

Chapter 3

Beekeeping Equipment

This section will be largely a practical demonstration. We shall not try to explain all the possible uses of all the types of equipment, but will try to show all those which are the essential everyday tools of the beekeeper and how they work.

They are grouped under five separate headings:– (1) Beehives and their accessories, (2) protective clothing to prevent stings, (3) tools used in opening, inspecting, manipulating and transporting hives, (4) equipment used in handling the crops of honey and beeswax, (5) miscellaneous and specialist items.

3.1 Beehives and their accessories

The old-fashioned straw skep is still available from suppliers. It is now a rather expensive item, though originally it was a cheap option which any farmer could make from his own straw. When used as a beehive, it does not permit modern methods of beekeeping. It can be useful for catching a swarm, but the same job can be done just as well with a cardboard box, available free from your local supermarket.

Too many different patterns of beehives are readily available on the market in Britain. All are equally well liked by the bees, but different beekeepers all swear by their own favourites. The problem they cause is that parts from one type of hive will not fit another type. The one crucial piece of advice about them to intending beekeepers is to **CHOOSE ONE READILY AVAILABLE TYPE, THEN STICK TO IT AND REFUSE ALL OFFERS OF INCOMPATIBLE EQUIPMENT.**

The essence of modern beekeeping practice as initiated by Langstroth is complete flexibility, allowing boxes or even individual combs to be transferred between hives. Any mixed equipment will tie your hands and be a source of frustration.

3.1.1 Parts of a hive and its accessories

Most modern beehives follow the pattern of the original Langstroth hive as it has been simplified by commercial beekeepers. The Langstroth pattern itself is in almost universal use throughout the USA, Canada, Australia and New Zealand. It consists of a *floor*, which is a rectangular board with raised $\frac{1}{2}$ inch (about 13 mm) wooden cleats on three of its four sides, the fourth open side providing an entrance slot; one or more *brood boxes* which are simple rectangular wooden boxes without top or bottom, having rebates cut in the top edges of a pair of opposite sides to hold the ends of the top bars of the carefully dimensioned wooden *frames* in which the bees are guided to build their combs. These boxes simply stack one above the other. There will also be several shallower *honey supers* of the same basic design as the brood boxes; a *crown board*, which is a flat board to cover the topmost box, and which may have one or two feed/bee-escape holes cut in it; and finally a *roof* with sides which fit down over the topmost box for security against wind, and which is covered with roofing felt or metal to make it weather-tight.

Most beekeepers will also use a *queen excluder* — either a sheet of slotted zinc or plastic, or a frame of accurately spaced wires — which can be laid to fit exactly between two boxes. The slots are just wide enough for worker bees to pass through, but prevent the passage of queen or drones which are larger. Those honey supers above the queen excluder remain entirely free of brood which simplifies harvesting at the end of the summer.

There may also be an *entrance block* to close the entrance for transporting the bees if necessary, and when this is inserted so as to close the entrance completely, the solid crown board must be replaced by a perforated zinc *transportation screen*, and the roof removed to allow top ventilation to the imprisoned bees. For transport, some means of securing the stacked boxes to one another are needed. Some of the options available are *ratchet hive straps*, or *plastic tapes*, or simply *wooden battens* nailed or screwed to the hive sides.

Feeders are also available to give supplementary feeding of sugar syrup in September to those stocks which have been left after harvest with too little honey to see them through the winter, or to those stocks found in spring to be dangerously near starvation, or as a boost to a newly established swarm. There are two basic designs, *contact feeders* which slowly drip feed syrup through the perforated lid of the inverted feeder, and *rapid feeders* which allow access to the surface of a large volume of syrup through a *narrow* slot, so the bees do not drown themselves in the syrup. All contact feeders have to be enclosed by an empty super, as do some rapid feeders, though the *Ashforth* and *Miller* designs are of the size of a hive box, and simply sit above the top box of the hive under the crown board.

3.1.2 The WBC hive

The diversity of hive types in Britain is due to the efforts of many well-meaning amateurs near the beginning of the twentieth century. Chief among them must be mentioned William Broughton Carr who designed what is still called the WBC hive. This is the pattern of hive you see in all the pretty rural pictures. Carr's idea was that bees would fare better in Britain's damp climate if protected from the weather by double wooden walls, like the cavity walls of a house. His design is considerably more complicated as it consists of a number of rather flimsily constructed inner boxes that carry the frames with their ends right on the tops of the side walls. These are built up on a solid wooden floor standing on wooden legs with a specially constructed entrance, and the stack of boxes is topped either by a crown board or (more traditionally) by a cloth "quilt". But then stoutly built telescopic outer wooden "lifts" are placed around the inner boxes resting at the bottom on the outer edges of the floor, and a pitched roof covers the stack of lifts. It is an excellent hive for the bees, but uses a great deal of timber and is therefore both expensive and heavy. It is also tricky to transport with bees in it.

The frames used in the WBC hive are different in size from those used in the Langstroth hive, and they have extra long top bars which make them very easy to handle, but awkward to fit into a Langstroth-type box, even if it is re-dimensioned otherwise. However the WBC hive became so popular in Britain that these frames have become the British Standard.

3.1.3 The National, Smith and Wornit Commercial hives

Several Langstroth-type single-walled hives have been designed around the British Standard frame. The original National hive was at one time adopted as the British Standard Hive. This has specially thickened front and back walls to its boxes to accommodate the long top bars of the British Standard frame. A close relative is the Wornit Commercial Hive designed by the Appliance Dealers Messrs. R. Steele and Brodie of Wornit in Fife, who for long were the principal suppliers of beekeeping equipment in Scotland, but who closed in 1998. This hive has slots cut into the bottoms of the box walls which engage with wooden ridges set into the tops of the walls of the box below. This makes a very solid hive, excellent for transport, but whose boxes can be difficult to separate for inspection.

The Smith Hive, designed by Willy Smith of Innerleithen fits the British Standard frames into a Langstroth-type box by chopping 19 mm ($\frac{3}{4}$ inch) off each end of the long top bars, reducing them

from 432 mm (17 inches) to 394 mm ($15\frac{1}{2}$ inches). It is the simplest and cheapest of the British designs.

Now that Steele and Brodie are out of business, the Wormit Commercial hive is no longer available commercially, but there are still a few beekeepers using them. They are *almost* completely compatible with National hives, but not with Smith ones because the Smith hive uses frames with shorter top bars. For the same reason, Smith and National hives are incompatible.

The most commonly used hive type throughout the UK is probably the Modified National, which is the same design as the original National, but with a simplified front and rear wall construction to the hive boxes. In Scotland however, and certainly in this area, the Smith hive has, until recently been almost equally popular. However the Modified National is being actively promoted by most of the equipment suppliers and so is probably going to become the *de facto* standard for the whole of the UK.

3.1.4 Some more unusual hive designs

Less common patterns are the Modified Dadant and Langstroth Jumbo hives which are American designs taking larger frames to encourage big brood nests; the Glen Hive which is an enlarged version of the WBC; and the Modified Commercial which is a version of the National with deeper brood boxes and brood frames. A new addition to this range is the Dartington Long Hive which expands horizontally rather than vertically, and works well for any beekeeper who never moves his bees. All these hives with extra large brood boxes require a physique something like Desperate Dan's to move them around, and are perhaps best avoided by lesser mortals. The bees love them all!

3.1.5 Top and bottom bee-space

Difficulties of compatibility of equipment are compounded by inconsistency in using *top bee-space* or *bottom bee-space*. Langstroth's principle requires there to be a 6 mm ($\frac{1}{4}$ inch) bee-space between ALL separable parts, and in particular between the tops of the frames in a lower box, and the bottoms of the frames in the box above. *Either* the top bars may lie flush with the top of the box, and the bottom of each box must protrude 6 mm ($\frac{1}{4}$ inch) below the bottoms of the bottom bars of the frames it holds (bottom bee-space), *or* the top bars fit 6 mm ($\frac{1}{4}$ inch) down from the top of the box, and the bottoms of the frames in the box above hang flush with the bottom of the box they are in (top bee-space).

The original Langstroth design, the WBC hive, the Wormit Commercial and the original and modified National designs used the first arrangement. Most others use the second, which is generally thought nowadays to be slightly more convenient for the beekeeper. All modern Langstroth hives and some modern National hives have gone over to this second arrangement of top bee-space. Before buying additional equipment, make sure it matches yours in this regard, because mixing these types leads to a well and truly gummed up hive in working which you are almost bound to kill many bees unavoidably.

3.1.6 Putting hives and frames together

Assembling hive boxes and roofs

If hive boxes and roofs are being bought new, some money can be saved, and transport made easier, if they are bought "in the flat". They then have to be assembled, which is a reasonably straightforward job with hammer and nails, though for knocking together the joints on Smith type hives, hammering the parts through a piece of scrap wood avoids the bruising of the wood that direct hammering will cause. Glueing the joints as well as nailing them is recommended. The instructions that come with the boxes are fairly clear, and anyone who can put together an Ikea flat pack need have no fear.

The top quality traditional hives are of western red cedar and are best left unpainted. If any wood treatment is applied, then

- only apply it to the *outside* of the boxes where the bees don't walk much;

- make sure it is a type which does *not* contain an insecticide as protection against woodworm. That would kill your bees in short order! The manufacturers of beekeeping equipment sell a recommended type, though many beekeepers successfully leave western red cedar boxes totally untreated, and they last for many years.

In recent years, some manufacturers have been experimenting with hives made of the plastic polystyrene, to National or other designs. They are said to keep the bees very dry and warm in winter, and they have other advantages. The boxes are supplied flat packed and require no glue or tools to assemble. They are supplied with a mesh floor as standard and so, taking into account the ongoing problems with Varroa, this is a big advantage. They are however not very cheap, and of course cannot be scorched with a blowlamp to disinfect them.

Assembling frames and foundation in which the bees will build combs

The frames for the bees to build their combs in, of whatever design, are best bought in pieces for assembly at home. When frames are assembled the parts fit snugly together and many beginners think that friction with added propolis is all that is needed to keep them together. Don't make that mistake, or you will one day lift a comb by its top bar to inspect it, only to have the whole thing suddenly detach itself to fall in a hopeless mess at your feet of squashed bees (maybe including the queen!), spilled honey, broken comb, and destroyed brood. Even worse, you may find that when you prise out the top bar with your hive tool, the top bar is all you get, and the comb and the rest of the frame is still in the hive, and totally impossible to get out. Frames **MUST** be securely nailed, and frame nails are readily available.

One nail must be inserted through each side bar into the top bar, and then the frame turned over and the same done on the other side. Also nails should be inserted from the bottom of the frame through each bottom bar into the side bar. Some people nail across through both bottom bars. Although this is very secure, it prevents the bottom bars from being prised out again in order to insert fresh wax foundation again at a later date. However if you are prepared to scrap brood frames when the comb becomes unsatisfactory, this does not matter. The cost of each frame is currently about £1 (2007 prices). Before fully assembling the frame however, remember that *wax foundation* must be secured inside it.

Foundation is the name given to the sheets of beeswax embossed with the pattern of honeycomb cell bases which appliance dealers sell, and which is fitted inside each new frame before it is placed in the hive. It can be purchased with wire reinforcement inserted for additional strength in the brood nest, or for combs that will be spun in a centrifugal honey extractor. Alternatively thin unreinforced sheets can be bought if you decide to harvest your honey in the comb. Foundation is what guides the bees to build their comb where **WE** plan and not where **THEY** fancy, which might well be spanning three or four of the wooden frames, making it impossible to lift out individual combs for inspection, thus defeating the whole Langstroth philosophy. In assembling a new frame therefore, the order of operations is as follows.

First remove the wedge from the top bar, which is held there by a sliver of wood, and clean away that sliver with a sharp knife or your hive tool. Then assemble the top bar and the side bars, making sure the slots in the side bars are facing *inwards*. Nail the side bars to the top bar from each side as described above making sure the frame remains on the square.

Next fit the bottom bar on the side of the frame away from the wedge and nail it in place. Ensure that each end of the bottom bar lies flush with the outside edge of the side bar so that the side bars will hang truly parallel and at right angles to the top bar. If the frame is not to be given to the bees immediately, next fasten the wedge and the other bottom bar to the frame with sellotape and leave it like that until the day it is to be given to the bees. Foundation put into a frame quickly loses its attractive aroma of beeswax and goes stale, and then bees will not build satisfactory comb from it. Foundation kept in its air-tight plastic wrapper will keep in good condition for several years, provided you don't let mice get at it.

When inserting foundation into the frames, choose a warm day or a warm room to work in so that the wax is not too brittle. Carefully slide the foundation along the slots in the side bars, orienting the sheet if it is wired so that the hooked ends of the crimped wires, or the loops on the zig-zag wires (bent by you at right angles away from the sheet of wax) fit into the gap where the wedge came out. Then lay the wedge back into the place it came from and use it to nip the top of the sheet of foundation and to trap the ends of the wires, securing it with three nails NOT hammered right home (you may wish to get them out again at a later date). Finally insert the remaining bottom bar in the frame, ensuring that the bottom edge of the foundation can slide freely between the two bottom bars to allow for expansion when the bees warm up the wax, and nail that bottom bar in place.

It is worth making sure you get all this right. Frames which have not been correctly assembled will put both you and the bees throughly out of temper, probably on a day when you are both already fed up because the weather is bad.

Spacing frames in the hive

The standard frames with straight side-bars must be spaced apart in the hive by some sort of spacer. The traditional British spacer is the “metal end” which is going out of favour as it quickly goes rusty, gets clogged with propolis and finally collapses at a crucial moment after cutting your glove and your finger inside it. The modern replacement, the “plastic end”, is a little better but can slide off the short lugs of Smith frames at embarrassing moments. Most users of the Smith hive prefer the alternative of self-spacing Hoffmann frames, whose side-bars are thickened at the top so that they are in contact over a short distance when the frames are correctly spaced. The bees do propolise the contact area, but it is small enough to be tolerable. Alternatively Hoffmann converter clips in plastic can be nailed to the side bars of conventional frames to do the same job. In the honey supers, straight-sided Manley frames in contact throughout their depth are excellent, since they hardly ever have to be inspected, and so the fact that they get propolised hard together does not matter, since they only need to be dealt with away from the bees at harvest time. These Manley frames are a little more expensive, as they use more timber, but they are very strong, hang beautifully straight in the honey extractor, and last for many years.

Another spacing alternative in honey supers is to use ordinary straight-sided frames without any attached spacer, but to fit *castellated spacers* inside the super, which are metal strips looking like the battlements on a castle, and into the gaps of which the frames fit neatly. Modern National supers are made with a slot to receive these castellated strips. They must *never* be used in the brood box however, since they prevent the frames from sliding along and make inspecting the brood box very difficult.

The WBC hive is designed to take 10 frames in a box at metal-end spacing. Some modern Hoffmann frames give a slightly closer spacing — $1\frac{3}{8}$ inches (3.5 cm) instead of $1\frac{1}{2}$ inches (3.8 cm) — and it is then possible to squeeze an eleventh frame in. This is inadvisable as the frames jam hopelessly after a little propolis has been added by the bees. It makes for much easier working if the end space is filled with a *dummy* — a simple wooden board cut into the shape of a frame, and easily made at home from an off-cut of shelving. The Smith and National hives take 11 frames at metal end spacing and the same argument applies here about adding a 12th frame when the narrower Hoffmann spacing is used.

3.1.7 Choices to be made for dealing with the honey crop

In the 1980s and 1990s much of the honey harvested in Scotland was Oil Seed Rape honey, which tends to granulate very hard in the comb unless one is very prompt at extracting it. If you have this crop in your area, you may have to cut out all the honey comb from the supers, and to soften the honey for harvest with gentle heat. If so, do not use wired foundation in the supers, but instead use just part sheets of unwired (possibly home-made) foundation. These can be quite quickly inserted, held in place by the wedge only. With care even these combs can be extracted if the honey has after all remained liquid.

This also allows you the option of just cutting the combs out of the frames and using it as honey-in-the-comb, saving the trouble of spinning the honey out using an extractor.

When harvest time comes at the end of the season, the bees have to be separated from the honey-combs that you want to harvest. The commonest way to get bees off the honey combs you wish to remove is to use a *clearer board*. The crown board can double up for this job, but two *Porter bee-escapes* are needed to fit into the two holes in the crown board. The modern plastic type are less trouble than the old tinfoil ones. Before they are used it is a good idea to dismantle them so that you understand how they work as one-way valves to allow bees out but not back in again, and also to smear a little petroleum jelly on the sliding parts, so that when the springs are gummed up with propolis you can get them apart to clean up the mess. Canadian or French style clearer boards (using a rhomboid or other shape of escape with no moving parts) are simpler and more effective. Do not leave clearer boards in contact with the bees for more than a couple of days at most. If you do, the bees will gum up any Porter escapes with propolis making them unusable unless they are carefully ungummed, or the bees will learn to find their way back through the maze of the escape and take back all the honey for their own use.

3.2 Protective clothing

Although the choice is varied, it is not so crucial to make the right choice and stick to it. To work bees with confidence it is essential to feel adequately protected, and it is not hard to obtain clothing that will under normal conditions keep all stings at bay. Note that this is NOT a licence to ill-treat your bees, nor is it a guarantee that you will not be stung. In fact I can guarantee that if you keep bees for long, you certainly WILL be stung. But it will be your own fault when it happens, and you certainly need never get a severe stinging unless you are careless.

A well-fitting hat-and-veil or helmet-and-veil combination to protect the head and neck is the basis of the armoury, backed up by some form of overall or bee suit, which also keeps your other garments clean from honey, wax and propolis. An alternative is a full bee suit with a veil incorporated into it. The bee suit gets dirty surprisingly quickly, so regular laundering is a good idea.

Some beekeepers dislike using gloves and are prepared to tolerate some stings to their hands. Many prefer to use gloves with elasticated gauntlets to cover the wrists. Various types are sold by the beekeeping appliance dealers, but if you are buying gloves make sure they fit your hands.

A pair of wellingtons to protect the ankles completes the outfit.

3.3 Tools for working with bees

The *smoker* and the *hive-tool* are the two things that are never long out of the beekeeper's hands when hives are being visited.

A *copper* smoker, well cared for will last for twenty years or more. A tinfoil one at about half the price will rust through in two seasons. Stainless steel ones at an even higher price than copper are now available if you wish to treat yourself to a luxury.

The *hive tool* is used as a lever, hook, scraper, screwdriver, and even hammer when need be. Get one painted a good bright colour (or paint it so yourself) or you will lose it in the grass, on the hive roof, under your tool-box etc. ten times in one afternoon — the author speaks from experience. Without it propolis will beat you. With it you can keep propolis at bay.

Two *cover-cloths* or *rollers* to lay over the tops of the frames when a hive is being examined will help to keep the bees subdued with much less use of smoke, and also help to keep some heat in the hive if it has to be examined on a cool or breezy day. They are simply made at home of some stout cloth of a size to cover the hive top, and with a wooden batten sewn into each of two opposite ends. A cloth can be rolled back to expose one frame at a time and the other rolled on from the opposite side. Some people like to dampen the cloths before use as the bees are repelled by the cold wet cloth. The

appliance dealers also now sell cover cloths fitted to a wire frame with a gap which can be slid over the frames to give the right size of working space at all times. Perhaps sliding is not quite so kind to the bees as unrolling however.

If you intend to transport hives, note that it is really a two-person job, and if you cannot get a *hive-trolley* near your hives, then a pair of *hive carriers* makes that unpleasant lifting job just about bearable.

A few simple joinery and general tools such as a hammer, a screwdriver, a saw and perhaps a chisel will let you do routine maintenance and repair work. If you are more ambitious and wish to build your own hive, than a rebating plane and some form of jig-saw will be needed. Making your own frames is not recommended unless you are a dedicated joiner. It is of course helpful to have access to a good work-bench for joinery work.

3.4 Equipment for handling the crops of beeswax and honey

If you are content to deal *only* with honey in the comb, then little equipment is needed, apart from common kitchen utensils.

For extracted honey you will need a centrifugal extractor — DON'T rely on borrowing, though SHARING may be a good idea. This is an expensive item new, particularly now that new regulations are insistent that stainless steel must be the metal used. You will also then need a settling tank or "ripeners" as it is called, although this can be of plastic, as well as at least one strainer to filter out particles of wax and other debris.

Various patent devices are available for processing beeswax, but on a small scale an ordinary kitchen double boiler is helpful. Small moulds for casting blocks of wax can be bought, but wax can be cast into a block in a pie dish or pyrex bowl with sloping sides.

Preliminary washing of honey residue from wax before it is melted down can be done in a washing-up bowl, and the washing water then strained off through an ordinary kitchen sieve or strainer. For those who wish to try making mead, the strained honey from wax cappings is usually a good starting point.

A solar wax extractor which uses the heat of the sun to separate beeswax from debris is useful if there is a fair quantity of wax to handle.

3.5 Miscellaneous and specialist items

One or two *nucleus boxes* which are miniature hives taking 5 or six brood frames only are convenient for rearing new queens.

Special paint sets for marking queens with a dab of paint on the back of the thorax can be obtained, although this is not necessary, since the bees always know where the queen is, even if you don't. However it is sometimes very useful to be able to spot her easily.

There are plenty of other goodies to be seen in the catalogues of the appliance dealers, but in my view most of the essentials are listed above.