

Beehive Construction



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This publication was originally produced by the Extension Service of the British Columbia Department of Agriculture (1976). Under provisions of the Federal/Provincial Regional Cooperative Publishing Program, the Canada Department of Agriculture printed a revised version in 1979. The current edition is available in paper format and electronically @ www.al.gov.bc.ca/apiculture.

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Most beekeepers will assemble pre-cut beehive equipment at some time. Others go farther by manufacturing their own equipment. In either case, it is important to use standard dimensions and assembly methods to ensure that the equipment will be interchangeable, strong and durable. This publication offers dimensions and designs of individual hive parts, and a few assembly hints.

In Canada, the Langstroth movable-frame hive has been adopted as the hive standard. This hive design provides simplicity of construction and ease of manipulation, permitting rapid inspection and interchange of frames. Well-constructed equipment pays off in ease of management, and retains its resale value.

Note: Non-standard beehive equipment is occasionally promoted. Even though some designs may be practical and effective, we do **not** recommend any non-standard equipment because of higher costs, limited resale value and poor management flexibility.

LUMBER

Pine or cedar is recommended for all construction, except for the top cover and floor of the bottom board which use 13 mm (1/2 in.) plywood. Plywood is less affected by changes in temperature and moisture (Figures 2 and 3). All wood pieces must be flat. Small knots may be acceptable, provided they are not close to the edges or where handholds are to be cut.

Note: When lumber is not thoroughly dry, allowance for shrinkage must be made. The greatest shrinkage in lumber occurs across the grain. This is the only dimension for which excessive shrinkage should be allowed.

Cutting Pieces

Pieces must be cut precisely to the given dimensions. Handholds must be exactly 16 mm (5/8 in.) deep.

Bee Space

Space provided for movement of bees within the hive, and particularly between combs, is called the "bee space" and should be exactly 8 mm (5/16 in). Present-day hive equipment is designed on this principle.



ASSEMBLING SUPERS

Types of Supers

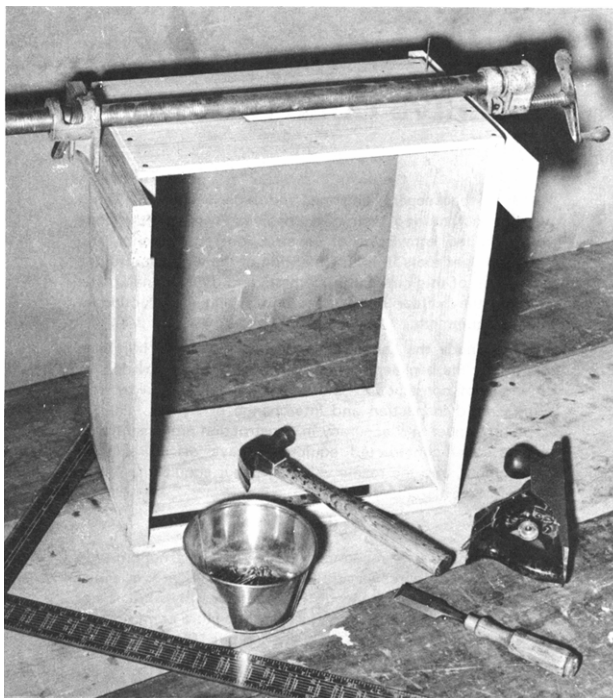
Supers are the wooden boxes that hold the frames of comb (Figure 1). For the standard super, the outside length is 50.7 cm (20 in.) and the width is 41.8 cm (16 ½ in.).

Supers come in three common depths:

- Standard 24.0 cm (9 ½ in.)
- Dadant 16.8 cm (6 5/8 in.)
- Shallow 14.7 cm (5 13/16 in.)

The Standard and Dadant depths are used for brood and honey supers while the Shallow box is used only for honey supers.

Commercial beekeeping operations use mostly Standard or “Full Depth” boxes for brood and honey supers.



Nails

Box nails (50 mm or 1 1/8 in.) are recommended for nailing supers, bottom boards and covers. Commercial operators sometimes use air-powered staple guns. Screws can also be used for maximum durability.

Assembly

While different assembly methods are possible, the following steps are recommended:

1. Nail metal rests to end pieces, using 16 mm (5/8 in.) common nails (not tacks)
2. Assemble, using clamps as in Figure 5
3. Nail through the top end into the side pieces
4. Remove clamp, reverse super, clamp and nail other end
5. Remove clamp, check diagonals to assure that super is square
6. Complete by nailing through the side pieces into the end pieces

Note: The holding power of nails driven into the end grain is increased by driving them in at an angle. For additional strength, end pieces may be glued before nailing.

Metal Parts

Metal hive parts include frame rests and hive-top covers which can be made of galvanized iron, aluminum or other suitable metal (Figure 4).



ASSEMBLING AND WIRING FRAMES

Frames and frame parts are best purchased from a beekeeping supplier to ensure proper dimensions. Ready-made plastic frames with foundation have proven effective, economical and durable and may be considered as an alternative to traditional wooden frames and wax foundation. Equally popular is plastic foundation sheet placed into a standard wooden frame. Plastic foundation is durable, reusable and does not require the wiring needed for wax foundation.

Nailing

There are different ways to assemble and nail frames. Figure 7 illustrates the best method. Use only special frame nails to ensure that the frames remain square and hang properly in the super with the correct bee space all round. A single frame-nailing device can be made at home or purchased from the beekeeping supplier.

To increase durability and overall strength of frames, wood glue may be used prior to nailing.

Wiring

For maximum strength and longevity, wire the frame as follows:

1. Use #28 gauge steel wire
2. In standard frames, use at least two horizontal wires. The wires should be located across the bottom holes and the third holes up from the bottom (Figure 9)
3. Use eyelets to prevent cutting into the wood
4. Horizontal wires must be drawn tight and secured with 16 mm (5/8 in.) cigar box nails
5. For extra strength, vertically wired foundation may be used

To secure the wires properly, a frame-holding device saves time and effort.

Embedding

Even though foundation may contain vertical wires, horizontal wires must be used to further strengthen the comb. Horizontal wires can be best embedded by applying a small electric current, causing it to heat up, so that it melts itself into the wax foundation. A 12-volt car battery or a transformer hooked up to the electrical system may be used.

The frame should be placed on the embedding board (Figure 8) with the comb foundation beneath the wire. When the electric current heats the wires, apply a slight pressure to the frame causing the wire to sink into the foundation. Promptly disconnect the current and keep the frame in place to allow the wax to congeal around the wire. Wires should not become too hot, or held for too long or they will burn through the foundation. Wires should not be embedded when the foundation is cold. Frames with foundation that has just been embedded (instead of frames with drawn comb) should not be stored in cold rooms, since contraction and later expansion of the wax will cause the foundation to pull loose from the wires.



HIVE COVER CONSTRUCTION

Figure 2 shows the standard hive cover of the Langstroth hive. The key feature is that the cover is telescopic and extends down the sides of the super on which it is placed. This provides maximum protection and reduces the risk of rain seeping into the top super. Plywood is most suitable. In colder climates, a 5 cm (2 in.) sheet of styrofoam can be sandwiched between thin sheets of plywood. While the overall thickness of the hive cover will increase somewhat, the hive cover will provide excellent insulation for the bees.

INNER COVER CONSTRUCTION

In former times, beekeepers used gunny-sack or burlap between the top super and the hive cover. There were disadvantages to using a soft innercover, including heavy propolizing by the bees, no space for bees to walk on the top bars, no space to install a formic acid dispensing bag, no top-entrance and no top hive feeding. Today, most beekeepers use a simple wooden inner cover that suits different purposes.

The inner cover consists of a 6 mm (¼ in.) piece of plywood with the same outer dimensions as the standard super (489 mm or 19 ¼ in. x 420mm or 16 ½ in.). The plywood board is equipped with wooden rims on both sides. The wooden rim on one side is 8 mm (5/16 in.) thick which equals the bee space. The other rim is thicker (about 12 mm or 1/2 in.) to provide sufficient room for a formic acid pad, pollen patty or granulated sugar on the top bars. At the front of the thicker rim, a space of about 5 cm (2 in.) has been left open which will be the top entrance of the colony during the beekeeping season.

About 1/3 down the length of the board in the center, a rectangular space of about 5 cm (2 in.) x 8 cm (3 in.) is cut. This open space allows bees access to the space between the inner cover and the hive lid. The hole is also used to feed the bees sugar syrup through an inverted feeding pail or jar.

BOTTOM BOARD CONSTRUCTION

Figure 3 shows a simple design of the solid bottom board. The rim of the bottom board forms the base on which the brood chambers and honey supers rest. Since the introduction of the Varroa mite, most beekeepers have modified the bottom board by cutting out a large rectangular portion and covering the space with wire mesh. Varroa mites that drop to the bottom of the hive fall through the wire mesh and are prevented from crawling back up. The wire-mesh bottom board also improves air circulation in the hive, enabling bees to shed excess moisture and condensation. Please note that the landing board at the hive entrance should remain solid for bees to land on and walk into the hive.

PAINTING

To ensure longevity, hive bodies must be treated with wood preservative or paint. Apply a good quality latex (or alkyd) base paint, followed by an exterior latex paint. Alternatively, apply an exterior wood stain. Do not paint or stain the inside of the supers. Instead of using paints or stains, supers may be dipped in a bath of hot paraffin for several minutes. Over time, the supers will acquire a 'weathered' grayish look. It is recommended to dip the supers again after several years. The service life of supers treated with hot paraffin is comparable to paint or stain.



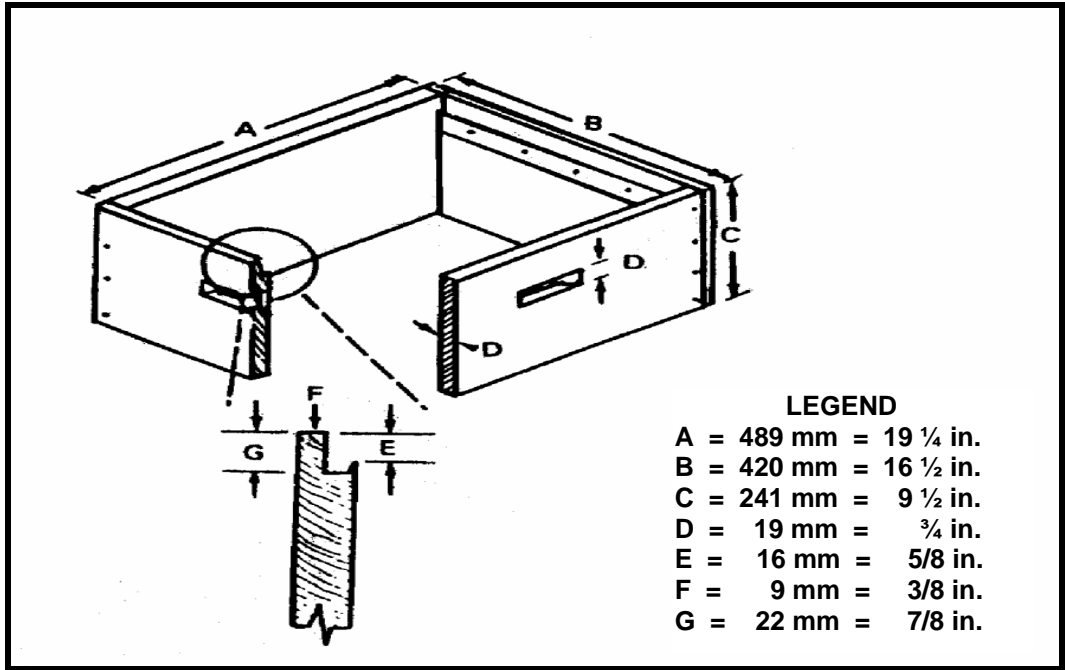


Figure 1. Standard Langstroth super

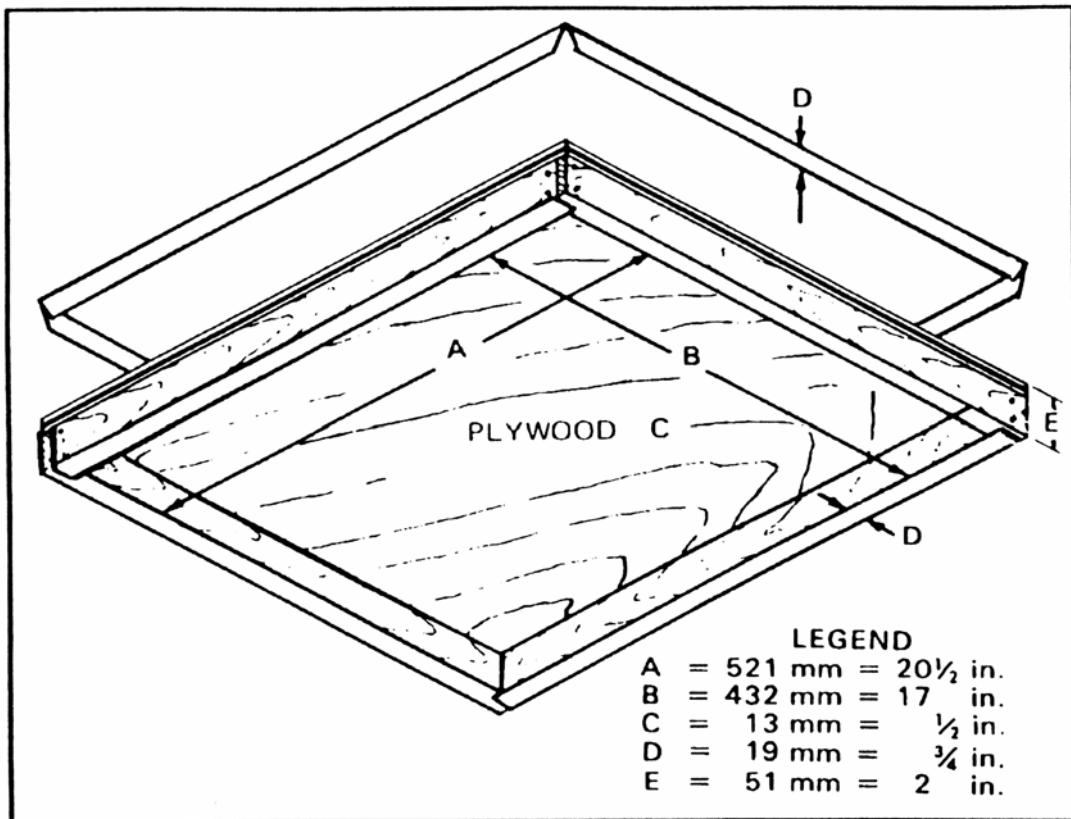


Figure 2. Hive cover for standard Langstroth hive (viewed from below)



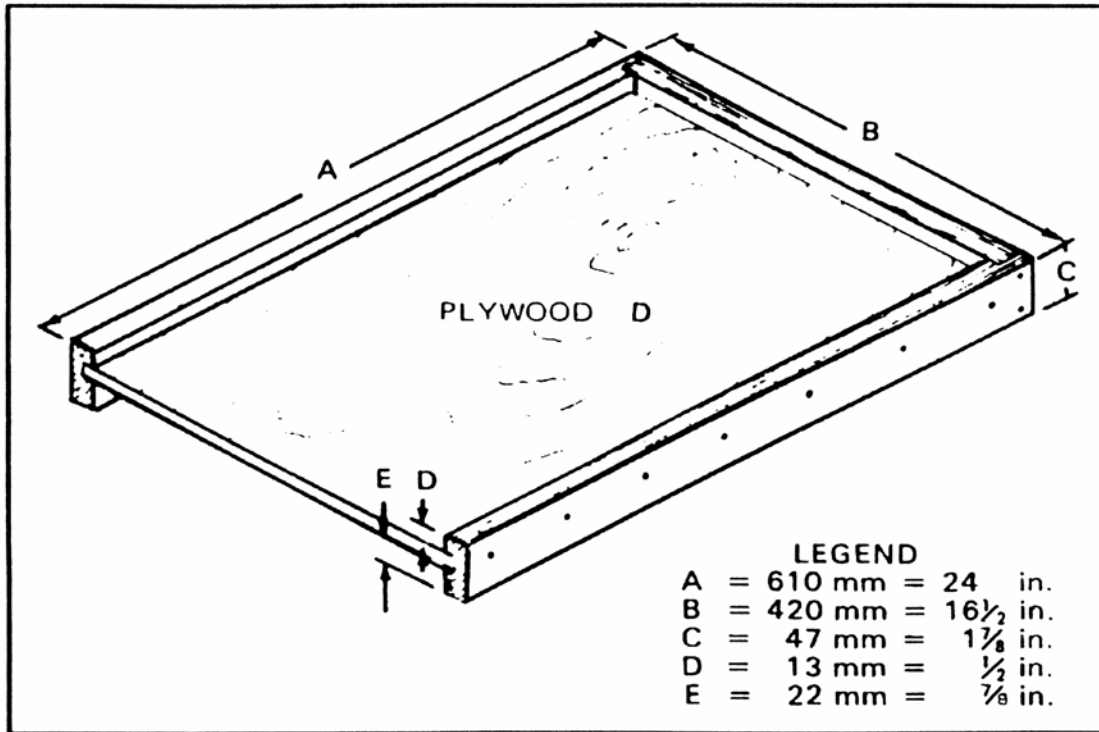


Figure 3. Hive bottom board for standard Langstroth hive

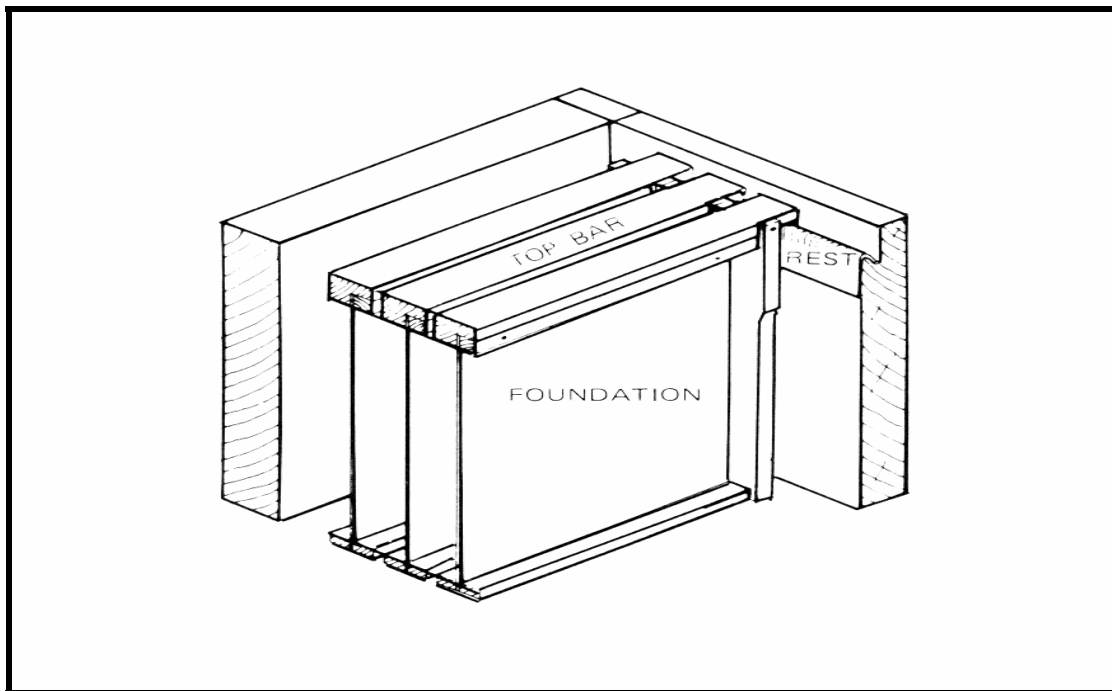


Figure 4. Cross view of ends of top bars sitting on metal rest



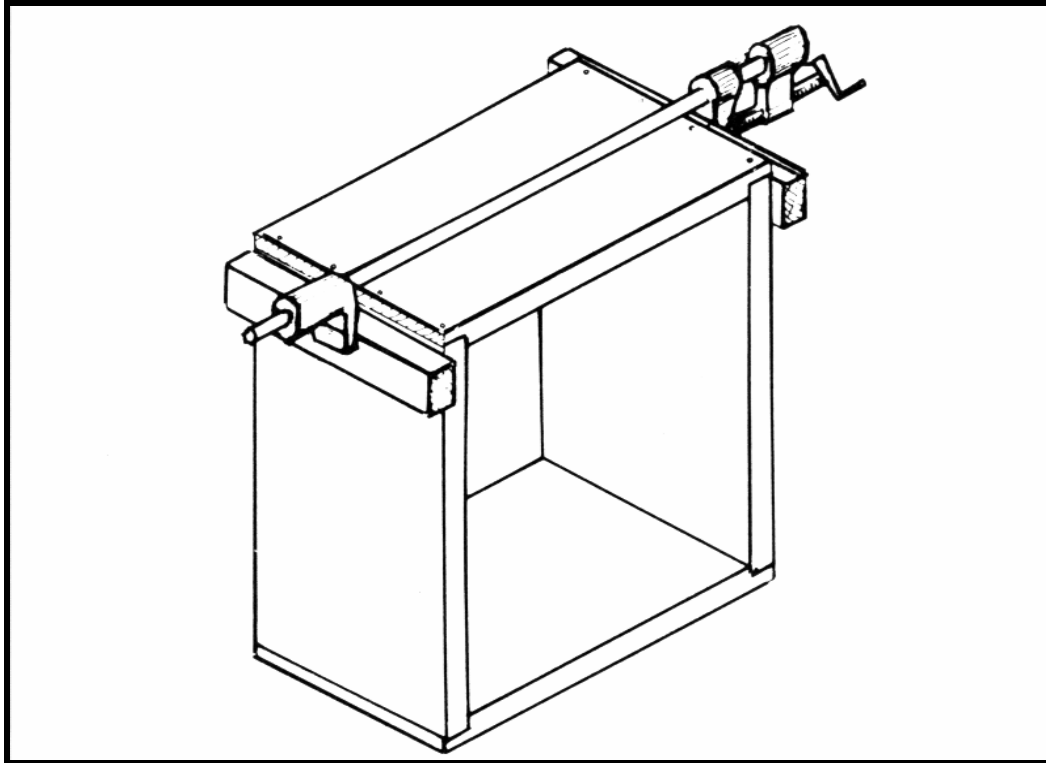


Figure 5. Preparing to nail super using clamp

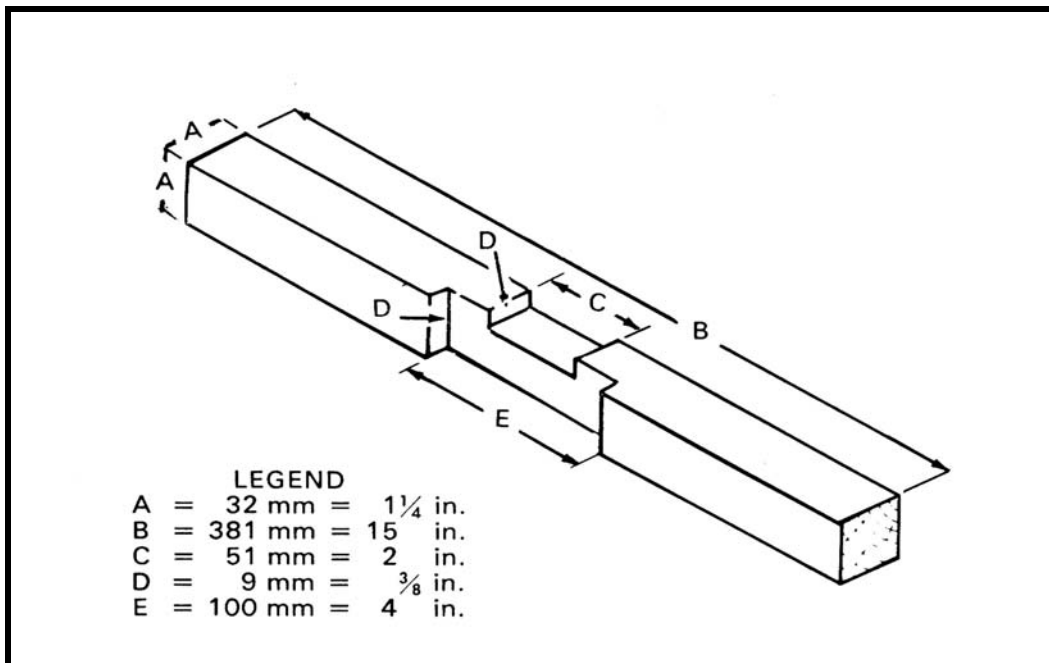


Figure 6. Entrance block showing both summer (E) and winter entrances (C)



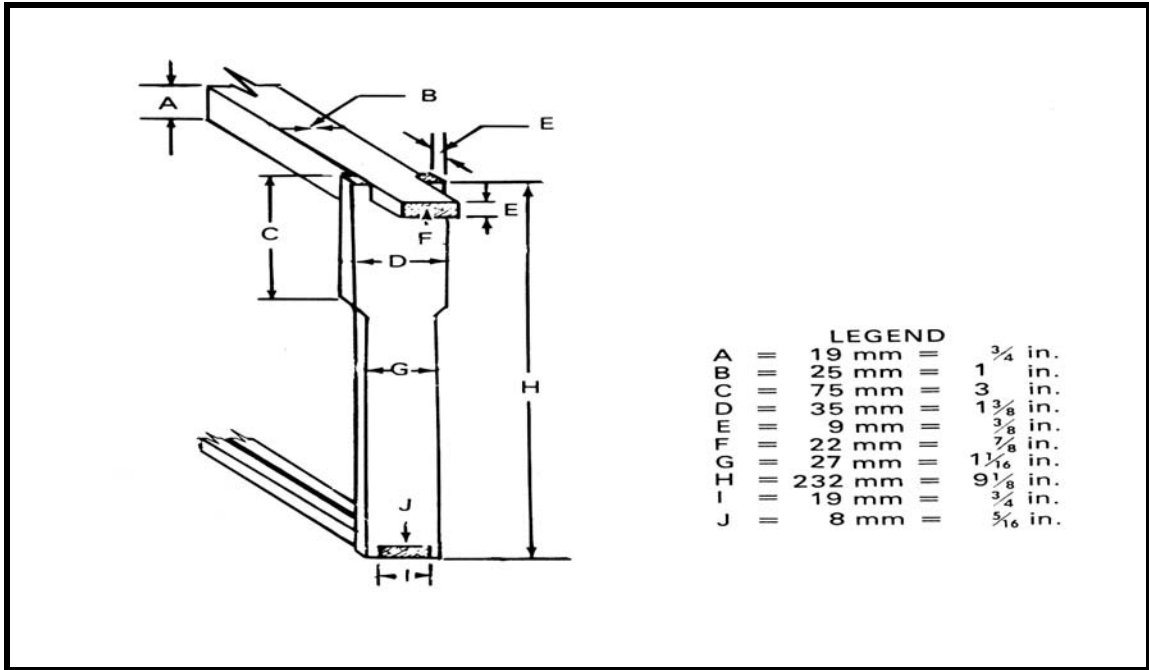


Figure 7. Standard frame

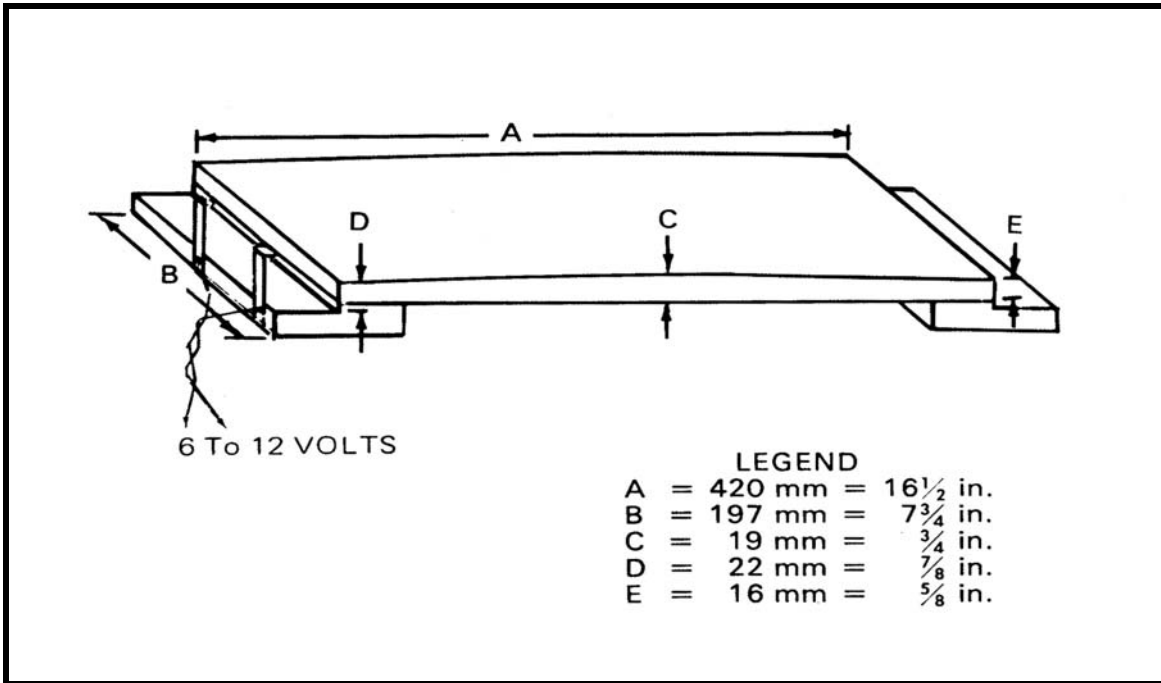


Figure 8. Embedding board showing the convex curve of the board
(This assures complete embedding of the wire)



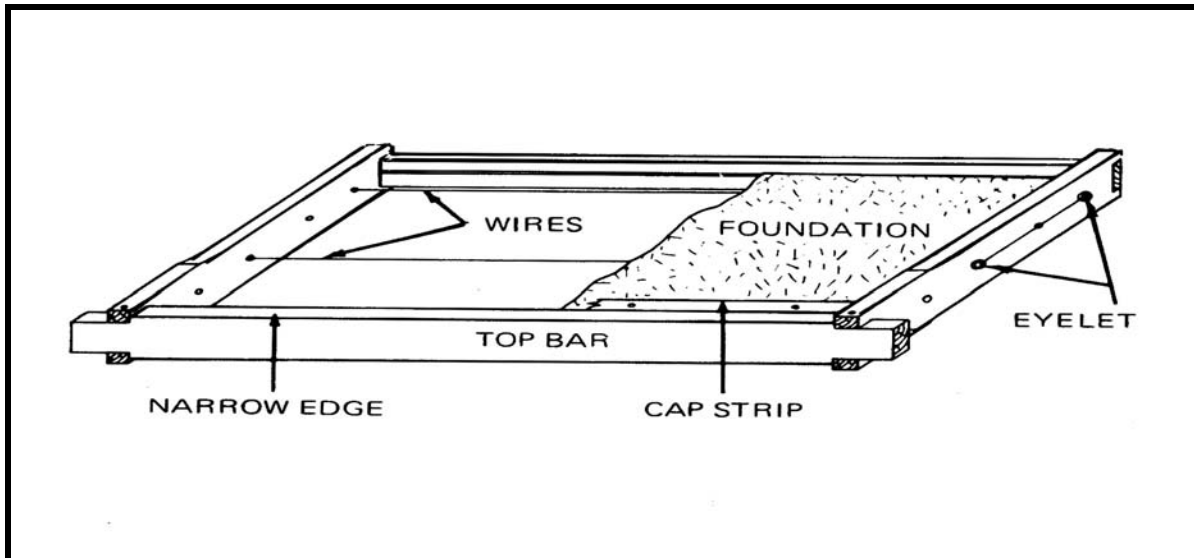


Figure 9. Frame wired with two horizontal wires and cap strip in place

THE ONTARIO AGRICULTURAL COLLEGE (OAC) POLLEN TRAP

To trap pollen, returning foragers must pass through some type of a barrier that will dislodge the pollen pellets from their legs. There have been many different designs over the years, but the OAC Pollen trap, originally introduced by the Ontario Agricultural College in 1962 has proven very effective (Figure 10). Its most attractive features include:

- Less crowding of bees at the entrance
- Drones can still leave the hive
- Pollen stays dry and can be harvested from the rear of the hive without interrupting bee activity at the front entrance

Installation

To install the trap, the brood chamber must be removed first and the floorboard reversed (front to rear). The trap is then placed in position so that its entrance is located where the original hive entrance was. The bees will orient to this new entrance promptly. The floorboard now serves to hold the pollen collection tray. Pollen can be removed by sliding the tray out at the open end of the floorboard (at the rear of the hive) without interfering with bee flight.



Pollen Trap Components:

The Pollen Tray

The tray is made from a frame of wooden strips 25 mm (1 in.) thick and 483 x 368 mm (14 1/2 in. x 19 in.) in dimensions. A piece of fine cloth or nylon mesh can be stapled to one side of the frame and function as the floor of the pollen tray. Wooden slats below the tray should hold the cloth about 25 mm (1 in.) above the floorboard.

With air circulation both above and below the tray, the pollen will remain dry and only need emptying every two or three days. Bees are prevented from gaining access to the pollen by a 4.2 or 3.6 mm (6 or 7 mesh/in.) galvanized screen placed horizontally above the tray (Figure 11).

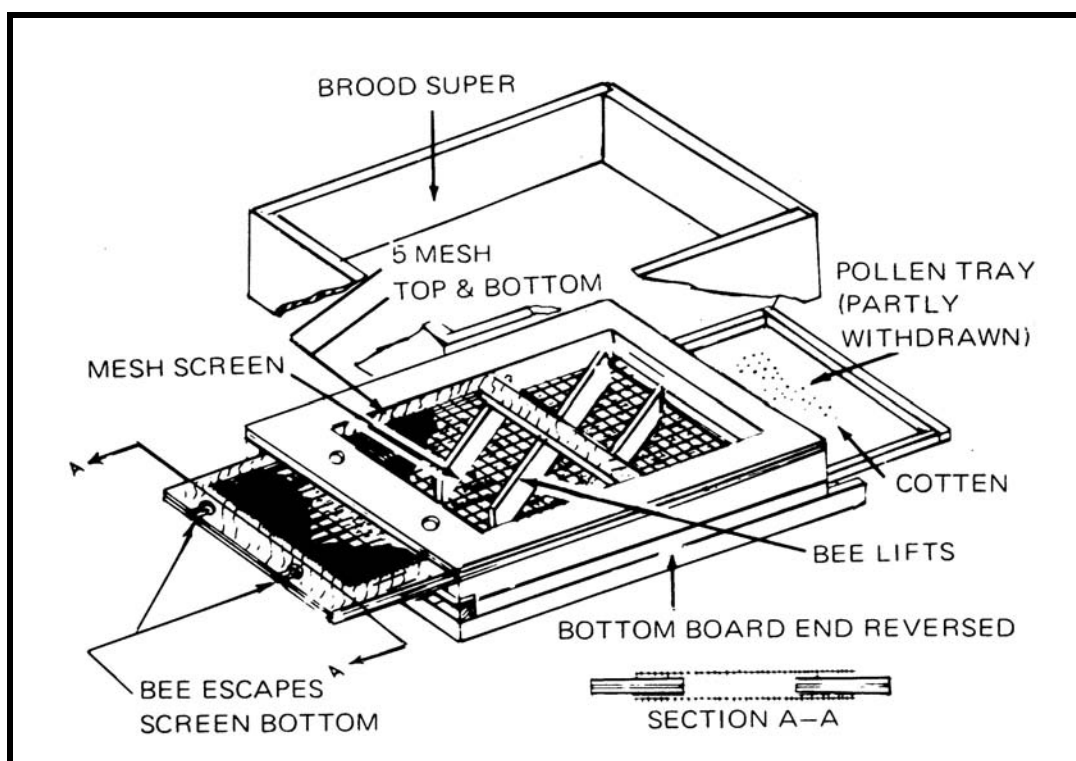


Figure 10. OAC pollen trap partially assembled

The Pollen Barrier

The barrier is made from two screens of 5-mesh galvanized screen, spaced 6 to 8 mm (1/4 in. to 5/16 in.) apart. The easiest is to fasten the screens to both sides of 1/4 inch plywood that can be pulled out of the trap from the rear of the colony whenever pollen collections need to be stopped. Cut out an area of 33 x 28 cm (approx. 11 x 13 in.) from the plywood and fasten the screens on both sides. Make sure that there will be enough space to slide the pollen barrier into the pollen trap. At one end of the pollen barrier slide, cut in bee/drone escapes (see **Drone Escapes**, Figures 10 and 11).

To ease installation and removal, grease the edges of the plywood slide with oil or wax to prevent bees from propolizing it.



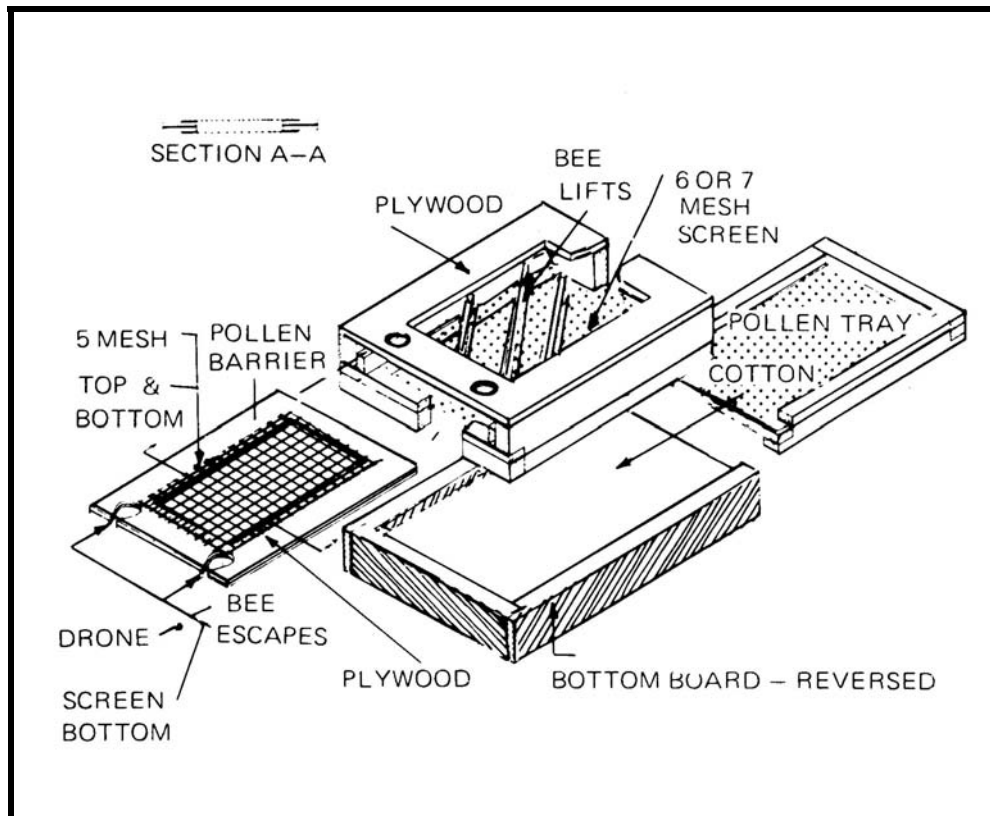


Figure 11. Diagram of OAC pollen trap showing individual parts

Bee Lifts are provided by fastening three slats of wood placed on edge to the lower screen. These are placed diagonally in the trap and extend up so they just clear the pollen barrier screens. These lifts permit the bees to readily run up to the pollen barrier allowing for more uniform distribution of pollen in the trays.

Drone Escapes are provided by drilling two 25 mm (1 in.) holes through both the front rim of the main trap unit and through the rim of the pollen barrier slide directly beneath it. Two V-shaped notches are then cut to connect the drilled hole to the front edge of the pollen barrier frame, leaving a space at the front margin just wide enough for a single drone to pass through. A small piece of screen is then tacked over the lower side of this hole and notch. This simple arrangement permits the drones, as well as many workers, to leave the hive without passing through the pollen barrier screens. Relatively few bees find their way back through these small openings.

The weight-supporting outer frame of the pollen trap is constructed of 19 mm (3/4 in.) lumber to form a rim about 76 mm (3 in.) deep. The balance is made of 6 mm (1/4 in.) plywood.

Pollen yields vary according to season and location. In some areas as much as 0.45 kg (1lb.) per day has been trapped from a single hive. Even with the OAC pollen trap, at least 33% of the pollen gathered by the bees passes through the pollen barrier. As such, there appears no reduction in brood rearing or honey production even when traps were kept on colonies throughout the whole season.



MOVING BEES

In British Columbia, migratory beekeeping has become an integral part of management. Commercial beekeepers ship large numbers of colonies from northern beekeeping areas to southern British Columbia for the winter months. Others move large numbers of colonies for crop pollination contracts.

When hives need to be moved, the cover, supers and bottom boards must be securely fastened with strapping, hive staples, or laths. Clustering screens, approximately 10 cm (4 in.) deep, may be placed on top of the hive. A folded tuck-in screen can be placed in the entrance during the evening when the bees are all inside. Screens provide ventilation and clustering space for the bees and are especially useful when colonies are shipped during hot weather.

In case of emergency, colonies can be moved without screening. This should only be considered for short distance shipments within beekeeping districts. For longer distances, screen or net the colonies to prevent bee escape.

Any beekeeper planning to frequently move hives is advised to build covers and bottom boards to the dimensions shown in Figures 12 and 13. These bottom boards and covers allow hives to be placed close together. The dimensions of the protruding entrance of the bottom board coincide with the combined 38 mm (1 ½ in.) overhang of the cover on the front and back hive. The absence of overhang on the sides of the cover permits close side-by-side placing of hives and reduces the chance of dislocating bottoms and supers in transit. This type of migratory equipment results in a tight-fitting, compact load.



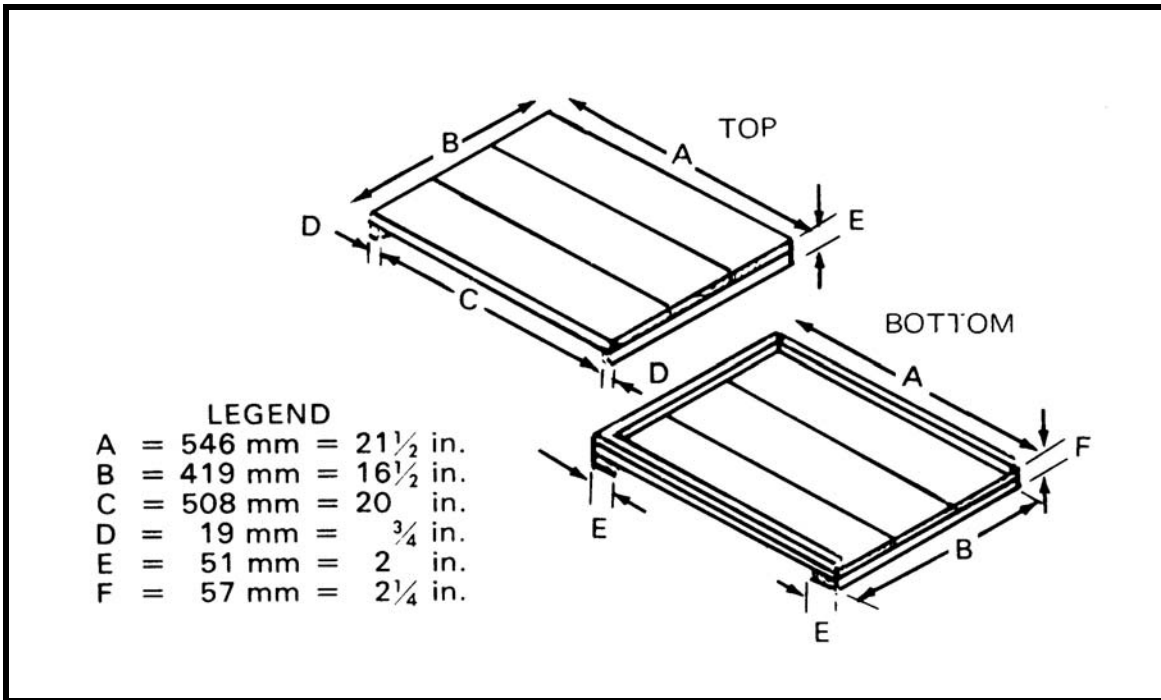


Figure 12. Langstroth hive cover and bottom board used for migratory beekeeping

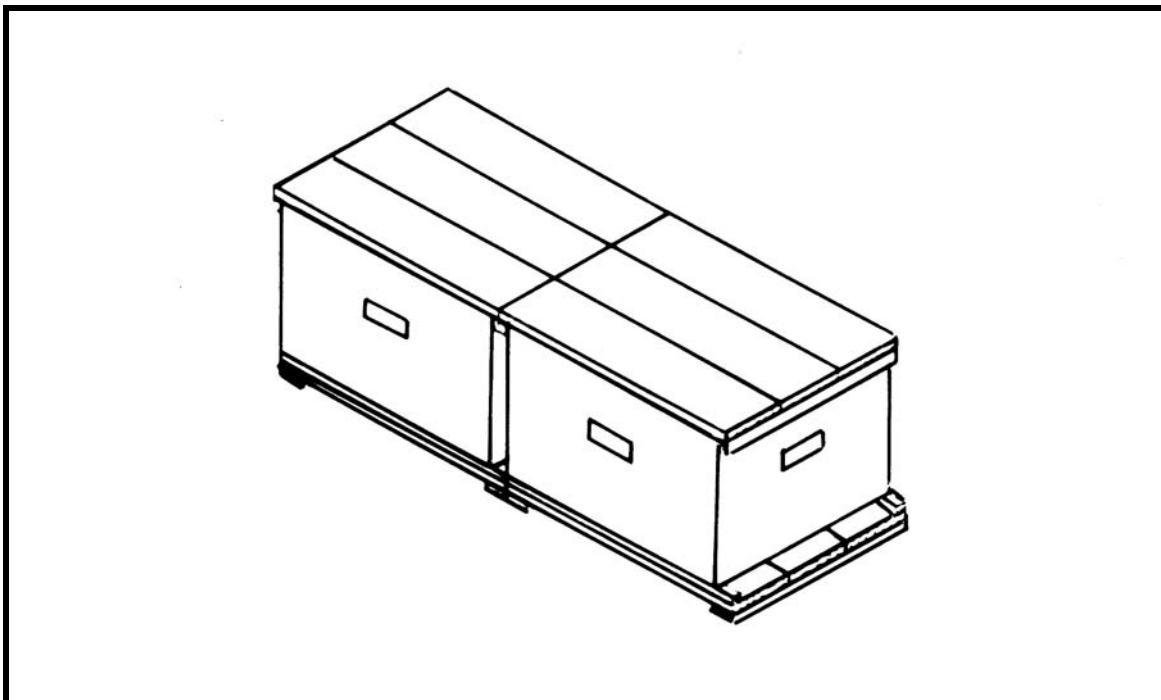


Figure 13. Two single super hives in position showing close fit of bottoms and covers (Note: No overhang of the cover on the sides permits close side-by-side placement of hives)

