tight joint and also protects the insulation material with which the shrinkage space has been filled. See head section, Fig. 14.
7" Log joists, 2'-0" o.c.---Double joists under rafters.
Fill space with insulation.

3/8" x 6" Log screen

4/2 x 2.4" Cedar shakes
7.6 exposure to the weather
Tar paper
1" x 6" Shiplap roof sheathing
5.5 Nailing strips 1.5" o.c., laid flat

Copper Flashing nailed along top edge only
2 x 2" Tenon on jamb pieces let into mortise in head piece

3/8" x 3/16" holes and 12" spike
2 x 2" Ribbon nailed to back of side jamb pieces

Cut log with slope for sill
2 x 2" Tenon on jamb piece beyond which is set in sill log
Plastic fiber seal

Finished flooring
Building paper

Rough or under-flooring of 1 x 6
Shiplap boards
8" log joists, 2'-0" o.c.

Continuous concrete wall
8" or 10" Anchor bolt
Local stone veneer

WALL SECTION
TAKEN THRU WINDOW

FIG. 14. TYPICAL LOG WALL SECTION
ELEVATION

SECTION

A

B-section

ELEVATION-B

NOTCHED POLE RAFTERS

ATTENTION

Despite the fact that sawed rafters, as shown above, are very often used for convenience in framing the roof; nevertheless, sawed or milled material is noticeably incongruous in appearance where exposed in the exteriors of log buildings. Hence, pole rafters, hand-made shakes, and similar hand-riven features to be preferred.

FIG. 15. VARIOUS WAYS OF FRAMING EAVES
ROOF FRAMING:

Roofs may be framed in several different ways, depending upon the kind of material available and the appearance desired. The framing for a shingle roof, whether of sawed material or round poles, is done in the same way as that of a frame building. The top log on the wall may either be cut with a flat seat for the rafters to rest upon, as at Y in Fig. 15-A, or else it must be notched out to receive them as at Z in Fig. 15-B. The gable ends may be run up with the logs, which is preferable for architectural appearance, or they may be framed like the gables of a frame structure, and then covered with wood siding, shingles, or shakes.

The shingles may be laid over sheathing boards in the usual manner or on shingle strips placed across the roof rafters parallel with the ridge and exactly spaced to receive them; commonly known as "barn-fashion."

The particular method to be followed in framing the eaves depends largely upon their projection. Where the effect of a considerable overhang is desired, an eave purlin log may be used to support the projecting shakes as shown in Fig. 17-A. To support 30- to 36-inch long shakes having a 6-inch lap, the log purlins should be spaced at approximately 24-inch intervals, as shown in Fig. 17. Where heavy snows prevail, the eave log may be placed slightly forward to help support the overhang or an additional eave log may be placed in position, as shown in Fig. 17-B. The gable logs are run up at the same time as the roof logs, and both rigidly framed together.

SHAKE ROOFS:

It is often desirable to use hand-split shakes for the roof covering. They are usually made from cedar, but may be of any straight-grained wood, free from knots, which splits easily. First, the logs are cut in lengths of 30 to 36 inches and then the shakes are split off with a tool called a froe, Fig. 16.
GABLE AND PURLIN LOG CONSTRUCTION

Purlins spaced approximately at 24" intervals to take 30" to 36" long shakes.

FIG. 17. FRAMING LOG PURLINS FOR SHAKE
After the log cuts are set on end, the froe is held on the upper end of the block and then struck a blow with a wooden maul which causes a piece of the block or a shake to split off. Being hand-split the thickness varies somewhat; the minimum being \( \frac{1}{2} \) inch. A roof of thin shingles, lacking sufficient scale, is never as effective as a rough textured one, using 3/4 to 1\( \frac{1}{4} \)-inch thick shakes, to harmonize with the sturdy appearance of the log walls. The width, normally 6 to 8 inches, is governed by the size of the blocks of wood, and varies accordingly, while the length is governed by the spacing of the roof logs or purlins. Shakes are always laid on the purlins in single courses, lapping the sides 1\( \frac{1}{2} \) to 2 inches and overlapping the ends at least 6 inches, as illustrated in Fig. 17. Nailing is usually done with 6 or 8 penny galvanized box nails. Copper nails may be used for greater permanence. A good shake roof will not leak although, from the inside of the building, it may appear to have many holes in it.

The ordinary, uninteresting, straight-line effect at the butts may be broken up by staggering them from 1 or 2 inches just as is done very often with shingles. This method produces an effect more in keeping with the log walls which, although involving greater care and additional labor, is preferable from an architectural point of view than the more common custom of laying them uniformly to straight lines.

At the ridge of the roof where the shingles or shakes intersect, provisions must be made for weatherproofing. Sometimes, stock metal ridges, ridge boards, and other inappropriate methods are used but the shingled Boston ridge, the comb intersection, or the pole ridge, shown in Fig. 18, are equally practical and much more satisfactory from the standpoint of architectural effect.

**FIG. 18. RIDGE TREATMENTS**
PARTITIONS:

Where the floor plan of a log building is divided into several rooms, at least two different methods may be used to construct the partition walls.

If it is desired to continue the log construction motive throughout the entire structure by using interior log wall partitions, they should be laid cut and framed in, cutting the door openings in the same manner as previously described for those in the exterior walls. When a log partition comes at a place in a cross wall where it is not considered desirable to have the log ends project into the room beyond the opposite face of the wall, they may be sawed off flush with the face of the cross wall, as shown in Fig. 19-A. This will not weaken the joint since the logs are both pinned and locked in place.

FIG. 19. INTERIOR PARTITIONS

Where frame partitions are used, they are constructed just as in a frame building. A gain or 3- to 4-inch deep groove should be cut in the log wall into which the end studding of the frame partition is to be set; Fig. 19-B. The cut should be made in each log before it is placed in the wall. In no case should the studding, at the ends of the partitions, be nailed to the logs which they intersect in order not to interfere with or be affected by the adjacent log wall shrinkage and settlement.
FLOORING:

A sub-floor is first laid using shiplap or sheathing. Over this a finished floor of either such hardwoods as maple or oak, or the harder softwood species such as Douglas-fir, western larch, and southern pine, may be laid. Vertical grain and flat grain may be had in both softwood and hardwood but the former shrinks and swells less than the latter, is more uniform in texture, wears more evenly, and the joints open much less. Finish flooring consists of tongued and grooved material of various thicknesses and widths.

Despite a slight tendency to splinter and wear irregularly over a period of years, plain, wide planking of random width boards makes an appropriate floor for a log building. An attractive floor may be had by using screws instead of nails, countersunk into a depth of \( \frac{1}{4} \) inch and concealed by inserting false wooden dowels, glued in place, shown in Fig. 20-B.

![Diagram](image)

**A-PLAIN TONGUED & GROOVED B-RANDOM WIDTH PLANKING**

**FIG. 20-FLOORING**
INTERIOR WOOD FINISHING:

Hanging doors and windows, and many other customary details of building construction are done in the usual manner. Whenever cupboards or other similar built-in units are constructed, they must be framed to sit independently or entirely free of the log walls as does the furniture. However, fixtures of various kinds such as lavatories may be attached to two adjacent logs without any subsequent structural complications.

CAULKING:

When round logs are laid up in a wall there is always an opening remaining between them. In exterior walls, this opening, or crack, must be closed up in order to make them weather-tight. There are several methods of doing this.

FIG. 21. AN EXAMPLE OF TIGHT JOINTS, WELL CAULKED
If the logs are reasonably straight and uniform in size and the corners carefully made, the opening between them will be small, often barely perceptible. When this is the case, it is filled with some sort of caulking compound applied with either a pressure gun or a trowel; Fig. 21.

In recent years several different kinds of caulking material have been put on the market. They usually are applied best with a caulking gun having a pressure release trigger whereby the caulking compound is forced out of the gun through a nozzle of which there are various shapes and sizes to suit different requirements. These caulking compounds usually are not affected by either heat or cold, retain their natural flexibility, and have an adhesive property which causes them to adhere to the surface to which they are applied.

A preparation of this character called "Atco Plastic Fibre Seal," Fig. 21, has been found to be especially satisfactory as well as economical in cost. It will adhere to the logs under all conditions and can be patched easily by simply applying more material. Being black in color it gives a desirable finish line. The seal should be applied to both sides of the exterior and interior log walls, and produces an almost hermetically sealed building. When applied with a pressure gun having a 3/8-inch nozzle, one gallon will fill about 300 linear feet of opening. If applied in cold weather, the seal should be heated to a temperature of 60°F.

CHINKING:

When it is necessary to use logs which are somewhat rough and irregular in shape, the resulting space between the logs may be so large that the caulking material cannot be used satisfactorily to fill the opening. In such cases, it will be found necessary to insert "chinking" which usually is applied to the inside wall in either one of two methods.

1. Segments of a log are split out in sizes which will fit the opening to be chinked and carefully shaped with the ax to make a tight fit. They are usually cut from 2 to 4 feet in length and then securely nailed in position. This kind of chinking requires considerable work and patience if a good looking job is to be secured.
2. Also, small round poles may be used to fill these openings. Usually, they are cut in sizes and lengths which will fill the opening from wall to wall. This sort of chinking may be applied rapidly to either inside or outside walls, and when finished, makes a neater appearing job than the preceding method.

After the chinking has been completed, it will be found that the openings have been reduced sufficiently in width to allow the caulking material to be applied successfully.

DAUBING:

In the past, it was customary to "daub" the openings between the logs with plaster or, frequently, just plain mud.

It has always been a serious problem in log construction to devise a practical method for permanently fastening the plaster daubing in place on both inside and outside walls. In some instances, shingle nails are driven into the logs from 2 to 3 inches apart for the full length of the opening and then the plaster is applied to fill it. Sometimes, cattle hair is added to the plaster on the assumption that it will increase its adhesive consistency and, thereby, hold it more rigidly in place. Elsewhere, wood strips are nailed on the lower log to hold the plaster in position. This, however, is unsightly and detracts from the otherwise pleasing appearance of log buildings as shown in Fig. 22.

FIG. 22. WOOD DAUBING STRIPS
CHINKLESS LOG CABIN CONSTRUCTION:

This method of construction is old and associated with the building of log structures in Scandinavian countries. It does away with the chinking and mudding so prevalent in many buildings of this type. It consists of grooving the underside of every log in each tier so that it saddles the log beneath, making a close joint for its entire length. The marking of the groove is accomplished by means of a tool which, for convenience, may be called a cabin scribe or a drag. See Fig. 23.

The scribe is 12 inches in length, made preferably of 3/8-inch square steel or iron bent in much the same manner as the spring in a steel trap; the two ends being turned down about 1/2 inches like two fingers, diverging to about 3/4 of an inch at the points, and then sharpened with a flat surface on the inside of the point toward the loop. The loop should be hammered out thin to provide sufficient flexibility to allow the points to spread or close easily. A ring is welded around the two halves of the tool which, when slipped up or down, makes it possible to adjust the points and thereby prevent any further spreading while the tool is actually being used. A link from a small chain, placed over the legs before the points are turned, will serve the same purpose and, to prevent the points from springing together, a small piece of wood may be forced between them.

To fit a log, first frame it at the ends and then fit it down to within about 2 inches of the lower log where the opening between them is the widest. It is difficult to do a good job of scribing when the logs are too close together. The scribe is then adjusted at the point where the opening is the widest so that, when holding the tool parallel to the opening, the lower point of the scribe will ride on the surface of the bottom log. By exerting sufficient pressure, the upper point will score the top log. Repeat this operation to score the upper log on the other side. The corner tenons must be marked likewise. Next, turn the log over, work the tenons down and then cut a V-shaped groove to the marked lines in the remaining portion of the log, using an ordinary double-bitted ax for this purpose.

This groove should be cut deep enough along its center to permit the outer edge of the groove to rest continuously on the lower log. By removing the least amount of wood to make the smallest possible groove, the better is the chance to obtain the closest fit with the least effort.
CHOPPING THE GROOVE

Do not remove any more material from the groove than is absolutely necessary to make a workmanlike, tight fit.

FIG. 23. CHINKLESS LOG CABIN CONSTRUCTION
FIG. 24. FRAMING HEWN TIMBERS
The principle of the scribe is based on parallel lines and it can readily be seen that if there is a hump on the lower log there will be a gouge on the upper one. When the work is carefully done the space remaining is so small it is negligible. Where an airtight wall is desirable, a strip of plumber's oakum should be laid on the bottom log before the upper log is dropped into place. Should this material not be available then dry moss makes a fairly practical substitute.

**HEWING TIMBERS:**

The facing or hewing of round timbers to obtain one or two sides surfaced flat for framing purposes, as shown in Fig. 24, is difficult for a novice to do because it requires considerable skill in the use of both the ax and broadax. There are, however, a number of mechanical aids, Fig. 25, which will be found helpful and should be used by anyone undertaking log construction in order to simplify the work as much as possible.

The carpenter's spirit level, the steel square, chalk line and chalk are necessary for laying off the lines to be followed in hewing timbers. In framing logs they should be laid up on skids, or horses, dogged fast in place with iron dogs, and the dimensions laid off on each end of the log with the level and square to insure that the lines on each end are parallel to each other. Then, with the chalk line, carefully snap lines on the side of the log connecting corresponding points at each end.

For squaring the ends of a log and for cutting pole rafters, the work is greatly simplified if the mitre box, in its various forms, is used to guide the saw, and for accurately measuring lengths, the steel tape or a board pattern cut to the exact length may be used.

**FIREPLACE FRAMING:**

The living room fireplace, invariably the most prominent feature, agrees best with a log interior when it is built of stone and provided with a crude log shelf. The fireplace itself may be either the traditional masonry type or the more modern metal lined one equipped with a heatilator.

The masonry of the fireplace and its chimney should always start on solid earth, below the frost line, like the foundations of the building itself. With the masonry, no settlement occurs as it does in the surrounding log construction. Consequently, it is
Drift pins to extend into second log below

SPlicing LOGS

2" x 10" x 10'-6" board

Ends carefully squared

2" x 10" x 2'-6"

PLAN

SECTION

By using a mitre box like this any log or pole may be sawed exactly square at either end.

MITRE BOX

1.6 Overhang of eave if sawed off on this line, parallel with wall face. Any desired overhang may be had by fixing this distance and not sawing. The irregular head rafter end is preferable to the elliptical saw-cut end.

FRAMING POLE RAFTERS

METHOD

Both mitre boxes to be cut at correct angle, 'X', for and pitch. Securely fasten them to the floor or to a log, used as horse, and spaced exactly the required distance apart.

Then place each successive rafter in boxes back down if any curvature exists, dog rigidly in place and saw to the pattern. This insures all rafters being alike and saves time. New upper surface of rafters to a smooth, even bearing for the roof sheathing boards.

FIG. 25. MECHANICAL AIDS
FIG. 26. FRAMING AROUND THE FIREPLACE
recommended that a self-supporting log framing be built around and entirely free of the masonry of both the fireplace and the chimney, as shown in section, Fig. 26. The opening should be framed in the same way as previously described for window and door openings. The fireplace and chimney masonry is not erected until the opening has been framed for it and, upon completion, the intersection between the stone and the wood should be thoroughly caulked to make an airtight, weatherproof job. This method allows the wall logs to settle, due to the unavoidable shrinkage of the logs, without the occurrence of any structural failure.

In building the ordinary fireplace, the firebox and inner hearth should be made of firebrick to withstand intense heat and the various parts proportioned in accordance with standard practice to insure efficient operation. Farmers' Bulletin No. 1889, entitled "Fireplaces and Chimneys," to be had from the Superintendent of Documents, Government Printing Office, Washington, D. C., will be found very serviceable in providing the practical information required in building fireplaces and chimneys.

The heatilator is a built-in recirculating steel unit consisting of metal sides and back to form a heating chamber, adjacent to the firepit, which draws cold air through a register at each side near the floor and, after being heated, ejects it through similar registers above. It should be installed in conformity with the manufacturer's directions, taking care to select a stock size unit suitable for the dimensions of the desired fireplace opening and to erect the surrounding masonry accordingly.

PAINTING OR OILING:

After all the openings have been properly caulked and the logs brushed clean, it is often desirable, although not absolutely necessary, to treat the log surfaces with some sort of preservative material. For the exterior, "Logwood Oil" is excellent for this purpose. The colorless variety is preferable in most cases but, if some color is desired, it can be had by adding just enough burnt umber, or raw sienna paste, to give the proper shade.

For interior finish, apply a coat of clear shellac and then one or two coats of dull varnish. The trim can be treated in a similar manner in order to preserve the pleasing effect produced by the natural surface and color of the wood itself.
FURNITURE:

Anyone who undertakes to build a log cabin need not think that the work is entirely finished when the building is ready for occupancy because, usually, it is not. Next to the building, in importance, is the matter of interior furnishings; always a subject of great concern. It is obvious that odds and ends of furniture will prove to be misfits as also will too many "whatnots." Unless pieces of Early American pattern, perhaps the most appropriate ready-made furniture to be had in the stores, are purchased outright, then furniture of sturdy, rustic construction offers the greatest satisfaction.

If the design is kept quite simple there is no reason why most of the essential furniture, such as bunks or beds, tables, chairs, settees, and similar items, cannot be made by the individual. In the East, birch is preferred for its attractiveness and, in the West, lodgepole pine is most satisfactory. Other native species, however, will serve just as well.

Many cabin owners have found a great deal of pleasure in making their own furniture as a hobby. Simplicity, both in construction and appearance, is the keynote for producing the most harmonious effects in keeping with log interiors. For the benefit of those who contemplate doing this, several supplemental plates have been included.

CONCLUSION:

This booklet on log construction is not intended to cover all the important matters involved in the erection of log buildings. Its primary purpose has been that of dealing with the use of the logs themselves.

Selection of the site, accessibility of location with reference to transportation, sources of commodity supply, water supply, electricity, and sewage disposal are all subjects which must be given due consideration.

Neither has the preparation of plans been discussed, although several typical ones have been shown. This all important subject varies with individual cases. Where this booklet is used by the public it is recommended that the services of an architect or competent builder be sought to insure that: (1) the owner's desires are satisfied with respect to the necessary accommodations,
(2) any rules or regulations enforced by local authorities having jurisdiction are observed, and that (3) provisions for the installation of telephone, electricity, water, and sanitation are made before any actual construction is undertaken and, thereby, avoid any subsequent changes resulting from failure to observe these matters in advance.

These and many other matters pertaining to particular conditions and varying individual requirements and tastes, of necessity, must be taken into account in the erection of any structure.

As previously set forth, this treatise has been limited to nothing but the actual log construction itself. If, therefore, it serves a useful purpose in this respect its preparation will have been a worth while undertaking.

Helpful Bulletins
For Sale by the Superintendent of Documents
Washington, D. C.

Fireplaces and Chimneys - U.S.D.A. Farmers' Bulletin No. 1889 price - 10 cents

Protection of Log Cabins, Rustic Work, and Unseasoned Wood from Injurious Insects - U.S.D.A. Farmers' Bulletin No. 1582 price - 5 cents

Farm Plumbing - U.S.D.A. Farmers' Bulletin No. 1426 price - 5 cents
LEGEND

Use well seasoned peeled pine or birch. Make tight saddle joint between B and the legs. Cross poles to impulse the legs tightly. Notch E for cross poles. Upper surface of C to be slabbled face and fitted between D and cross poles, all rigidly braced together. Top pieces of table to be dowelled at places indicated with 3/8 x 1 wood dowels, glued and clamped to insure tight joints. Notch top pieces, A, 1" deep to receive B and D. Top outside edges of A, C, and E to be heued. Peleft wood to be finished as follows: 2 cts turpentine, 2 cts raw linseed oil, 1 pt drier to which add 1 pt raw sienna, 1/2 pt burnt umber, touch of burnt sienna. Surface of table top to be given 2 coats of spar varnish.
It is advisable to remove bark, which collects insects, to insure durability. REGION-1.
LIVING ROOM SETTEE

PLATE II

LEGEND

Join corner poles to slab frame and rail with mortise and tenon; then anchor the joints by means of ¾ x 6 lag screws. Fasten the arms to the corner poles with 3/8 x 5 carriage bolts and to slab support with 3/8 x 4" lag screws, and slab support to the frame with 3/8 x 5 carriage bolts. All wood to be peeled pine, fir, birch, and well seasoned, and finished with sandpaper. 1" x 2" hardwood cross-pieces to be securely fastened at top ends and notched into legs at bottom ends, held by 2" wood screws, driven into place at an angle. Back slats to be mortised and tenoned to rail and frame. All wood to be finished as follows: 2 oz. Turpentine, 2 oz. raw linseed oil, 1 oz. drier, to which add 1 pt. raw sienna, ½ pt. burnt umber, touch of burnt sienna. Cushions to be filler-type, without springs if so desired, and covered with home-spun fabric.

REGION 1
Corner poles to be mortised and tenoned to frame and rail and anchored in place, with \( \frac{1}{4} \times 6\) lag screws. Arms to be fastened to corner poles by means of \( \frac{3}{8} \times \frac{3}{4} \) carriage bolts and to slab support with \( \frac{3}{8} \times 4\) lag screws. The vertical wood slab support to be rigidly secured to frame with \( \frac{3}{8} \times 3\) carriage bolts. All wood to be lodge pole pine, Eastern pine, with all bark removed, or birch, all well seasoned. Bark collects insects, deteriorates the wood and eventually comes off, leaving unsightly, imperfect, unfinished surfaces. After carefully sandpapering the surfaces, then apply the following proportioned finish: 2 qts. turpentine, 2 qts. raw linseed oil, 1 quart of drier, to which add 1 pt. raw sienna, 1/2 pt. of burnt umber, plus a touch of burnt sienna. Cushions to be filler type without springs if so desired, and covered with home spun fabric. See detail of cushion support above, in which the 2\( ^{\frac{3}{4}} \) wide, heavy canvas strips are to be securely fastened with furniture tacks.

**LEGEND**

- Mortise & Tenon
- \( \frac{3}{8} \times \frac{3}{4} \) Slab frame
- \( \frac{3}{8} \times \frac{3}{4} \) Slab arm
- 4 Corner poles
- CUSHION SUPPORT
- \( \frac{3}{8} \times \frac{3}{4} \) Slab
- Cushion
- 2 Heavy canvas strips, each direction

**ARM CHAIR**

---

**PLATE III**

---

**REGION I**
LEGEND:
Use lodge pole, Eastern pine, the bark peeled off, or birch; all well seasoned. The cross-pieces to impale the corner posts tightly, joint glued, and toe-nailed from below. Do not cut side or end pieces until the bed spring has been measured and then allow for slight play in both directions in setting L-irons in order to facilitate the insertion and removal of mattress. Woodwork to be finished after being thoroughly sandpapered, with the following proportioned materials: 2 qts. turpentine, 2 qts. raw linseed oil, 1 pt. liquid drier, to which add 1 pt. of raw sienna, ½ pt. burnt umber, and a touch of burnt sienna. Use ¼"x 3" carriage bolts to fasten L-iron to wood frame. Note: For a single bed reduce to suit 5'-3" or 4'-6" spring.

DOUBLE BED

PLATE IV
Use well seasoned peeled lodge pole pine, Eastern pine, or birch. Cross poles to impale legs rigidly. Cross pieces of chair back to have curvature to fit the back. Joints to be tight, glued, and mortised and tenoned.

For finishing the following proportioned materials: 2 qts. turpentine, 2 qts. raw linseed oil, 1 qt. liquid drier, to which add 1 pt. raw sienna, ½ pt. burnt umber, and a touch of burnt sienna. Surface of rawhide seat to be given 2 coats of clear spar varnish.
Material to be lodge pole pine, tamarack, Eastern pine, peeled; or birch; all well seasoned. Sides and bottom shelf to be rabbeted and thoroughly glued. The two intermediate shelves to be made adjustable by boring three holes in each side piece 2" apart, above and below position shown, here for shelves, into which loose wood pins may be inserted for shelf support. Screw top in place, countersink screw heads and fill with plastic wood for concealment. Since plastic wood will not take stain, wood plugs or false dowels are better than plastic wood except where a painted finish is used. Book rack to be finished in following proportions: 4 parts turpentine, 4 parts raw linseed oil, 1 part drier, 1 part raw sienna, 1 part burnt umber, and a touch of burnt sienna.

BOOK RACK

PLATE VI
Materials to be wood and metal. Use well seasoned, peeled log, pole pine, tamarack, eastern pine, or birch. Make tight cradle joint between horizontal and vertical side pieces, using $\frac{3}{4}$ x $\frac{3}{4}$ inch carriage bolts, except that $\frac{1}{4}$ x $\frac{3}{4}$ inch lag screws are to be used for fastening the lower side pieces and bottom together. Secure the wrought iron strap handle to each side top piece with 3 - $\frac{3}{4}$ inch carriage bolts.

Wood sides to have hewn edges of $\frac{1}{4}$ inch thickness. Finish of the following proportions to be used: 2 qts. turpentine, 2 qts. raw linseed oil, 1 pt. liquid drier to which add 1 pt. raw sienna, $\frac{1}{2}$ pt. burnt umber and a touch of burnt sienna.

Fireplace wood hod.

Region: 1

Plate VII
Note: The Front view, like the perspective sketch & the plans herewith, shows only half of each.

LEGEND

Material to be peeled, well seasoned lodge pole pine, tamarack, cedar, Eastern pine, or birch. Joint to be glued. If any screws are used, counter-sink exposed heads, then conceal them with plastic wood or, preferably, false wooden dowel-like plugs. Finish to consist of the following proportioned materials: 4 parts turpentine, 4 parts raw linseed oil, 1 part drier, 1 part raw sienna, 1 part of burnt umber and a touch of burnt sienna.

BENCHES

PLATE VIII
DOUBLE DECK BUNK

LEGEND
Material to be well seasoned, peeled lodge pole pine, tamarack, Eastern pine or birch. Finish to be of the following proportions: 2 qts. turpentine, 2 qts. raw linseed oil, 1 qt. liquid drier to which add 1 pt. raw sienna, ½ pt. burnt umber and a touch of burnt sienna.
CHEST & BUFFET

LEGEND: Materials to be well seasoned, peeled tamarack, lodgepole pine, eastern white pine or birch. Ends, doors, shelves, drawer fronts of #2 T & G, common pine. Finish to consist of the following proportioned materials: 2 cts. turpentine, 2 cts. raw linseed oil, 1 pt. drier, 1 pt. ralph sienna, 1/2 pt. burnt umber, touch burnt sienna. Top surfaces to have 2 coats of spar varnish.

PLATE X
Fireplace: See Fig. 26, p. 36.

Dining Table: See Plate I.

Book Rack: See Plate VI.

Wood Hod: See Plate VII.

Bed: See Plate IV.

Chairs: See Plate V.

Arm Chair See Plate III

LOG FURNITURE
APPROPRIATE FOR LOG CABINS
FIRE GUARD CABIN

OCCUPIED DURING FIRE SEASON ONLY

PLATE XIII
RESIDENCE
REGION 1

FLOOR PLAN
EARLY LOG STRUCTURES

FLEECER RANGER STATION DEERLODGE NAT'L FOREST MONTANA

DIVIDE GUARD STATION BEAVERHEAD NAT'L FOREST MONTANA

LOG CABIN AT MEDICINE SPRING RANGER STATION BITTERROOT NAT'L FOREST MONTANA

THIS LOG CABIN IS BELIEVED TO BE THE OLDEST IN THE FOREST SERVICE.
U.S. FOREST SERVICE LOG CABIN IN ARIZONA. OBSERVE LOG PURLINS AND SHAKE ROOF.

O'HARA RANGER STATION DWELLING - NEZPERCE N.F. - MONTANA

PONY RANGER STATION DWELLING - GALLATIN N.F. - MONTANA

EARLY LOG STRUCTURES

PLATE XVIII
ILLUSTRATING BOX CORNERS
2nd. FLOOR JOISTS
LOG GABLES
LOG PURLINS
SHAKE ROOF

ELK SUMMIT RANGER STATION
LOLO NATIONAL FOREST, MONTANA.

PLATE XX
SUMMER HOMES

PLATE XXII
SUMMER HOMES

PLATE XXIV
GAME CHECKING CAMP  LOLO PASS  LOLO N.F. MONT.

ORGANIZATION CAMP  SEELY LAKE MONT.

CLYDEHURST ON THE BOULDER DUDE RANCH ABSAROKA N.F., MONT.

LOG RECREATION BUILDINGS
RECREATION & MESS HALL
ORGANIZATION CAMP
SEELY LAKE, MONT.

PLATE XXVI
Observe wedges under porch posts to provide for settling of walls. Wedges are gradually driven out as necessary.

CABIN GROUP
ORGANIZATION CAMP, SEELEY LAKE, MONTANA