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African Smallholder Beekeeping

Essential

Beekeeping Equipment

by Kibebew Wakjira (Ethiopia)
and Dr Guy Stubbs (South Africa)

AFRICAN HONEY BEE

IQQO
Oromia Agricultural Research Institute
Holeta Bee Research Center

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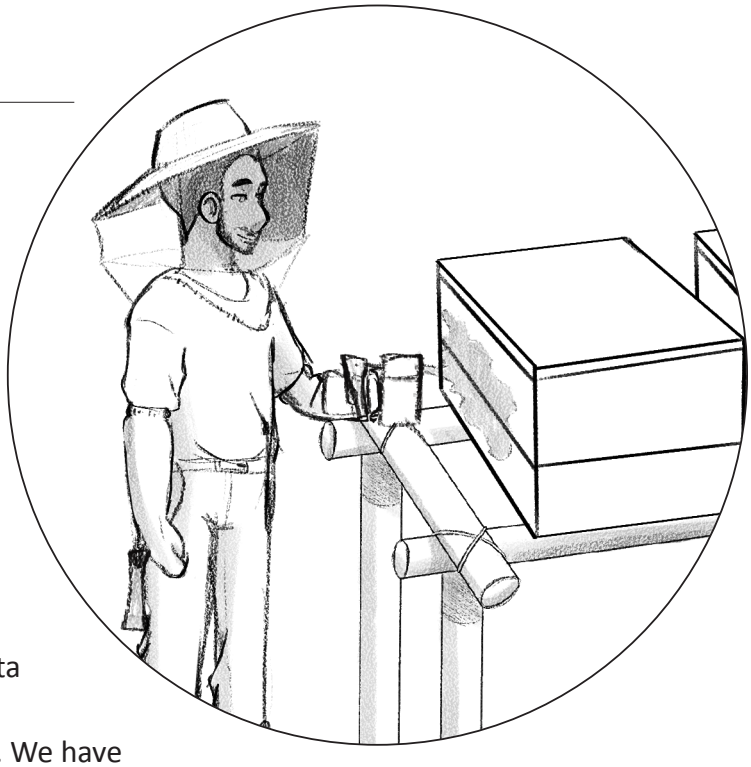


Dear Fellow Beekeeper

This is an uncomplicated guide for making essential beekeeping equipment to keep, protect as well as benefit from the African honeybee.

The suggestions in these manuals have been developed from research done by the Holeta Bee Research Centre, the SAMS project* and African Honey Bee. We have tried to offer acceptable solutions that will enable anyone to start beekeeping using the resources available to them.

By keeping bees you are much more than a Beekeeper. You are a honeybee guardian, preserving honeybees in a sustainable way to ensure biodiversity.

Biodiversity is the natural balance in nature that enables nature to survive and sustain us. Honeybees are very important in ensuring this balance because they pollinate plants. In other words honeybees by taking pollen from one plant to another on a mass scale ensures genetic diversity of plants that strengthens environmental resilience.

By keeping bees and caring for them you are protecting them and practicing nature conservation for generations to come. So, well done.

We hope that you benefit from these manuals.

Good beekeeping

Kibebew and Guy

IQQO
Oromia Agricultural Research Institute
Holeta Bee Research Center

AFRICAN HONEY BEE

* The SAMS project – https://sams-project.eu

Advantages of modern frame hives in Africa

- The comb is fixed firmly to the four sides of the frame.
  - This facilitates easy harvesting, and the beekeeper has little fear of damaging the comb.
- The strength of the built-in comb (strengthened by a wired frame) also allows easy transportation, even over bad roads.
  - It also affords easy control of a colony of bees without fear of breakage before the arrival at the new destination.
- Honey is extracted by means of the centrifugal honey extractor, which makes it possible to remove the honey without damaging the comb.
  - Empty combs are returned to the hive for the bees to refill with new honey, thus saving them from wasting time and energy to construct a replacement comb.
  - The honey harvest is maximised, as the beekeeper can keep adding drawn out combs to obtain much higher honey crops.
  - In Zambia, for instance, a frame hive with a strong colony of bees and good management, may produce over 60 kg of honey in a year.

Note: Bees consume the honey which causes the special wax-producing glands to convert the sugar into wax which is extruded through small pores. It takes 2.7 kg – 3.6 kg of consumed honey to produce 450 grams of wax. Wax appear as small flakes on the bee's abdomen.

Bee producing wax

- During hive manipulations, very few bees are crushed between frames, whereas dozens of bees can easily be killed with traditional hive beekeeping.
- The hive is so designed (with queen excluder and supers) that the queen and brood can be confined to the lower chamber.
  - Supers can contain only honey, and the lower brood chamber can be undisturbed when honey is harvested.
- A swarm of bees can be trapped as easily as with a traditional hive.
  - Bees measure the size of the cavity and are attracted by baits like propolis and wax. They are not fussy about the shape of the cavity.
- Hive boxes (supers) can be stacked easily.
  - This makes it easy to expand and contract the hive to meet the needs of the bee colony.

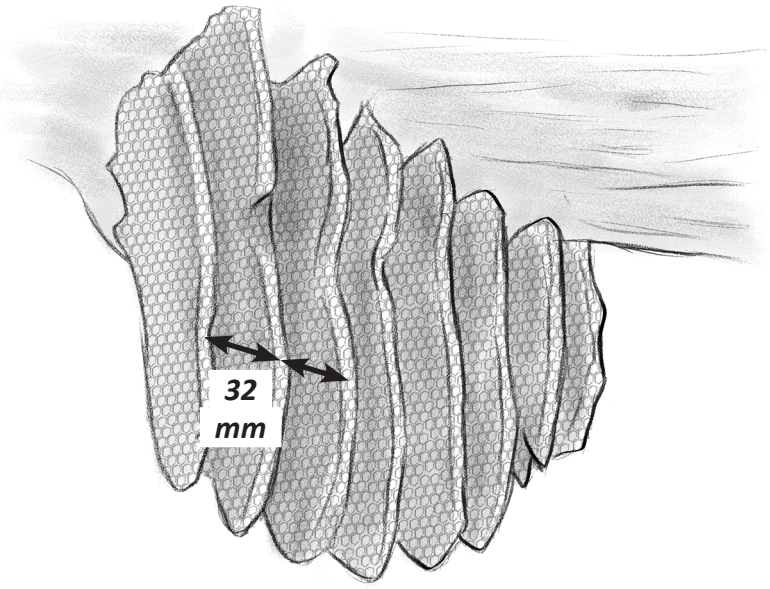
Note: A super is a box with no fixed floor or lid.

The bee space first and foremost

The bee space is the precise gap within a hive or natural nest that bees won't fill with wax or propolis. It enables the bees to crawl around in their home. **The ideal space is between 4mm and 9mm.**

If the space is **smaller than 4mm** bees will seal the space with **propolis** (bee glue).

> **Note:** Bees make Propolis from the resin of plants. It is used for its health benefits by humans.

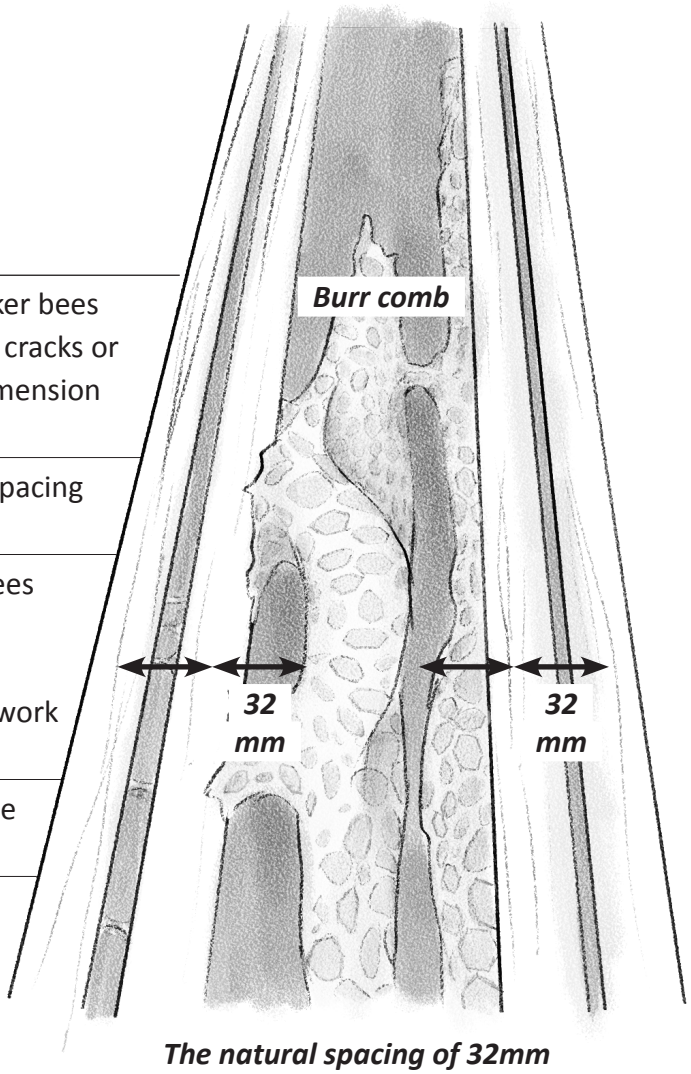


The natural spacing of combs in a wild bee nest is 32mm apart.

If the space is **bigger than 9mm**, bees will fill the space with **wax comb**.

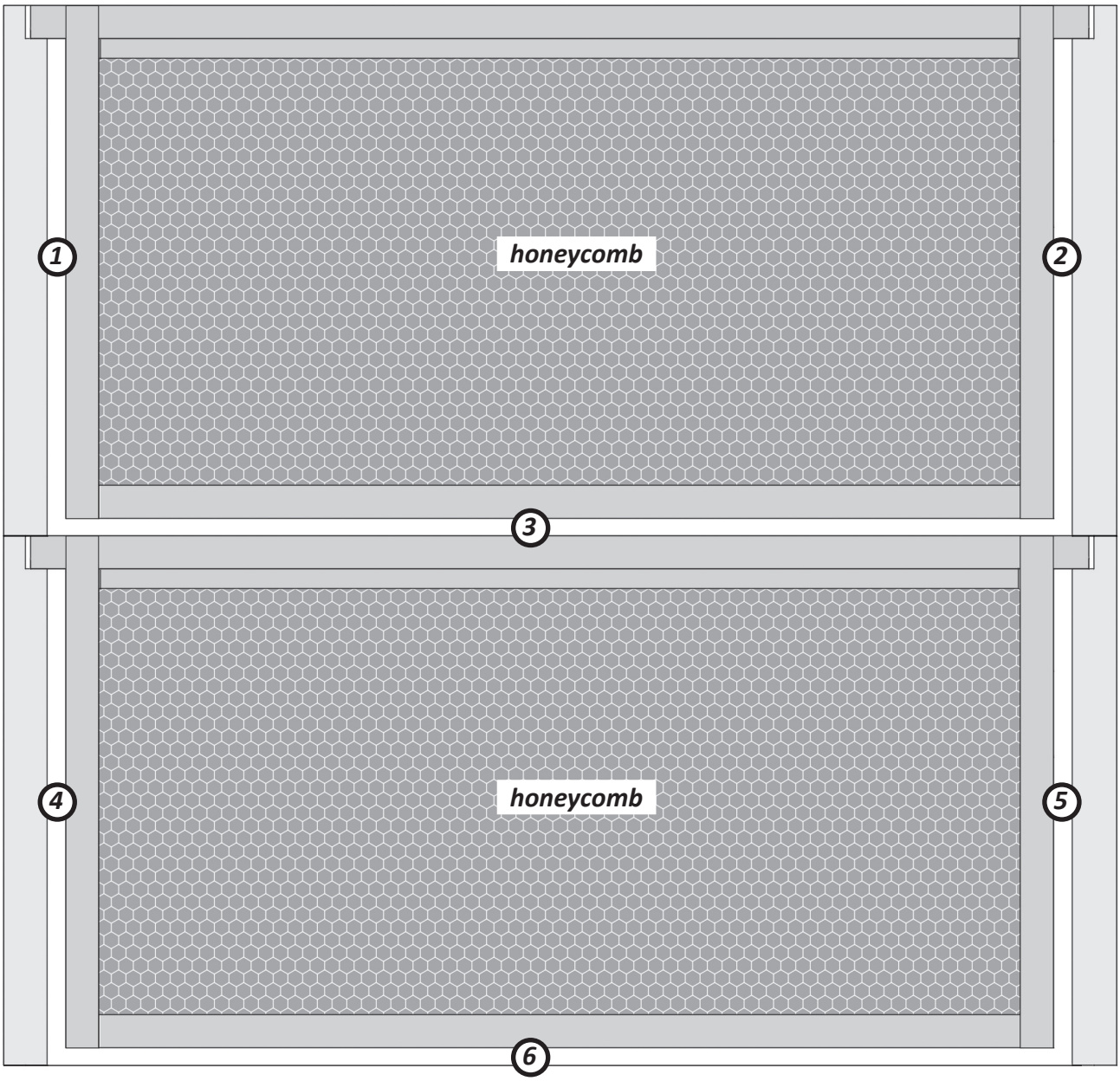
So respecting the bee space enables modern hive beekeeping.

Gap distance	Impact on bees
<4mm	This gap is too small for worker bees to pass through. Any spaces, cracks or crevices of this or smaller dimension will be filled with propolis.
4.3mm	This is the standard African spacing for queen excluders.
9mm	This is the usual space the bees will leave between adjacent areas of capped brood. This allows two layers of bees to work back-to-back.
>9mm	A gap larger than 9mm will be filled with wax comb.



The natural spacing of 32mm between comb has not been observed. The result is burr comb.

In all the spaces 1–6 illustrated below the bee space, i.e. greater than 4.3mm and less than 9mm, is taken into consideration.



Side view of two deep supers with frames showing the bee space.

So a modern hive with these bee spaces will work well and the bees will not propolise or wax the spaces.

Note: The bee space in a hive should be greater than 4.3mm so that the queen can also move all round the hive.

Modern beekeeping = Moveable frames

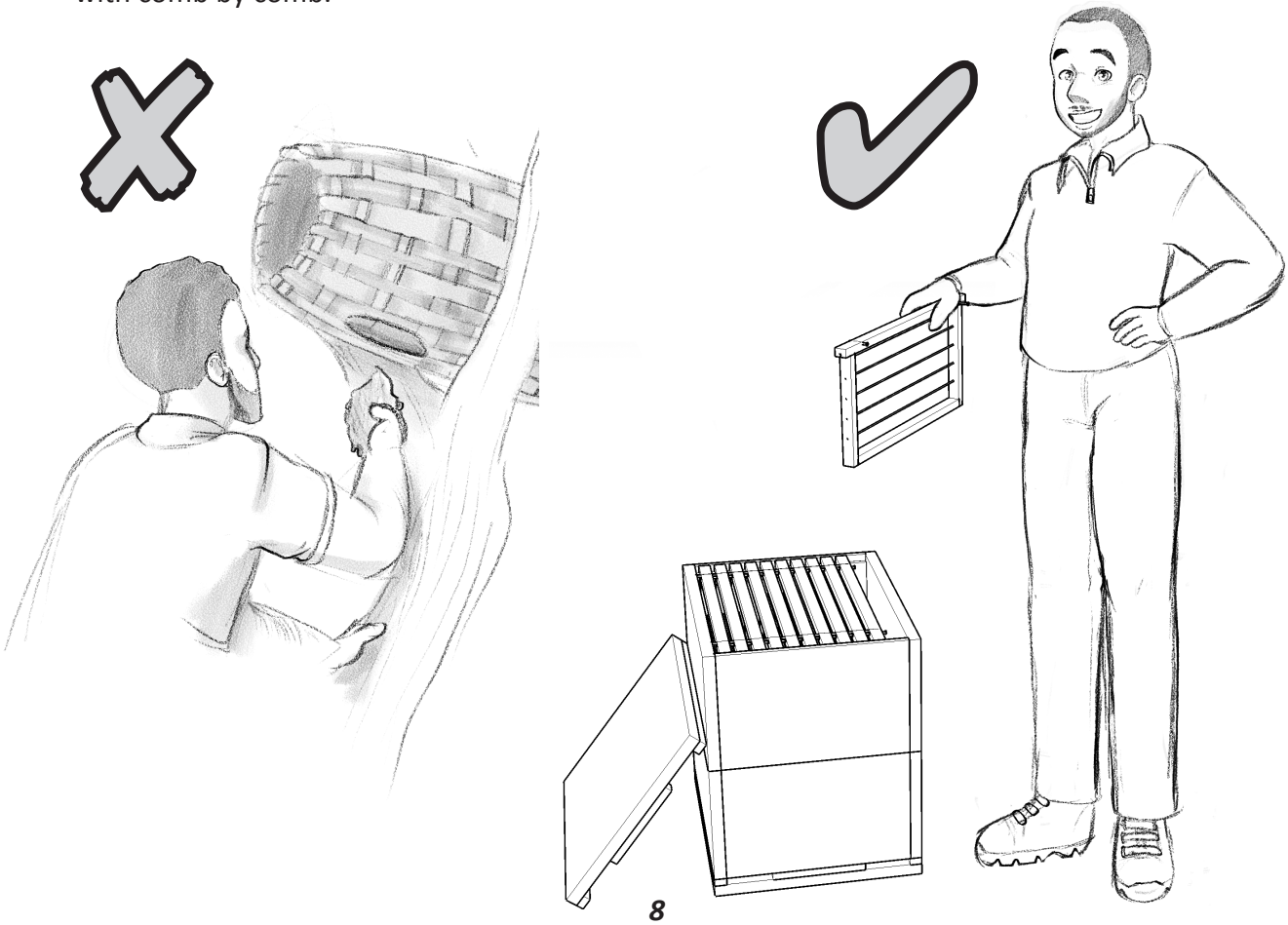
Advantages of the modern hive presented in this manual:

Like the traditional hives:

1. The construction of the hive is very simple because it only requires a table saw.
2. The hive can also be constructed from locally available materials.
3. It does not require skilled work force to construct the beehives and run the beekeeping.
4. The modern hive can be used to easily catch swarms.

Better than the traditional hives because:

1. Convenient to inspect and care for the bee colonies.
2. Expandable so can manage swarming.
3. Can add extra supers for honey production.
4. Can partition brood and honey.
5. Expandable so greater harvest.
6. Moveable frames result in less bees killed and less disturbance of the colony.
7. Modern hives enable better management of brood because it can be inspected and worked with comb by comb.

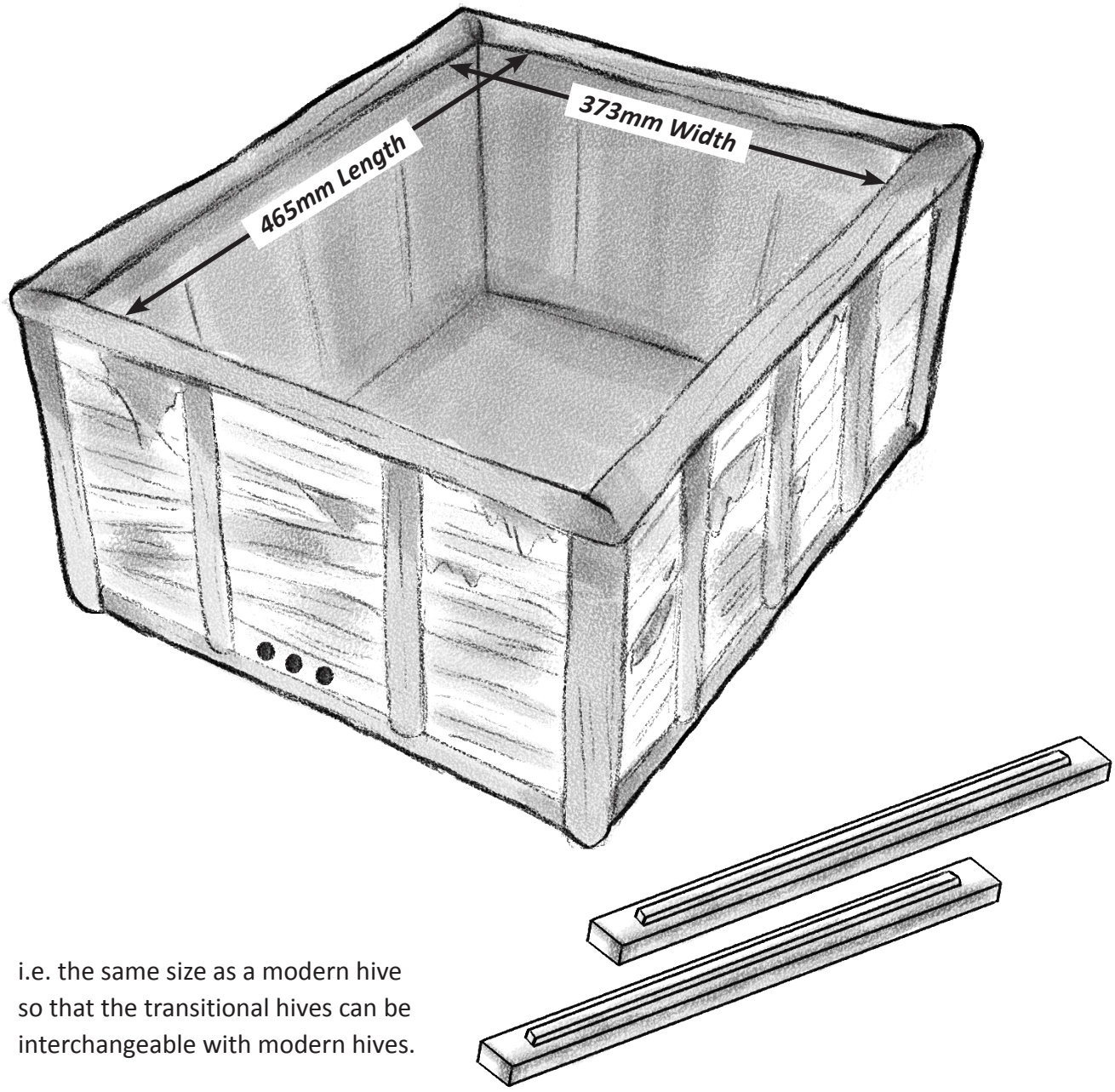


Transitional hive philosophy

Transitional hives use the bee space.

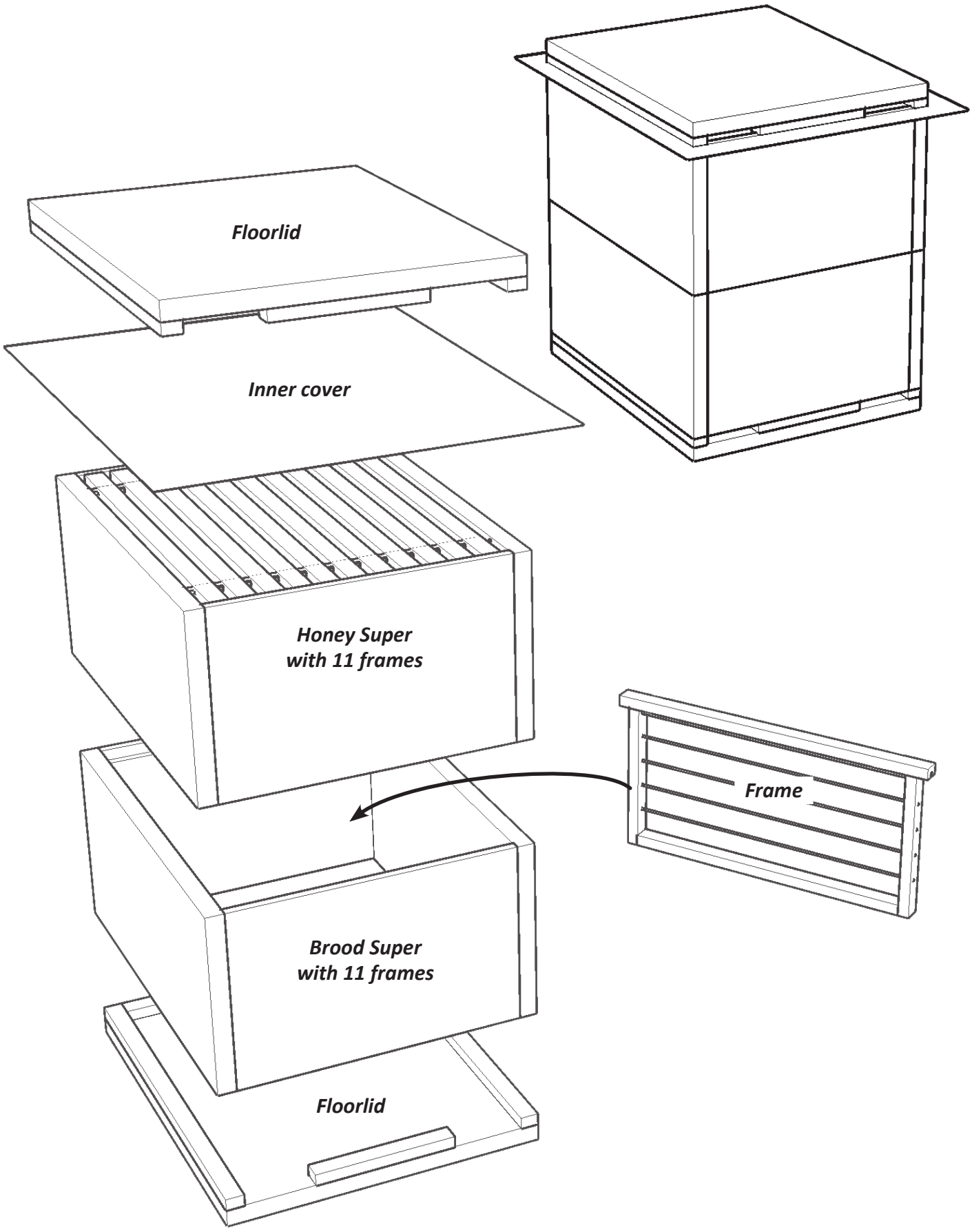
Top bars that are exactly 32mm with waxed starter strips are placed over a cavity to incentivise bees to build comb that hangs off the top bars. In this way combs can be individually handled using the top bars that the combs hang off.

The size of the cavity is not relevant so this manual proposes a transitional / top bar hive inside size of:



i.e. the same size as a modern hive so that the transitional hives can be interchangeable with modern hives.

A modern moveable frame hive



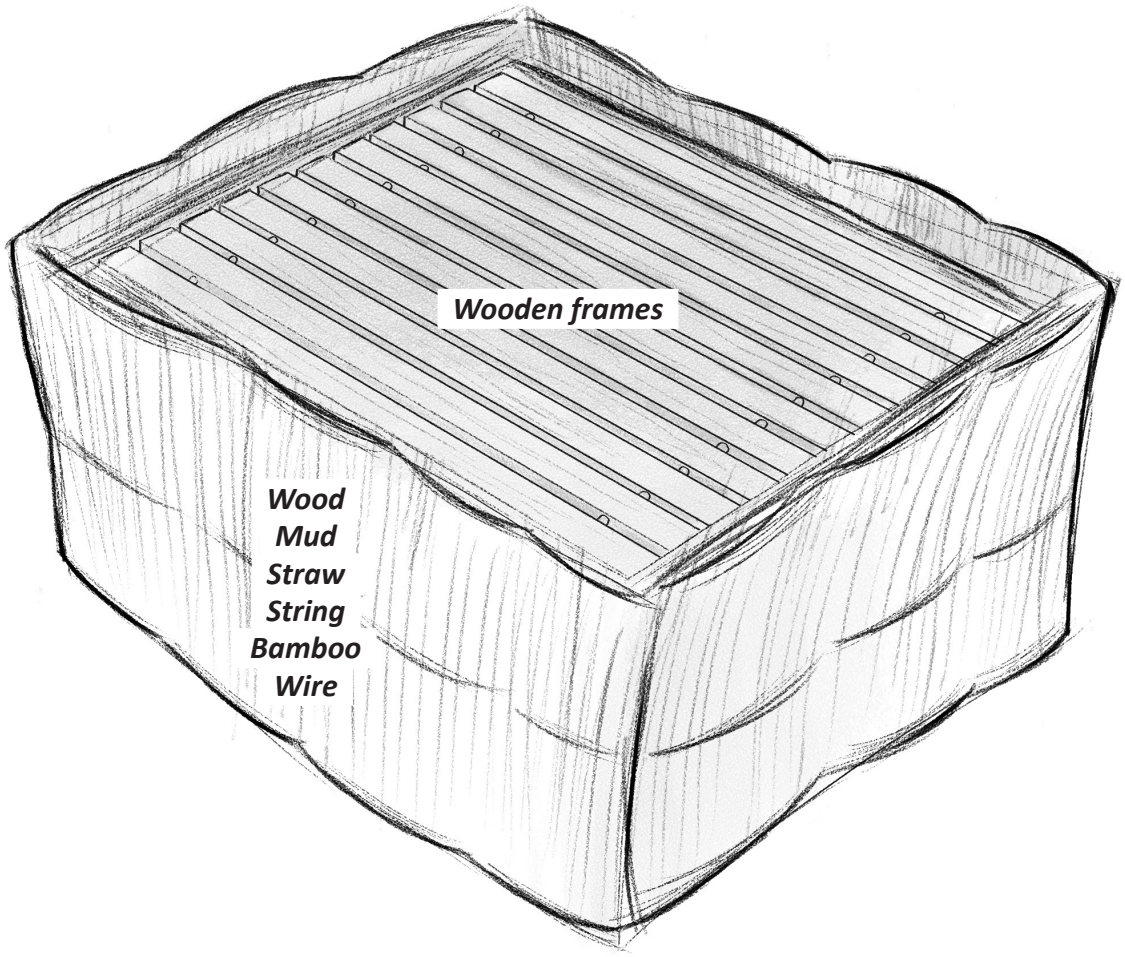
How to make a modern hive

Considerations with making a modern hive

1. Timber thickness should be 22-25mm (the maximum thickness for frames should be 27.7mm if you want to use your frames as a queen excluder See page 24).
2. Join with nails / screws and glue if possible.
3. Make sure super & floorlid inside sizes are 100%.
4. Make sure frame outside size are 100%.
5. Coat the outside of the supers and the whole of the floorlids with car / tractor / truck used oil. Heat the oil so when you apply it, it penetrates better.

> **Note:** Hot oil is extremely flammable and can explode if it comes into contact with a naked flame, so please be extremely careful.

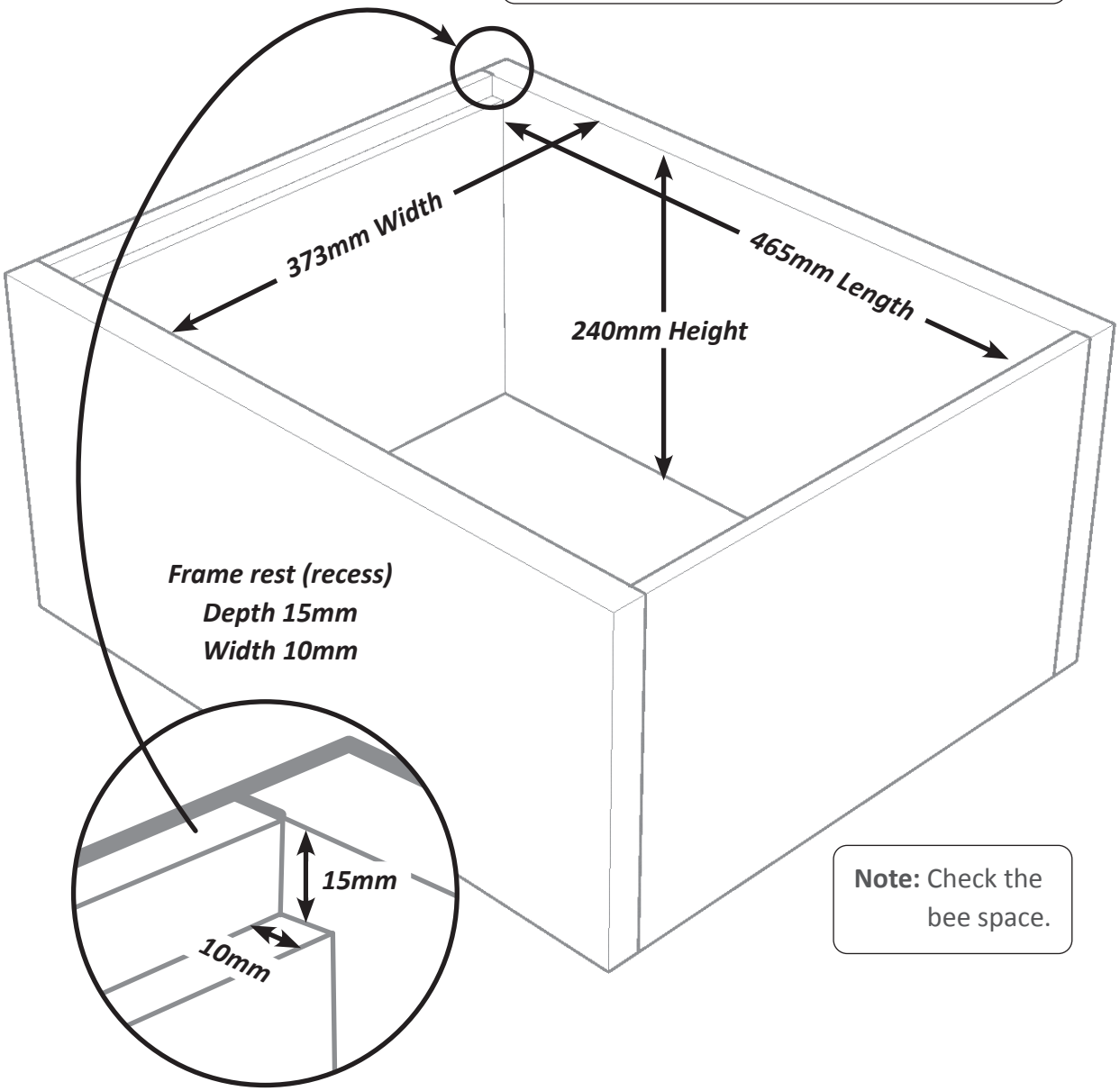
6. The hive consists of:
   - **a.** 2x floorlids
   - **b.** 22x frames
   - **c.** 2x supers
   - **d.** inner cover
7. Always double check the bee space.
   As long as the **bee space** is taken consideration of and the **outside** sizes of the frames and **inside** sizes of the hive are exactly the same as in this manual the hive can be made of any materials.



Modern hive deep super inside sizes

x 2 in one flatpack

Tip: A deep super is a box with no lid or floor that the bee frames fit into. It forms the main part of the hive body.



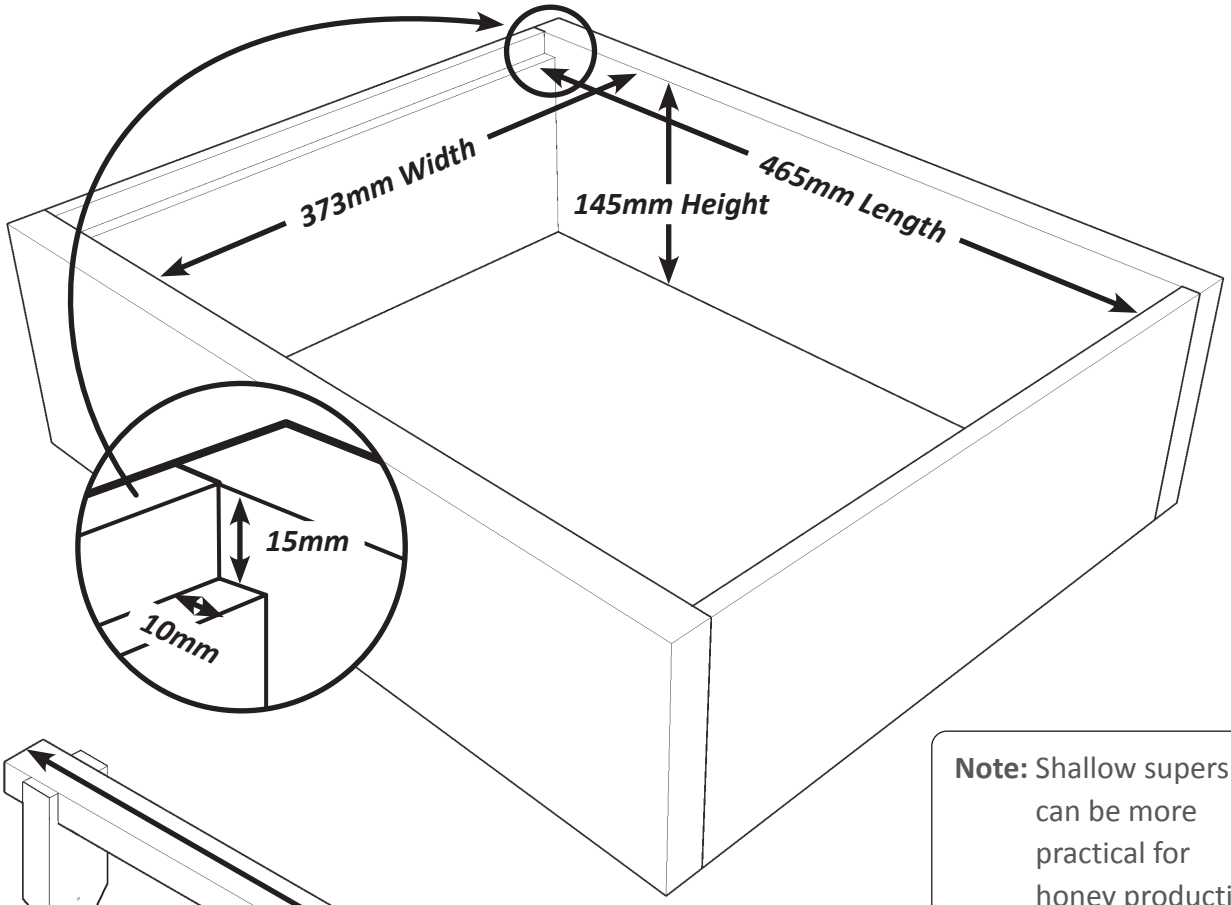
Note: Check the bee space.

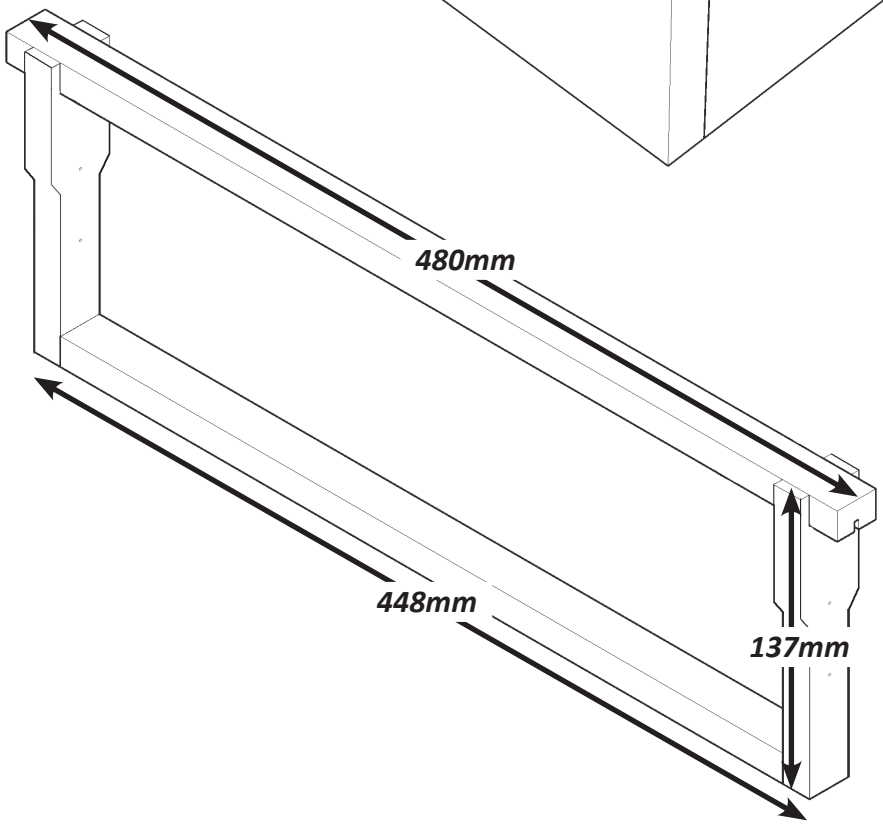
Note: The best combination is to use a deep super for brood (because it provides the queen ample space for laying) and wired shallow supers for honey (because less comb breakage is experienced during transportation and extraction).
But if you can extract (spin) the honey frames out at the hive, 2 x deep supers is a simpler method as long as you use wire to strengthen your combs.

Modern hive shallow super inside sizes

If you use this size you will either need 4 shallow supers or 1 deep super and 2 shallow supers for a hive.

Note: Sometimes it is difficult to get hold of timber wide enough to make the supers 240mm high. An alternative height that we use in South Africa is a super height of 145mm. In this case the frame height needs to be 137mm for the bee space to be observed.

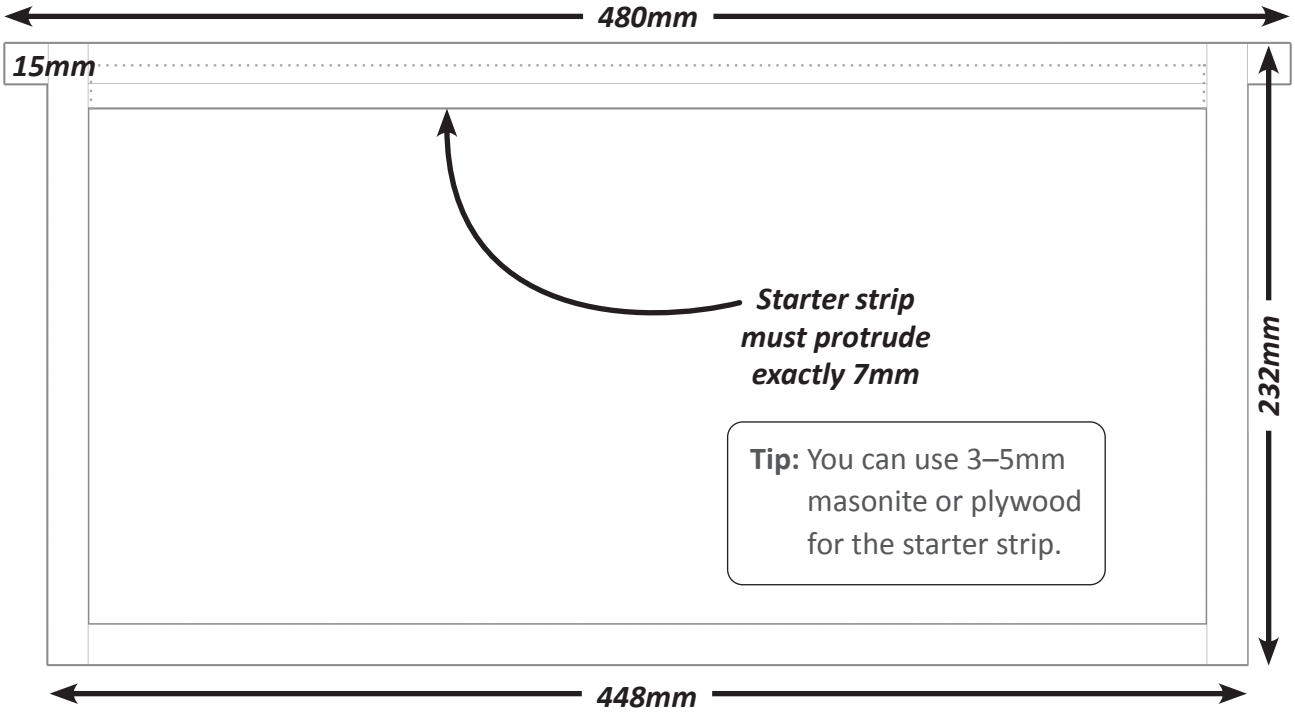




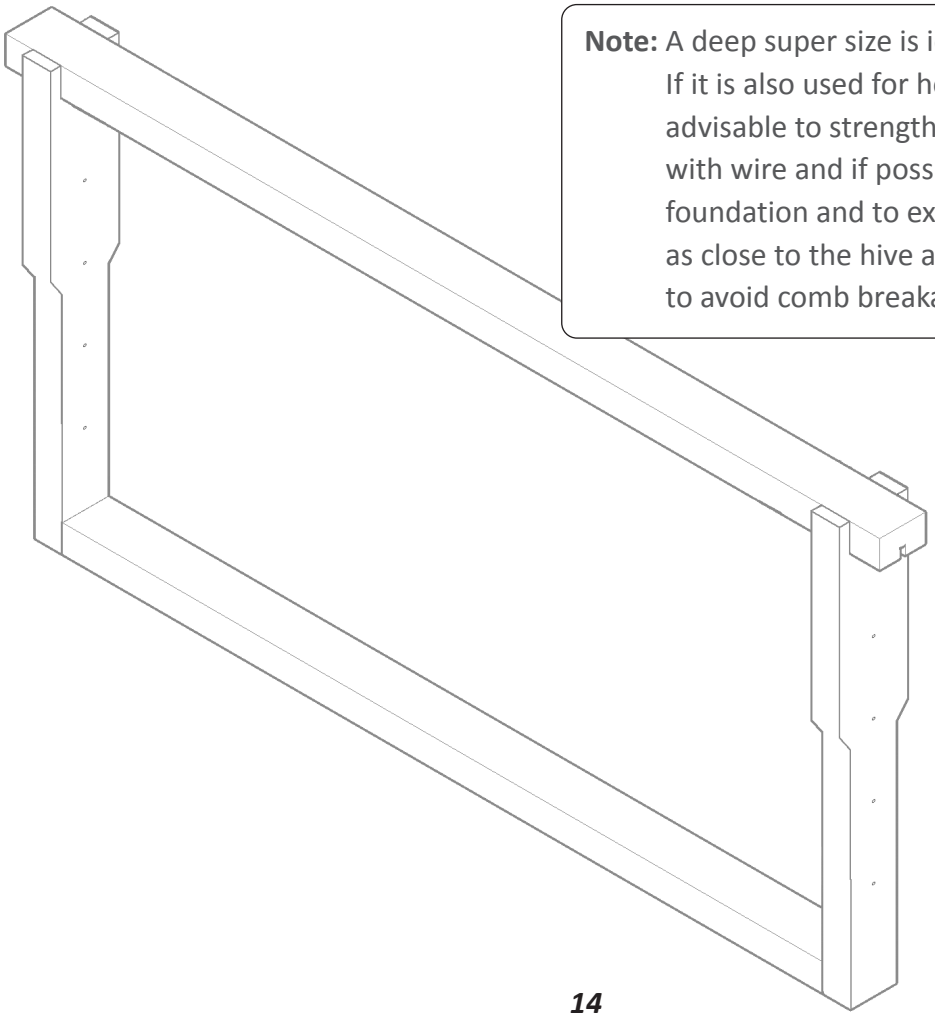
Note: Shallow supers can be more practical for honey production because 1) they are lighter than deep supers and easier to transport without the comb breaking, and 2) the comb area is smaller which reduces the chance of the comb breaking – especially if they are wired…

Modern hive deep super frame outside sizes A

x 22 in one flatpack

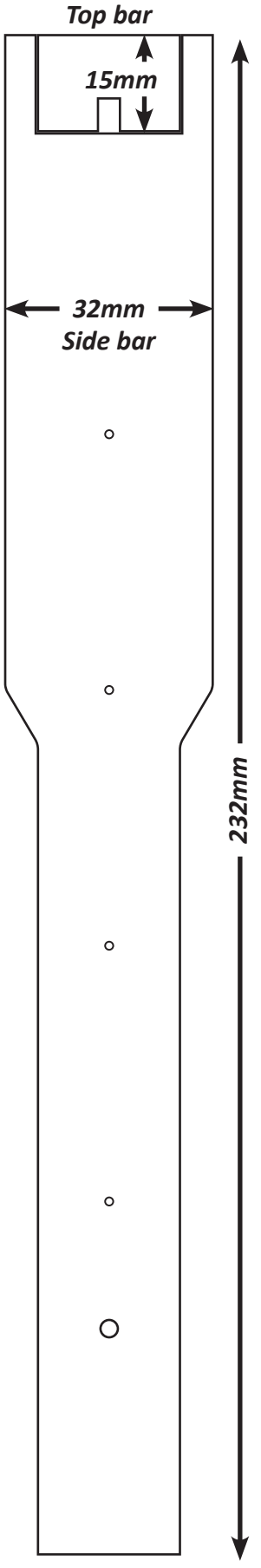


Tip: You can use 3–5mm masonite or plywood for the starter strip.

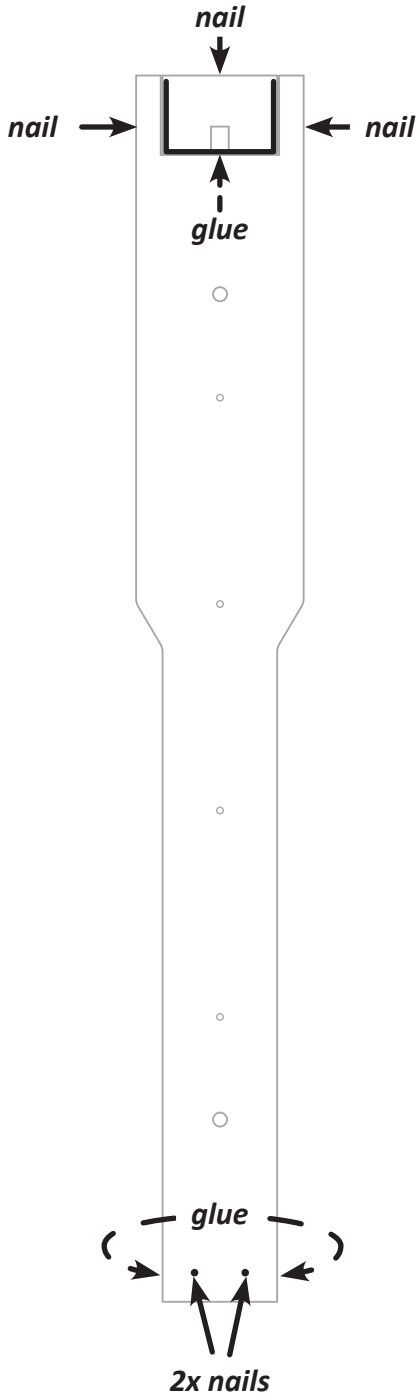


Note: A deep super size is ideal for brood. If it is also used for honey, it is advisable to strengthen the comb with wire and if possible wax foundation and to extract honey as close to the hive as possible to avoid comb breakage.

Modern hive deep super frame side bar sizes B



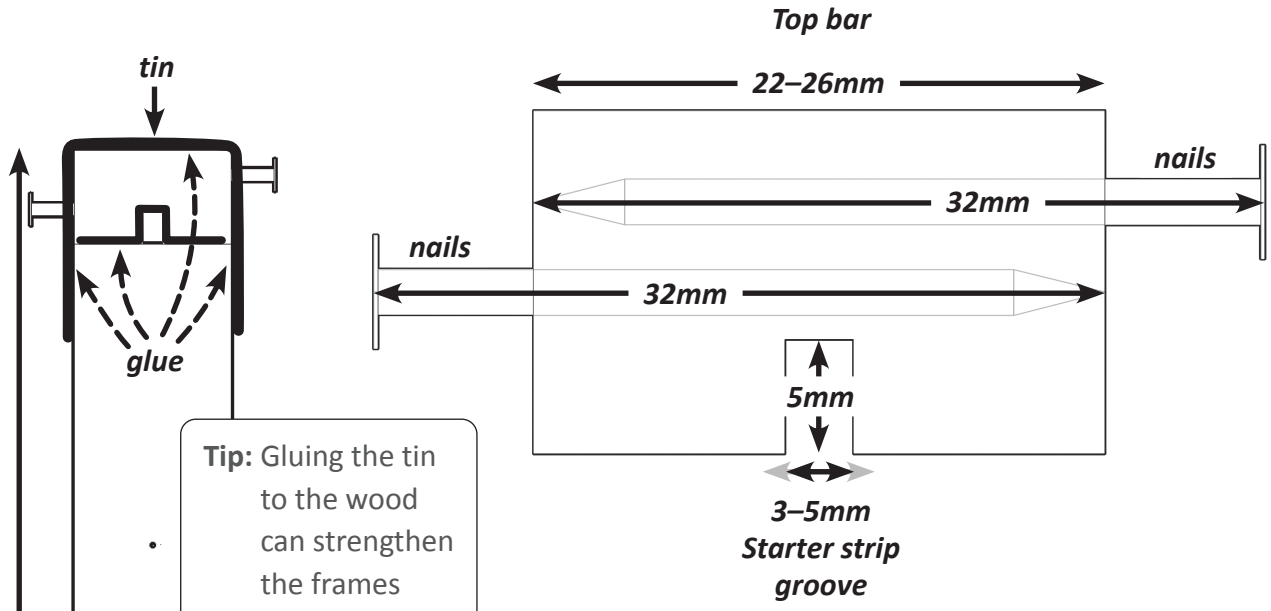
Tip: Use a 32mm wide side bar to get the right spacing of 32mm between starter strips.



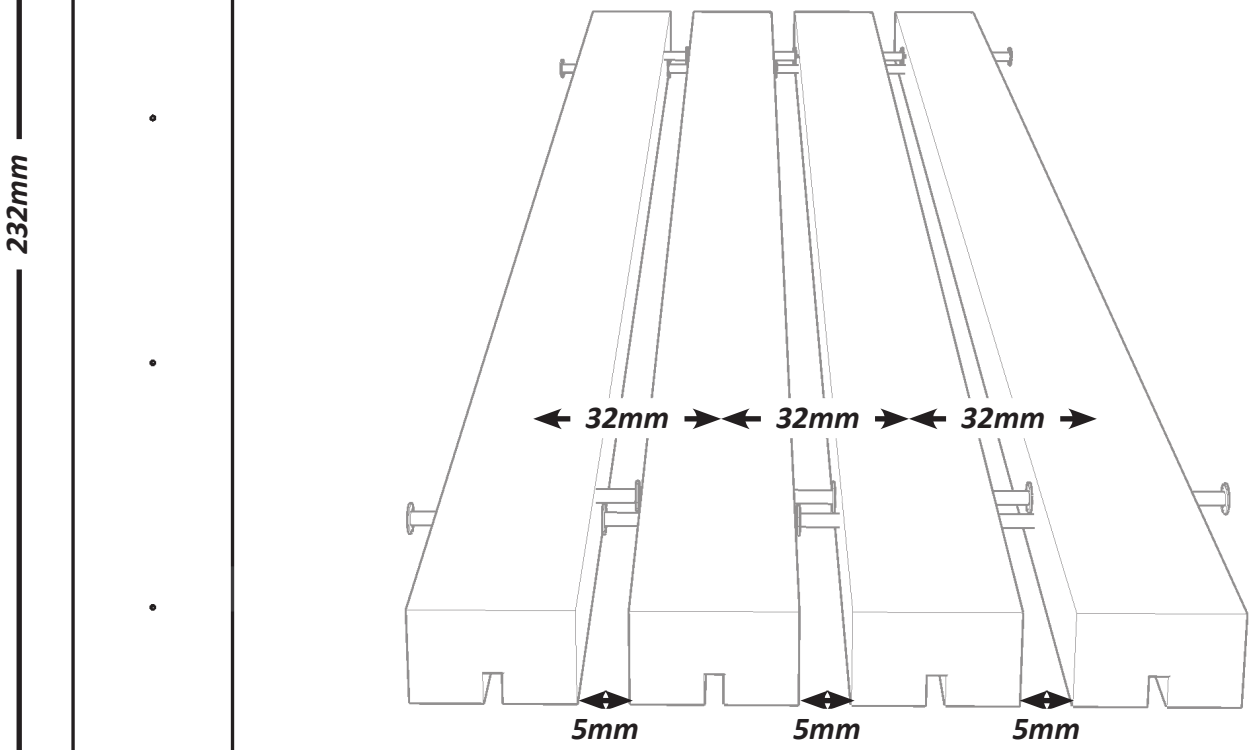
To assemble the frames in a way that their strength is maximized, glue and nail where indicated.

Modern hive deep super frame alternative side bar spacing

Another way to space frames is by using nails.



Tip: Gluing the tin to the wood can strengthen the frames even more.

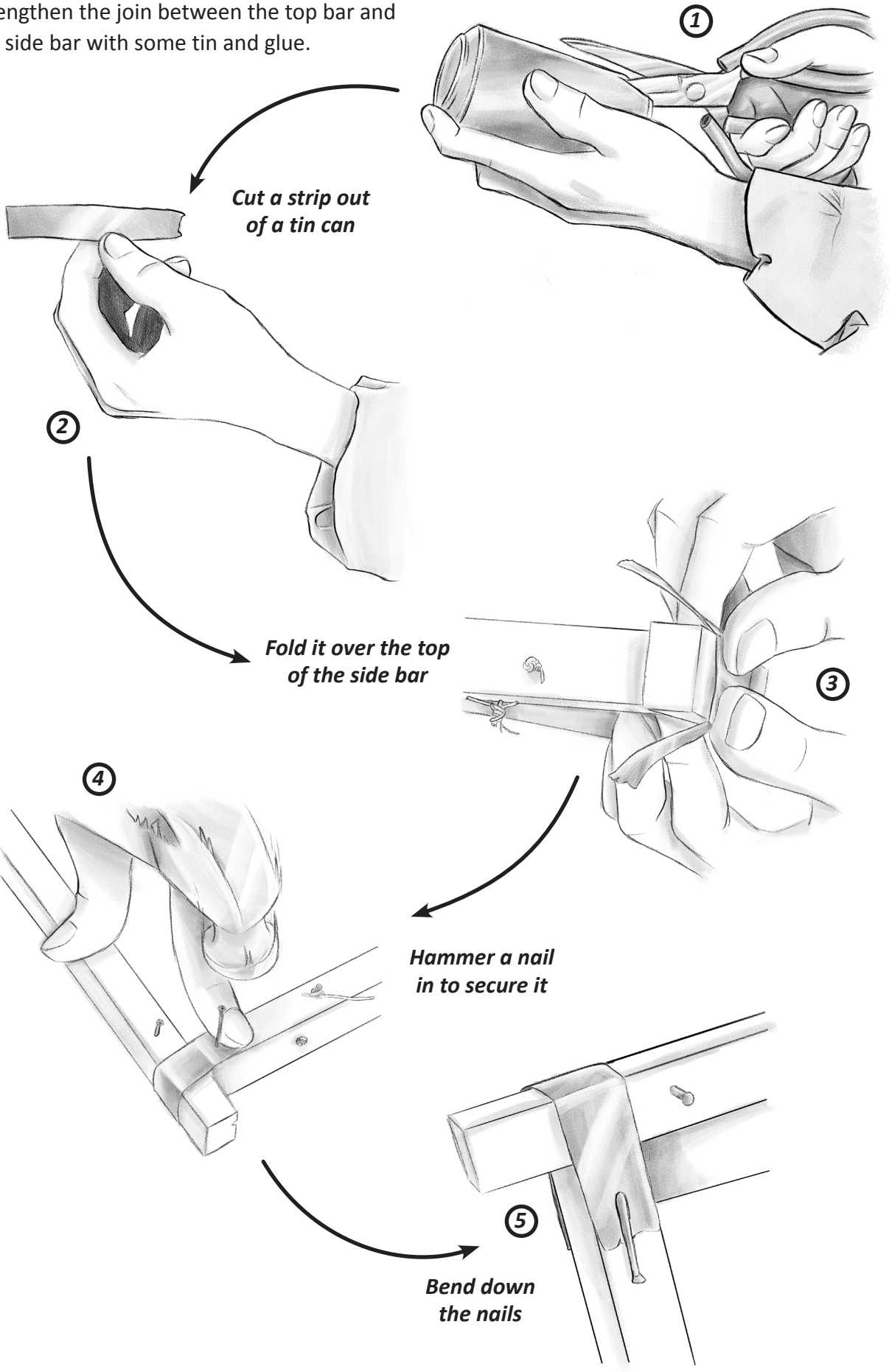


Side view of the alternative side bar

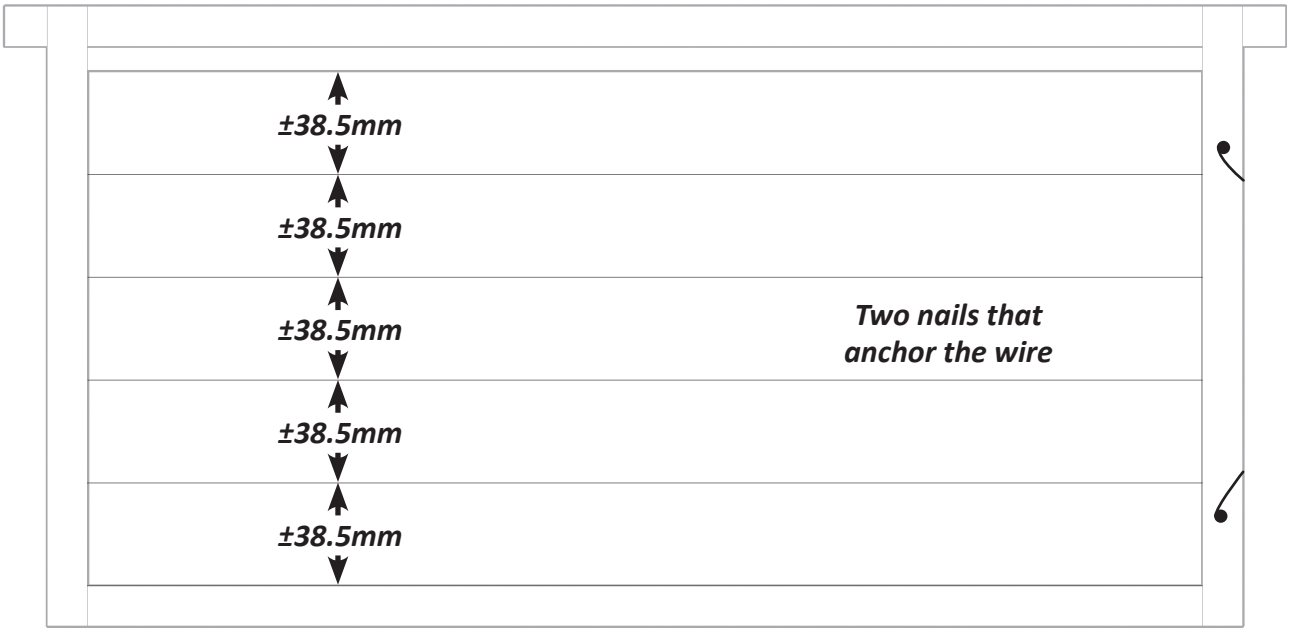
Note: Space between centre of starter strips must be exactly 32mm
Space for queen to move between top bars must be at least 5mm.

Strengthening the alternative side bar

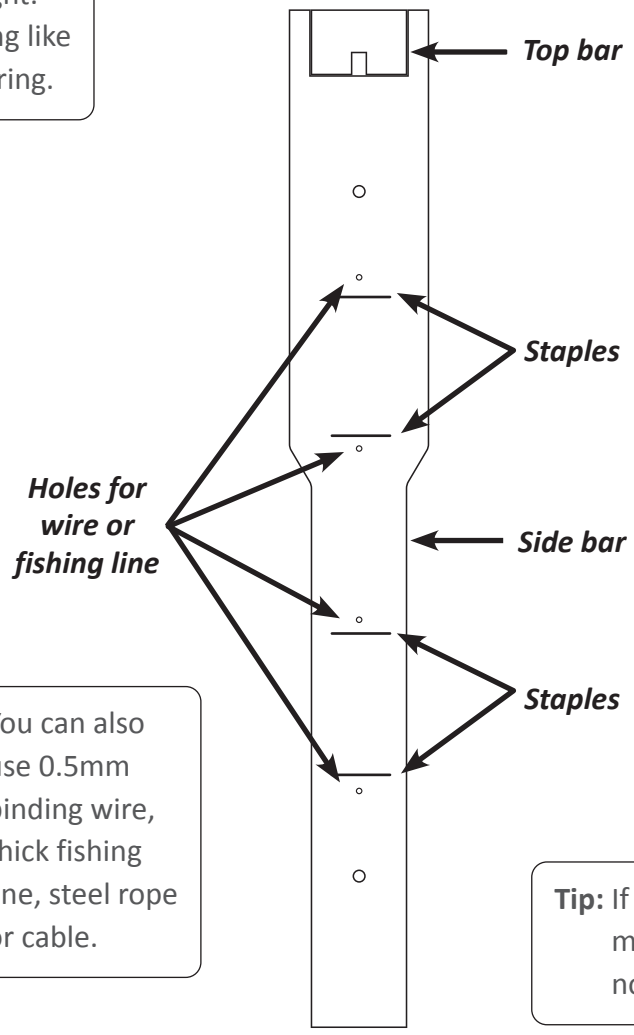
Strengthen the join between the top bar and the side bar with some tin and glue.



Adding bee frame wire



Tip: Pull the wire tight. They should ping like a tight guitar string.



Tip: You can use staples to prevent the wire cutting into the wood.

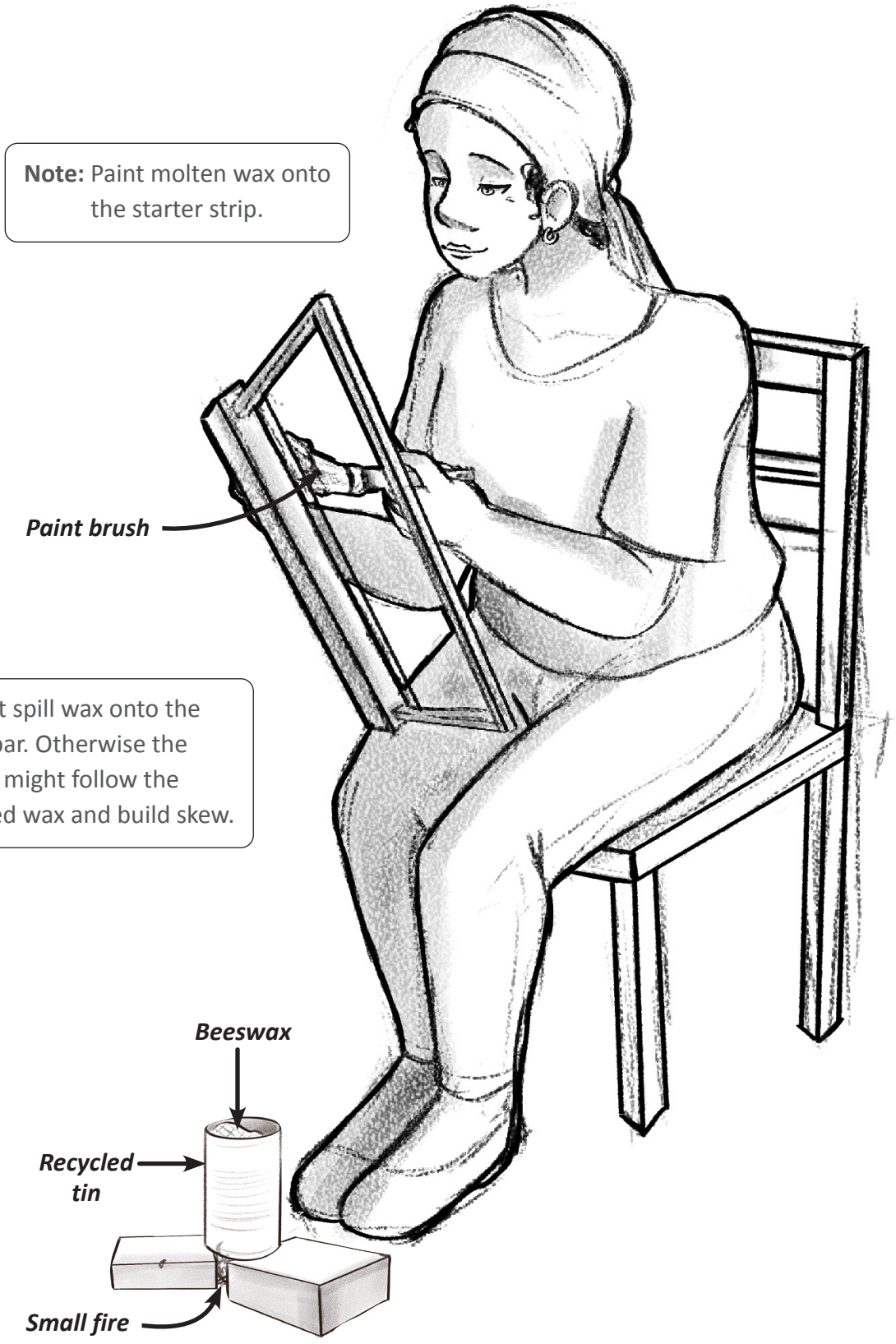
Tip: You can also use 0.5mm binding wire, thick fishing line, steel rope or cable.

Tip: If you use fishing line, make sure it is the thick, non-stretch kind.

Side view of a frame

Waxing your starter strip

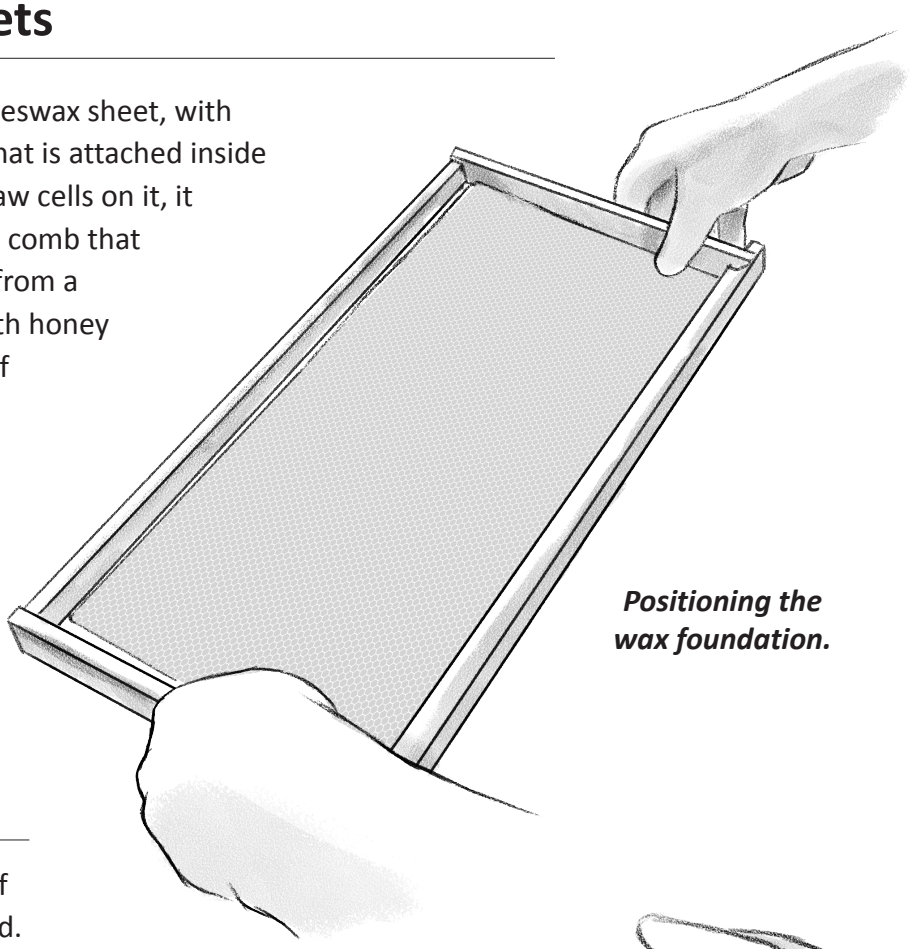
Note: Paint molten wax onto the starter strip.



Tip: Don't spill wax onto the top bar. Otherwise the bees might follow the spilled wax and build skew.

Foundation sheets

Foundation refers to the beeswax sheet, with embossed bee cell bases, that is attached inside a frame. When the bees draw cells on it, it results in a straight, framed comb that can be removed with ease from a super. Such combs filled with honey can withstand the rigours of harvesting and extraction even better than a frame that is just wired.

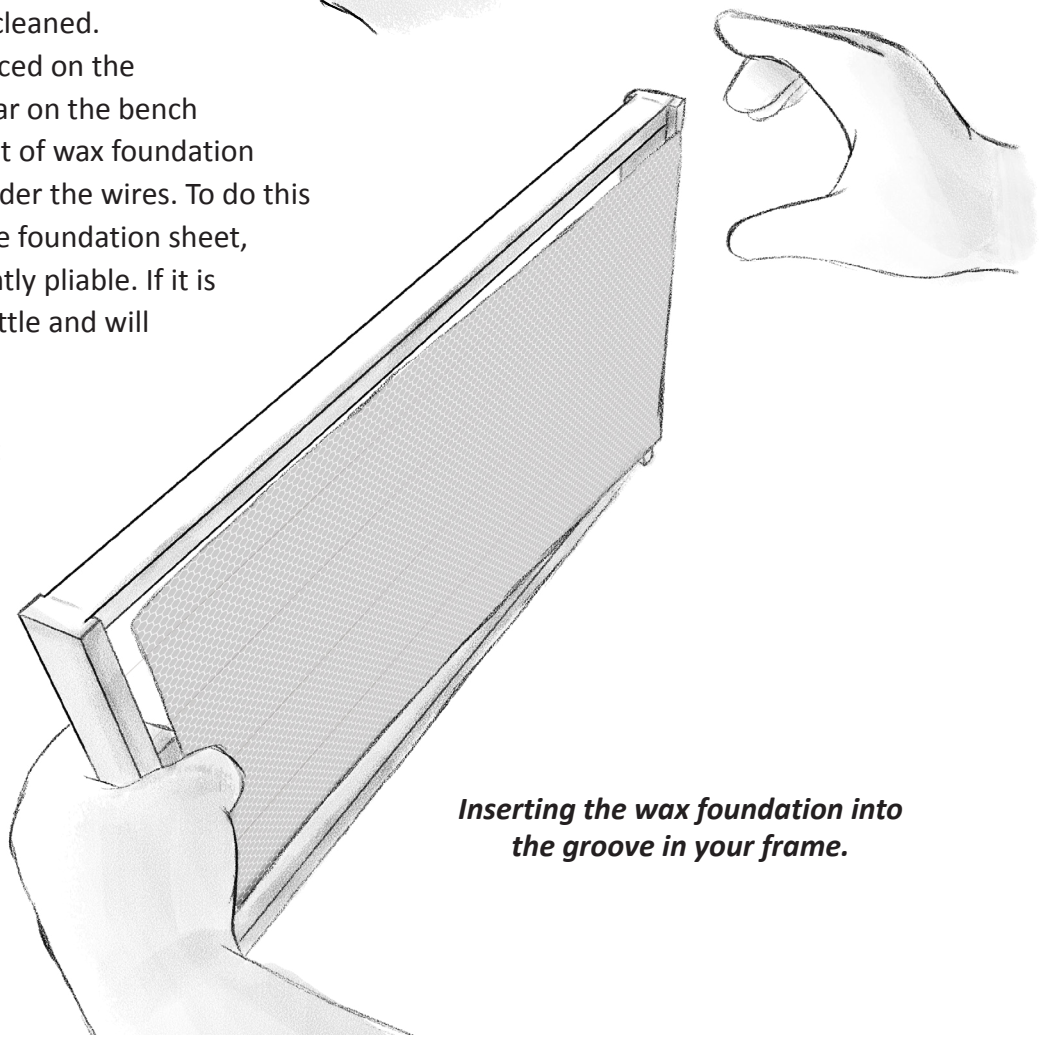


Positioning the wax foundation.

Inserting the wax foundation

The groove in the top bar of frames must first be cleaned. The frame is then placed on the bench with the top bar on the bench surface, and the sheet of wax foundation is woven over and under the wires. To do this without damaging the foundation sheet, the wax must be slightly pliable. If it is too cold, it will be brittle and will break easily.

The foundation sheet is then attached to the top bar.

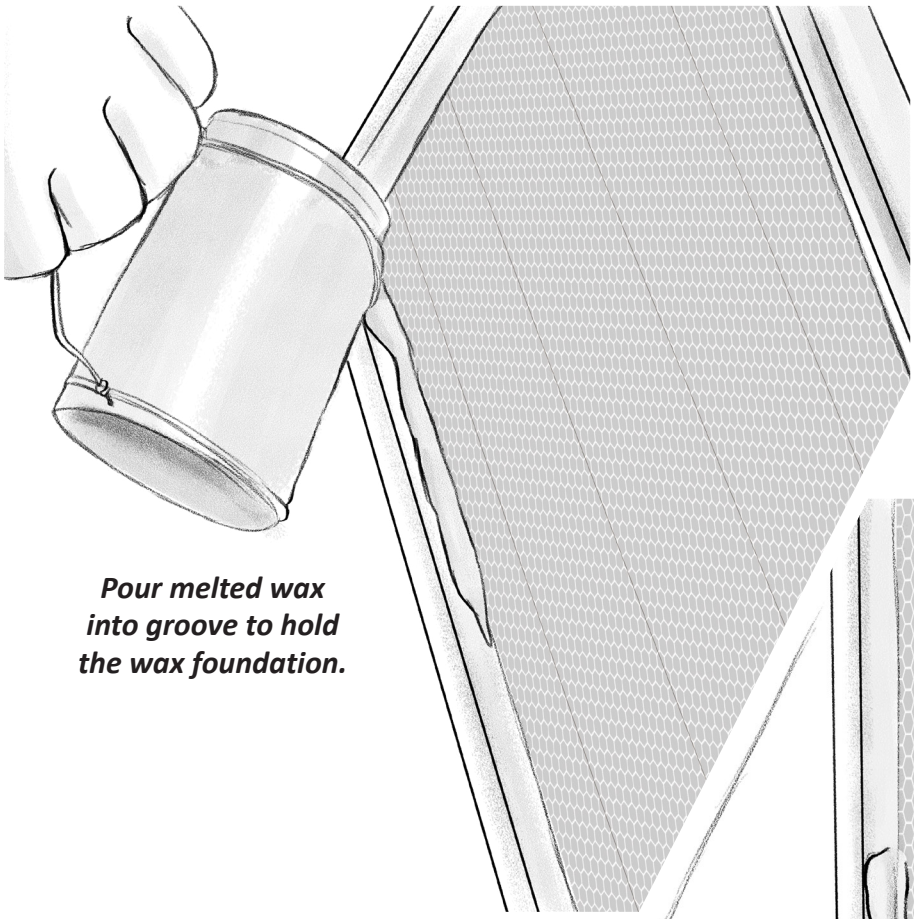


Inserting the wax foundation into the groove in your frame.

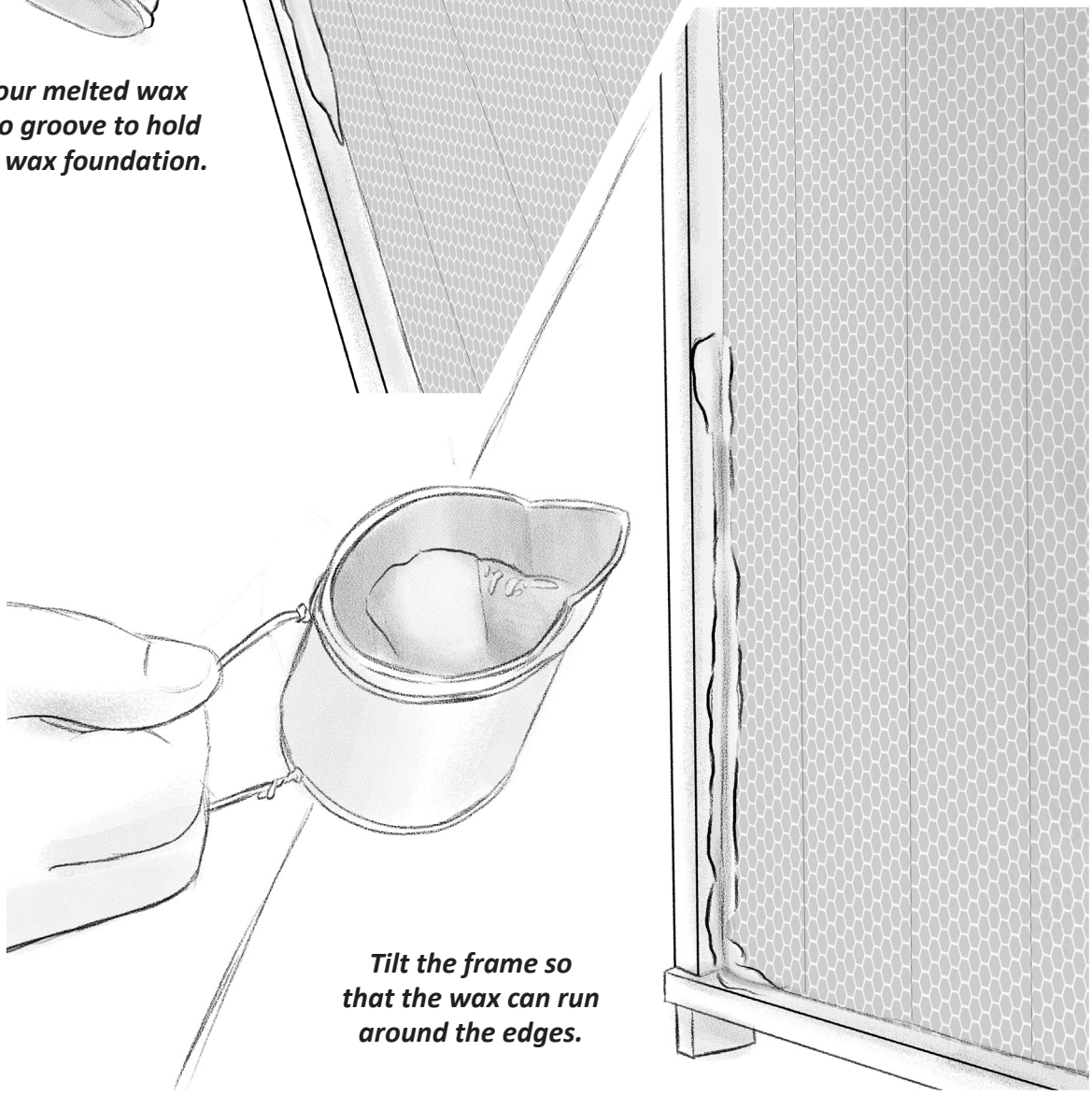
Securing the wax foundation

Molten wax is used to secure the wax foundation in the groove of the top bar. Care must be taken that the wax is not too hot, or it will melt the foundation.

Melt some beeswax in a metal container.



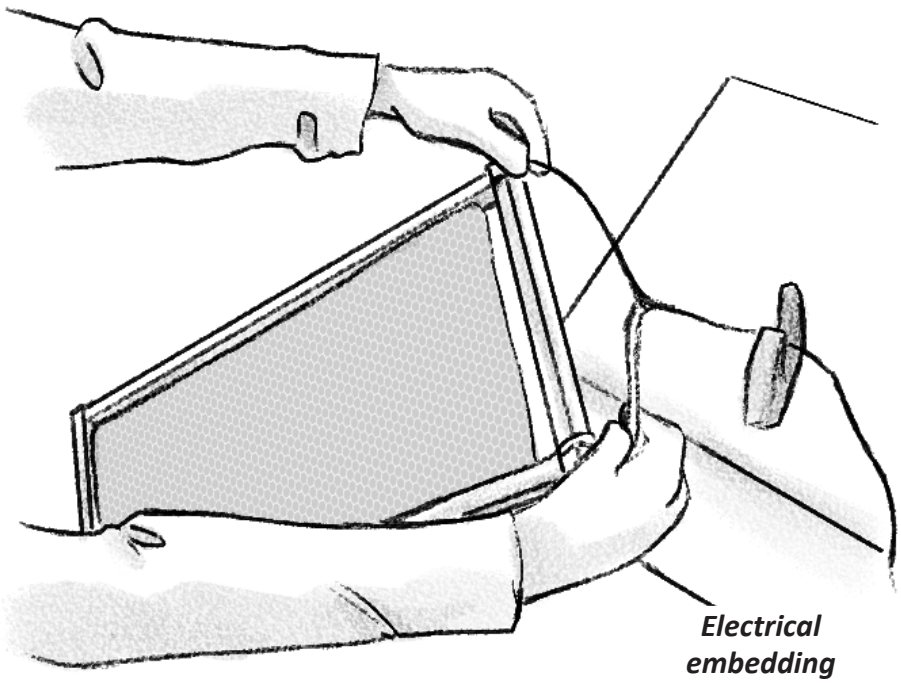
Pour melted wax into groove to hold the wax foundation.



Tilt the frame so that the wax can run around the edges.

Embedding the wax foundation

Embedding is the melting and / or pressing of the wires into the fitted sheet of wax foundation. This is usually done by heating the wires with an electric current to melt the wax. Spur-wheel embedders are also available in supply shops but not as effective as the electric current method.

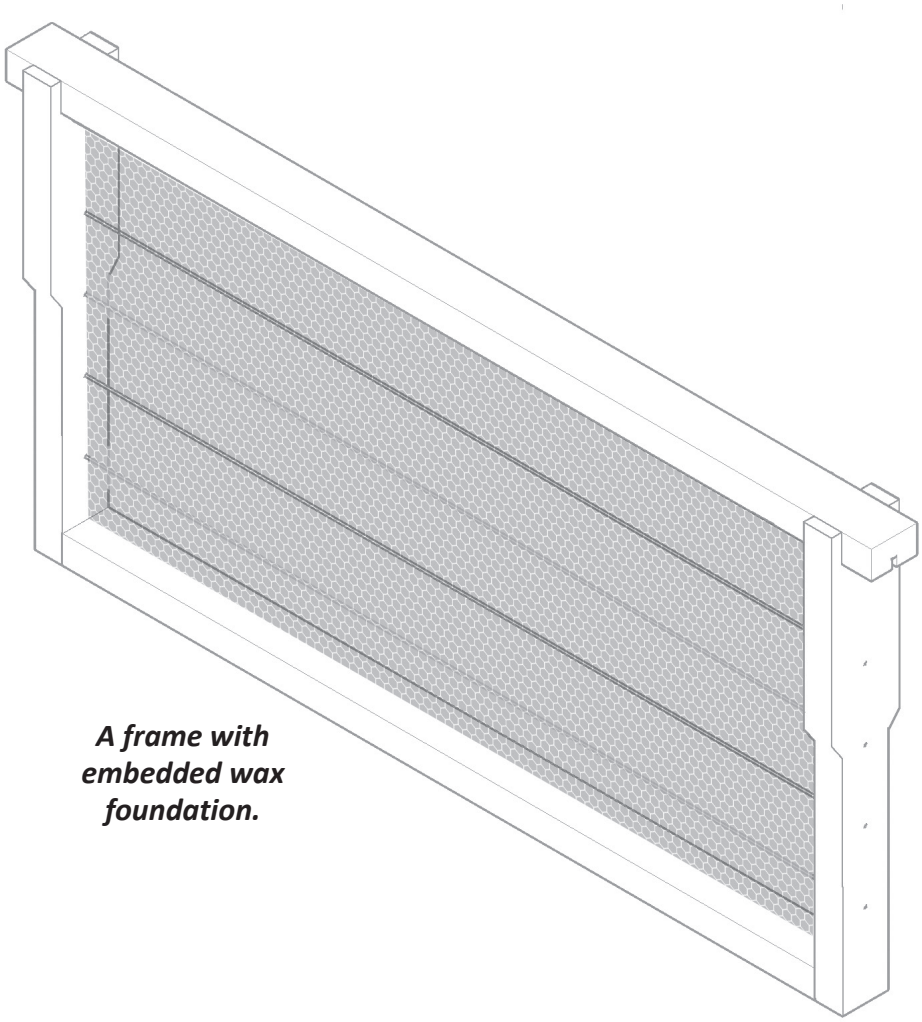


Electrical embedding

Electrical embedding is done by using the heat generated by the resistance of the wire when it is connected to a 12-volt battery. The wire heats up and melts easily into the foundation. Just the right time is required otherwise the wire gets too hot and can burn through the foundation.

Tip: Use a 12V battery to embed the wax.

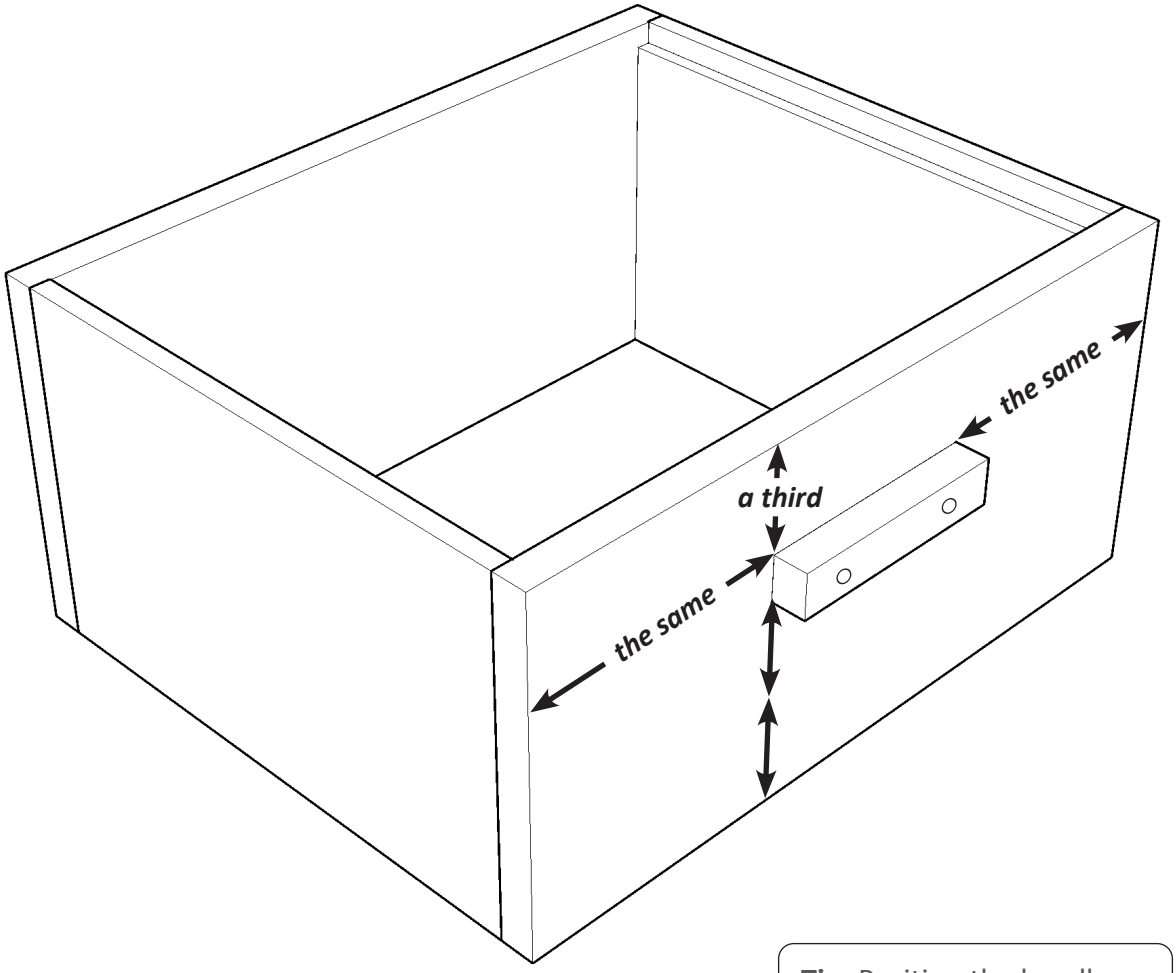
The spur wheel embedding: is done by heating the embedder in boiling water and then running it along the wire to embed it in the softened wax.



A frame with embedded wax foundation.

Handles for a super

The simplest type of handle for a super to assist in carrying it when full of bees and honey is a basic plank attached to each side of the super.



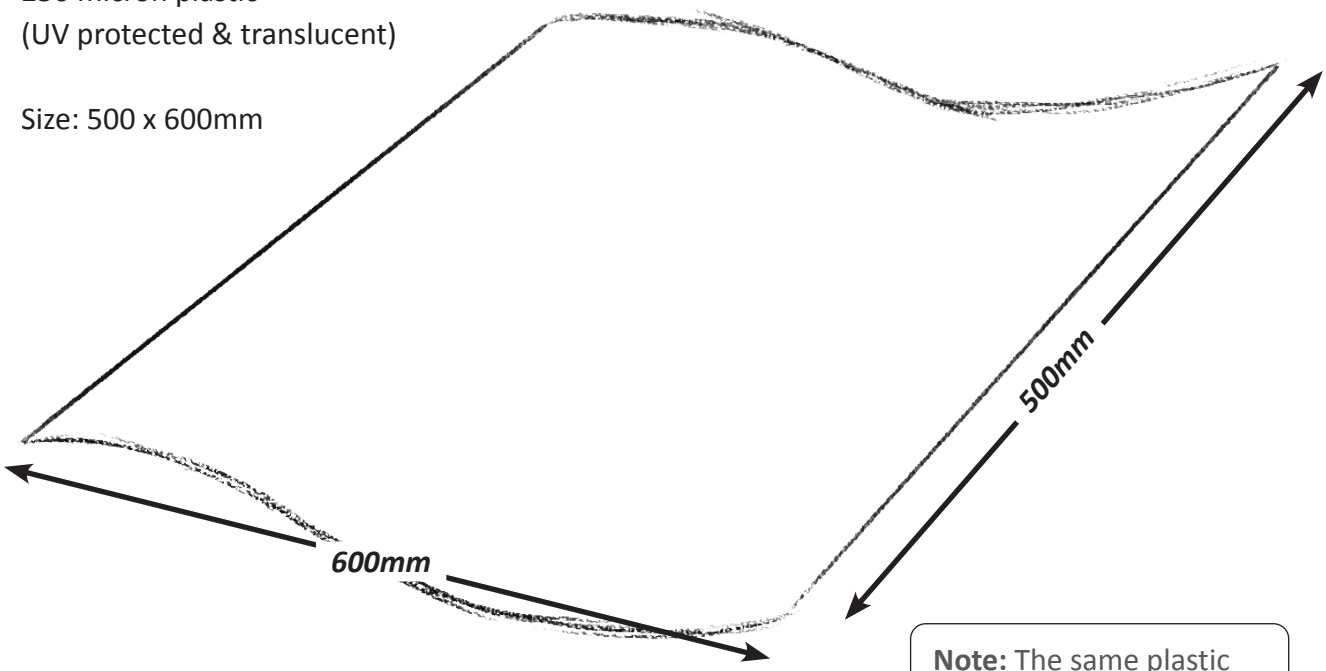
Tip: Position the handle one third from the top and in the middle.

Modern Hive Inner Cover

x 1 in one flatpack

250 micron plastic
(UV protected & translucent)

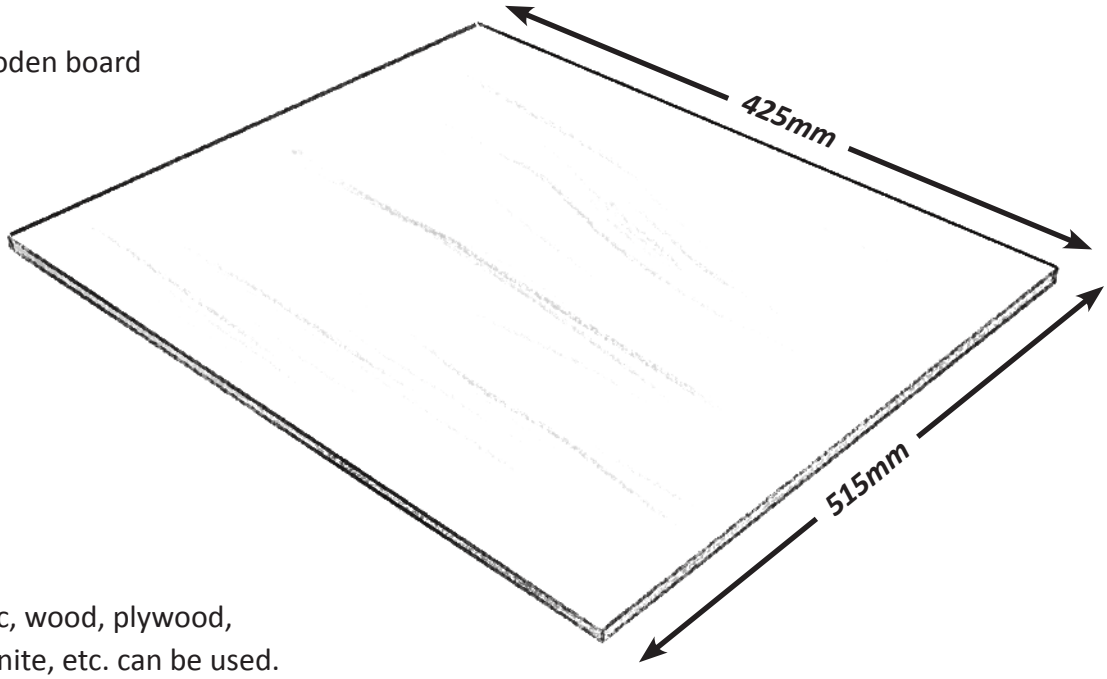
Size: 500 x 600mm



Note: The same plastic used for vegetable tunnels / nurseries.

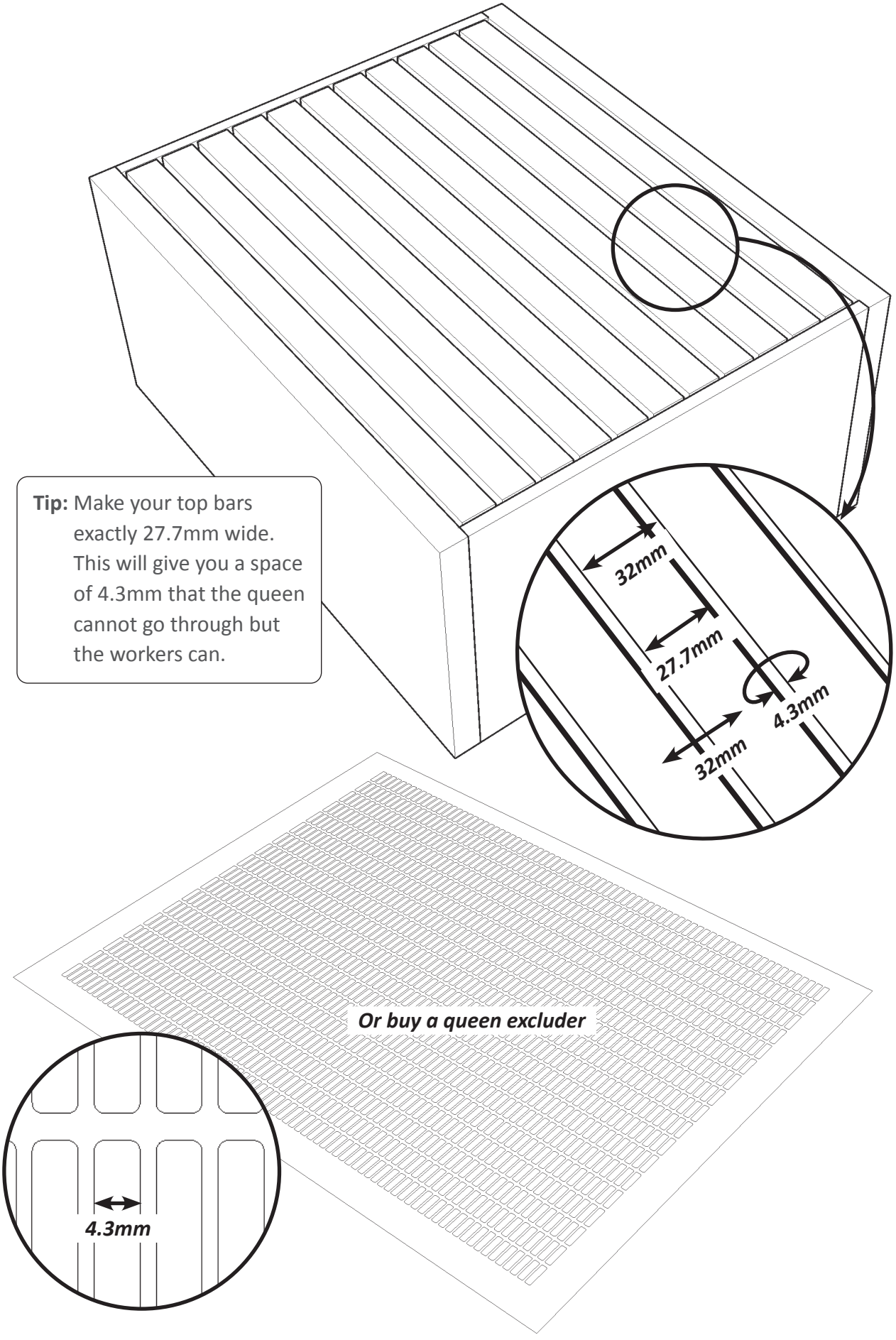
or

A wooden board



Plastic, wood, plywood,
masonite, etc. can be used.

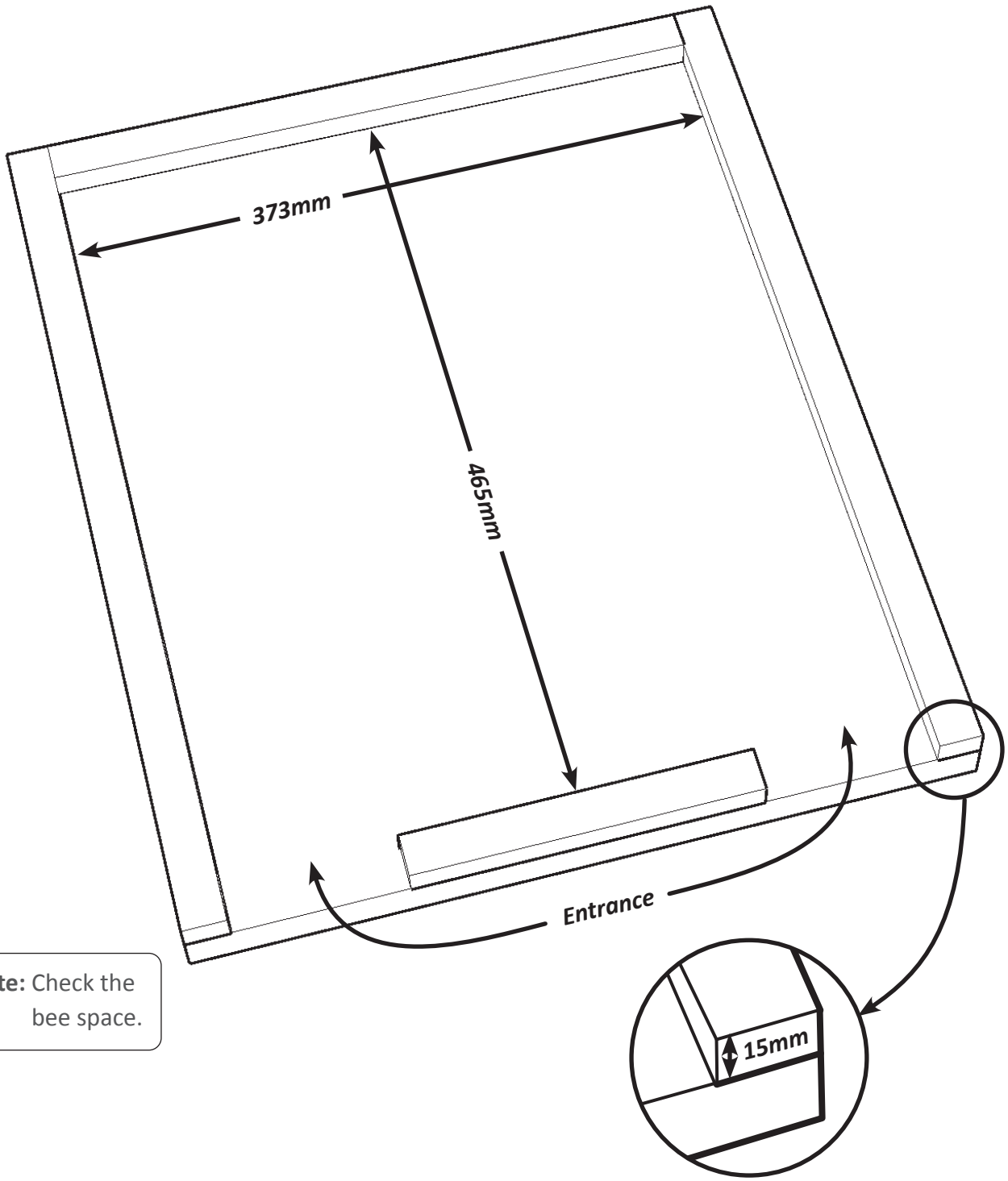
Queen excluder



Tip: Make your top bars exactly 27.7mm wide. This will give you a space of 4.3mm that the queen cannot go through but the workers can.

Modern hive floorlid

x 2 in one flatpack



Note: Check the bee space.

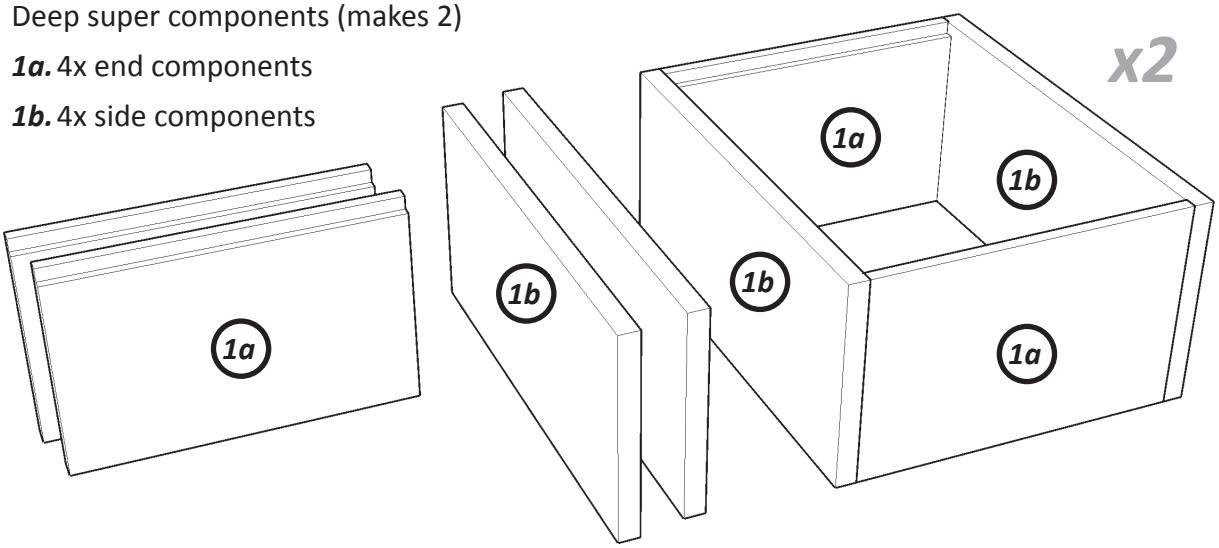
Tip: If you have two floorlids you have a floor and a lid. But in an emergency (like if you need to set up a trap hive), you have an extra floor and you can use a piece of wood, or corrugated iron, or some roof straw as lids.

A modern hive flatpack could include:

1. Deep super components (makes 2)

1a. 4x end components

1b. 4x side components



Note: A flatpack is a pack of the materials you need to build a modern hive.

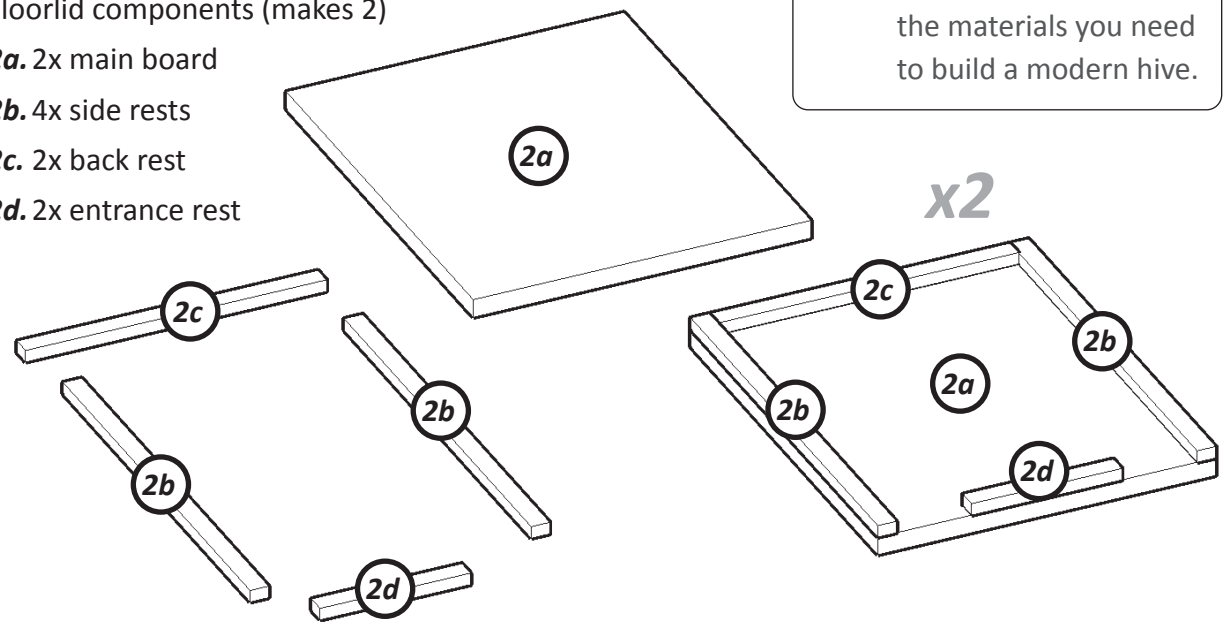
2. Floorlid components (makes 2)

2a. 2x main board

2b. 4x side rests

2c. 2x back rest

2d. 2x entrance rest



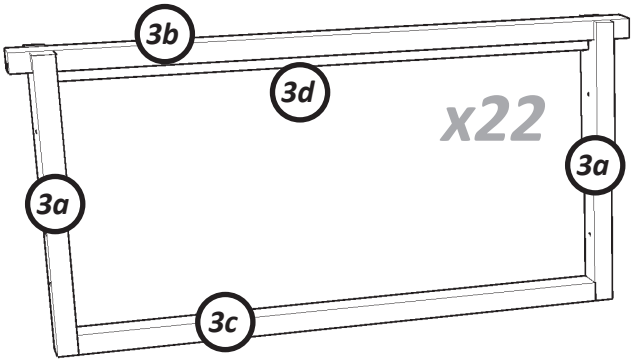
3. Frame components (makes 22)

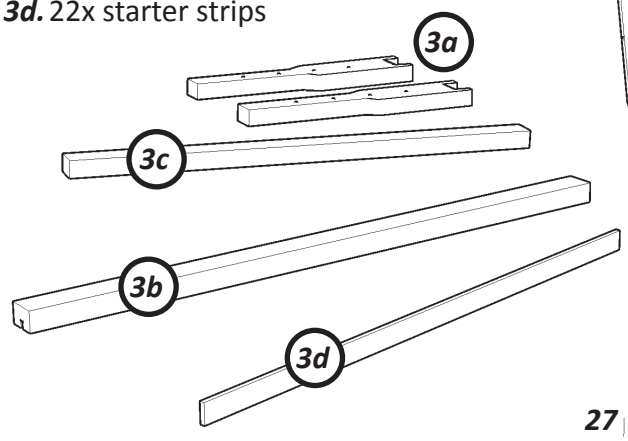
3a. 44x side bars

3b. 22x top bars

3c. 22x bottom bars

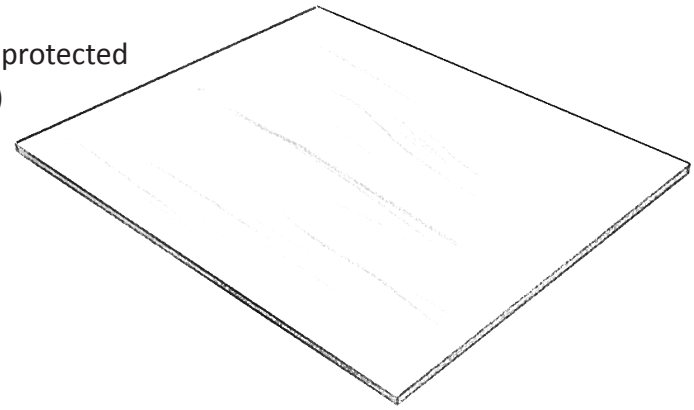
3d. 22x starter strips





Note: Sidebars must be supplied with 4 holes each for wire as per instructions.

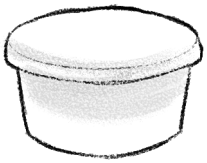
4. 1 x inner cover
(250 micron UV protected
plastic or board)



5. 40 x 60mm nails
(ring shanked if possible)

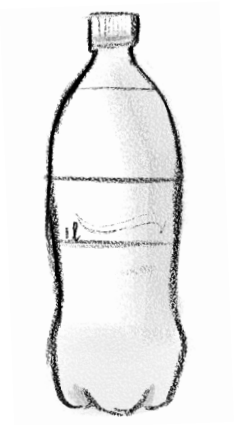
6. 300 x 32mm nails
(panel pins are best)

7. 200 ml wood glue
(in a sealable container)

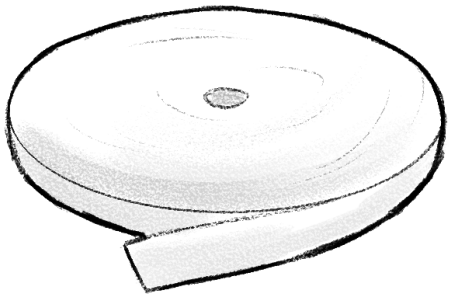


8. 50 grams of beeswax

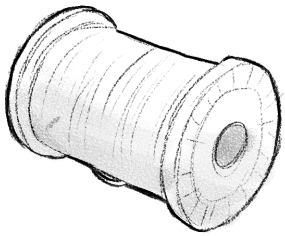
9. 1-litre oil



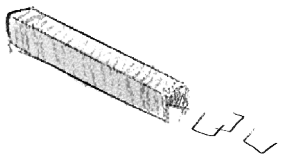
10. 4.5 m cotton strapping



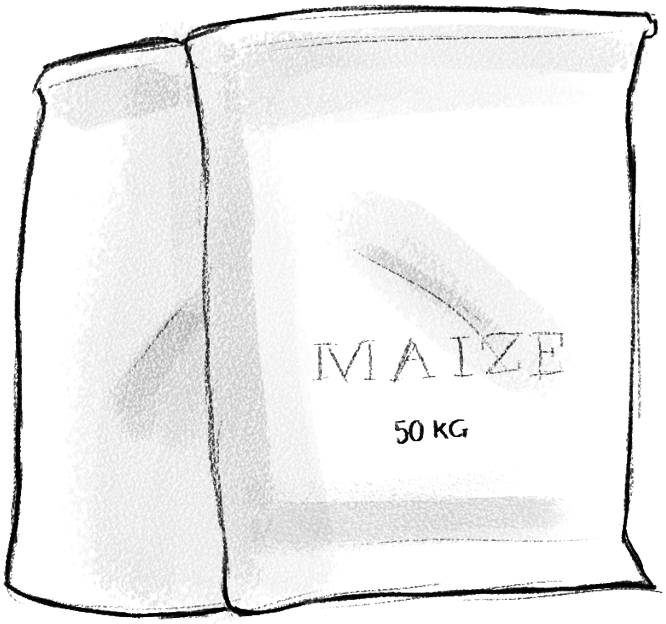
11. 88 m bee frame wire or
thick non-stretch fishing line



12. 200 staples (paper staples are fine)

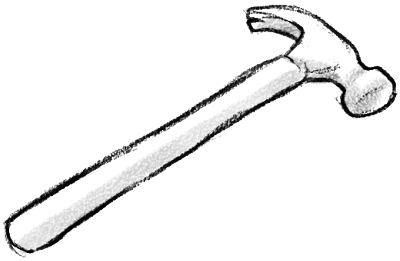


13. 70 kg clean maize meal / fertiliser bag

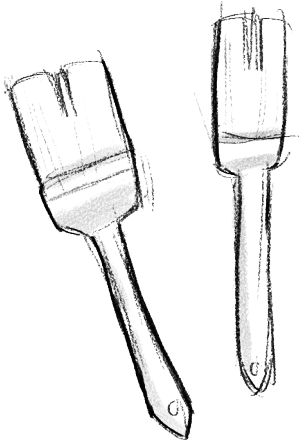


Items that can be shared between every 5 flatpacks

14. 1 x hammer (used)



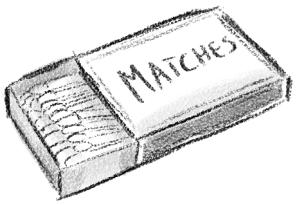
15. 2 x paint brushes
(one for beeswax and the other for oil)
(they can also be used)



16. 1 x small tin for wax (used)

17. 1 x medium tin for oil (used)

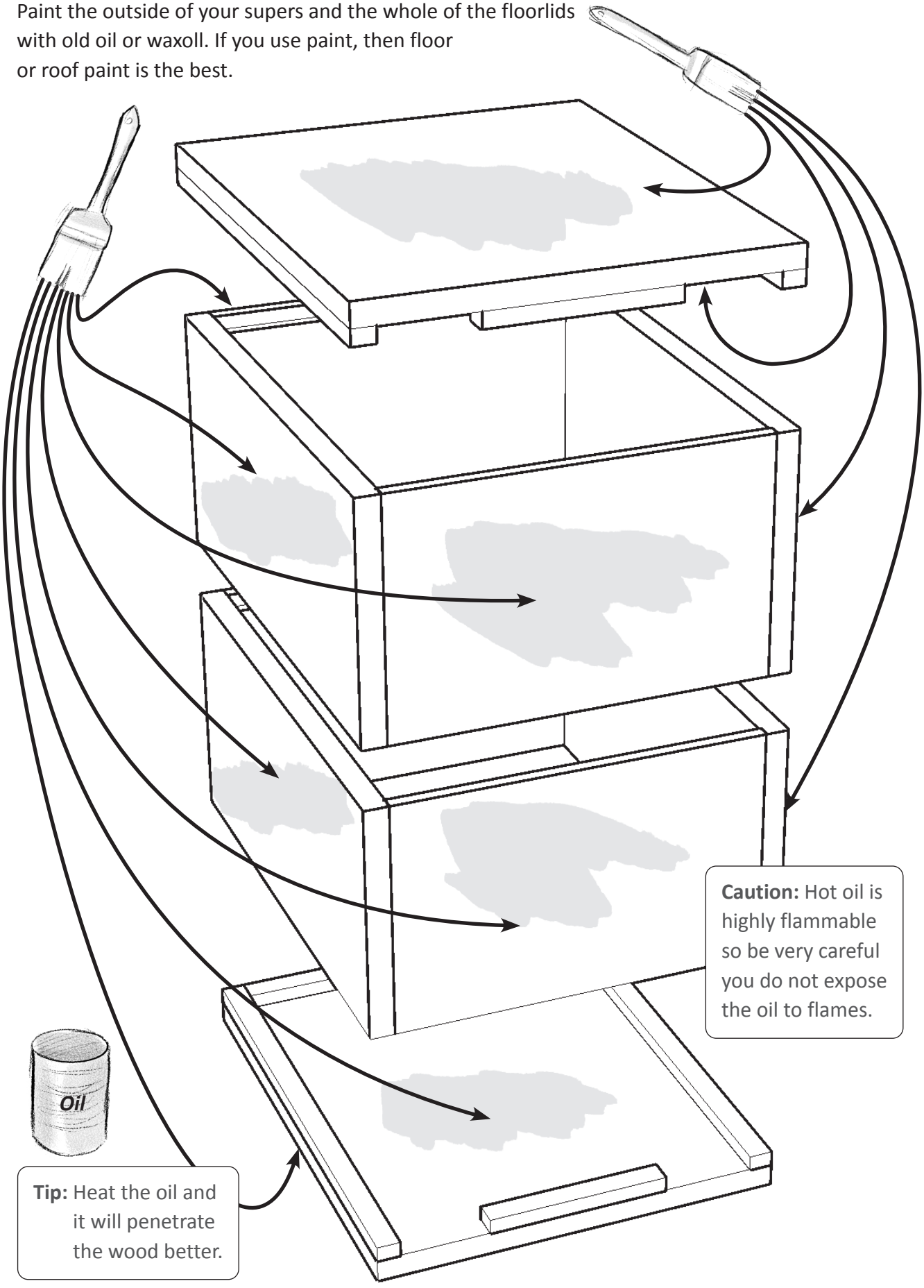
18. 1 x box matches



19. 1 x paper stapler

Paint your hive

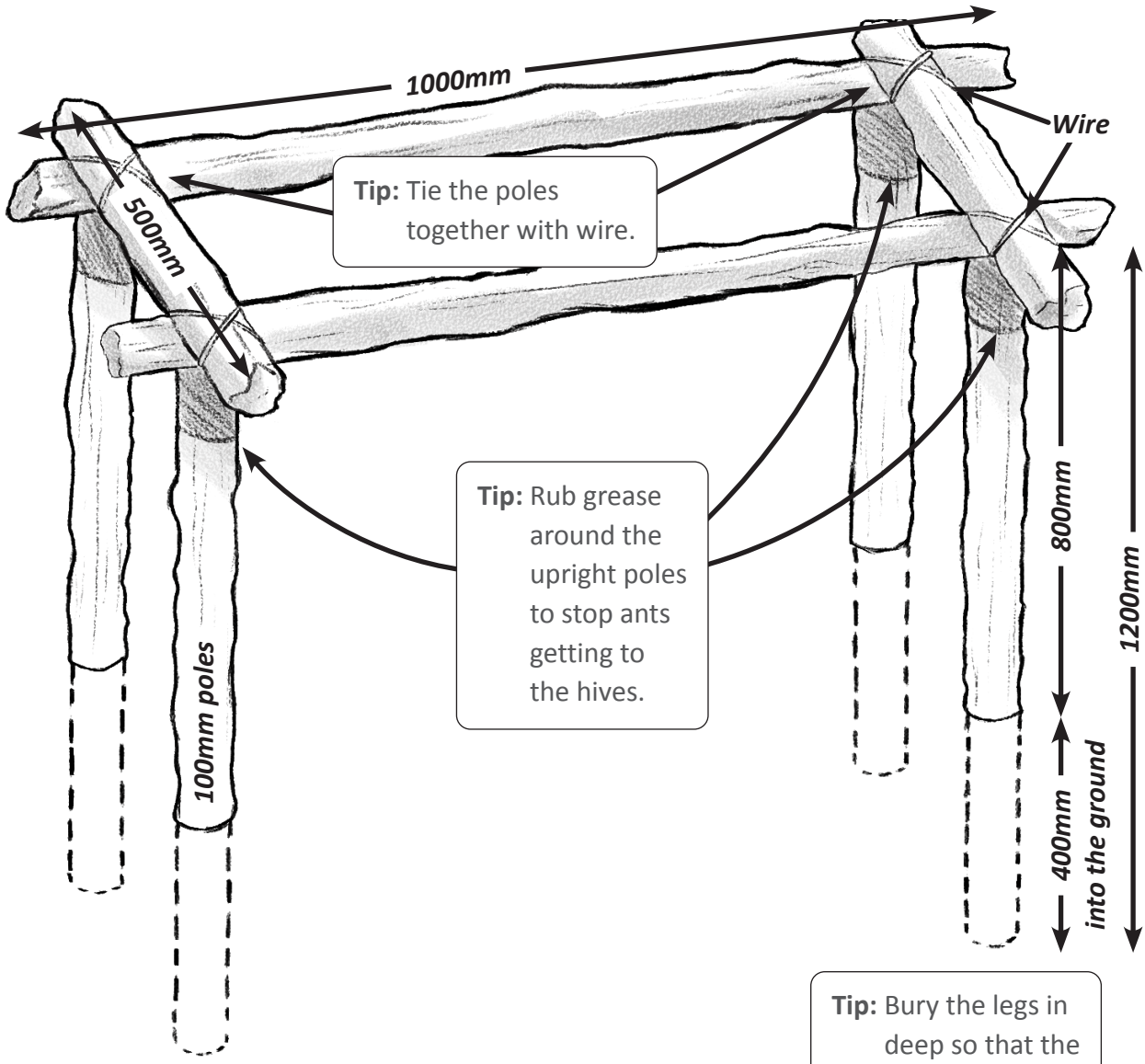
Paint the outside of your supers and the whole of the floorlids with old oil or waxoll. If you use paint, then floor or roof paint is the best.



Caution: Hot oil is highly flammable so be very careful you do not expose the oil to flames.

Tip: Heat the oil and it will penetrate the wood better.

How to make an effective hive stand

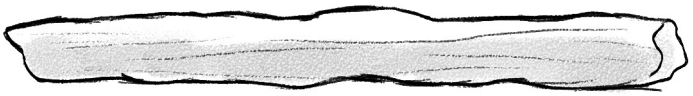


Note: How to make cob: mix straw, 25% clay, silt, and with water and stomp it around the legs with your feet.

List of materials to make a hive stand:

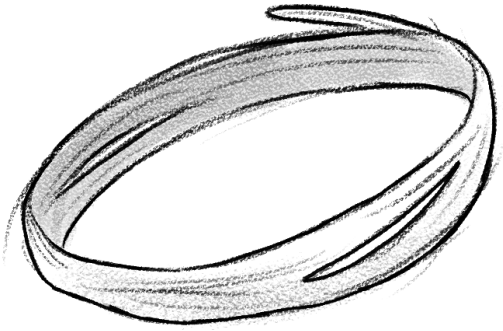
1. 2 x 1000mm poles (approximately 100mm thick)

2. 2 x 500mm poles (approximately 100mm thick)

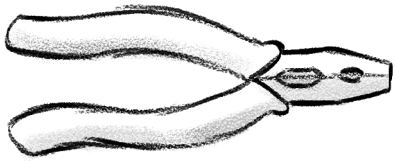


3. 4 x 1200mm poles for the legs (approximately 100mm thick)

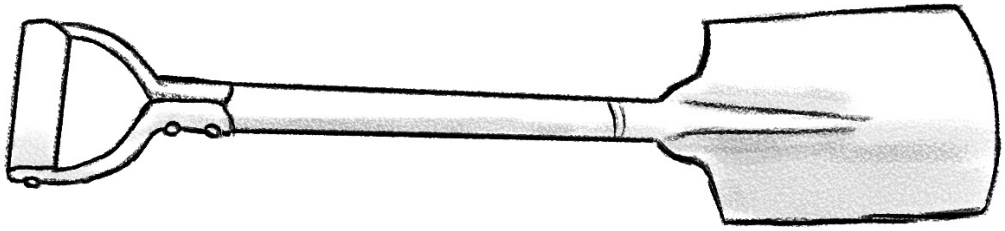
4. 8m x 2.5mm galvanised wire



5. 1 pair of old pliers

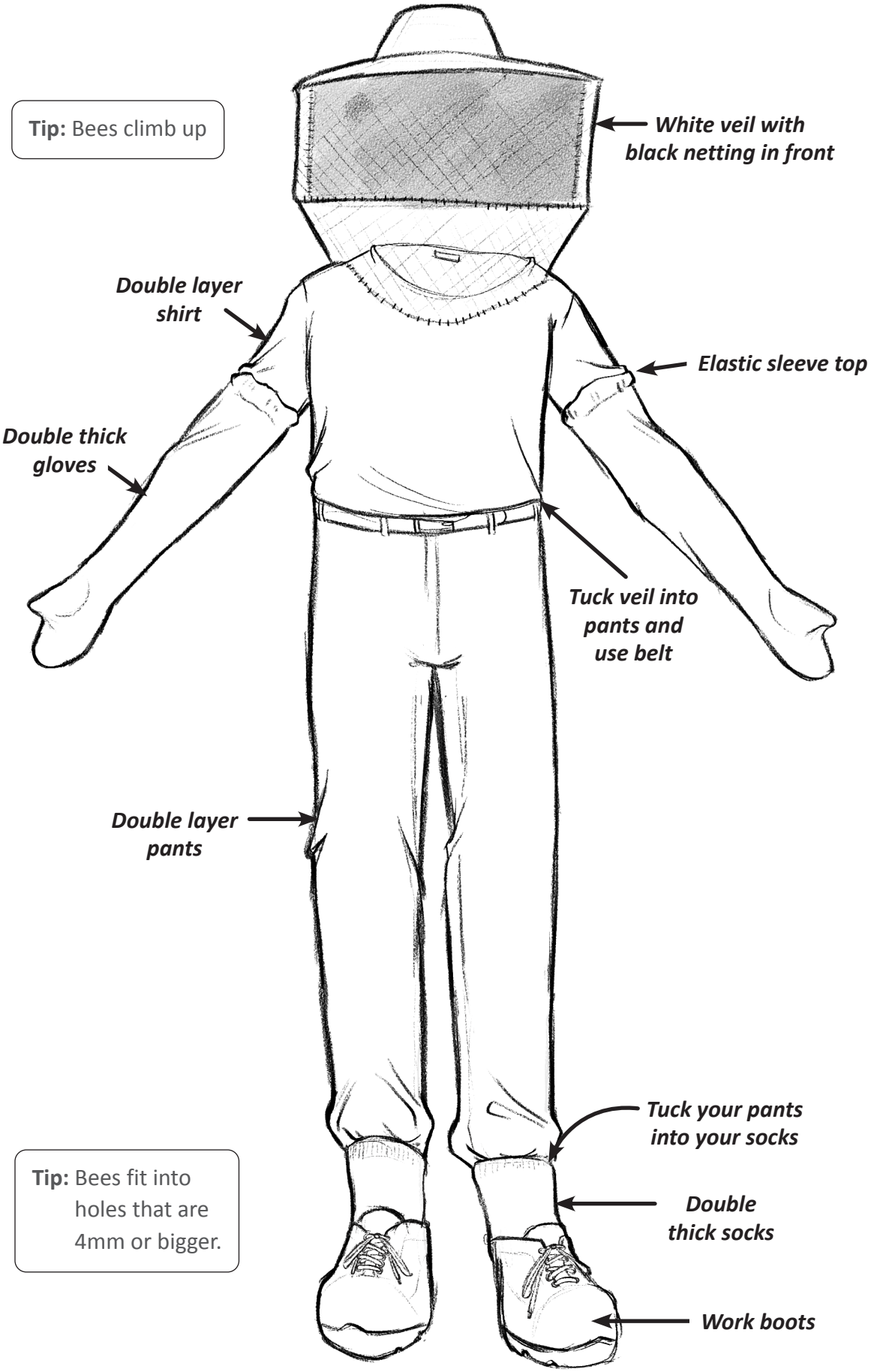


6. 1 spade

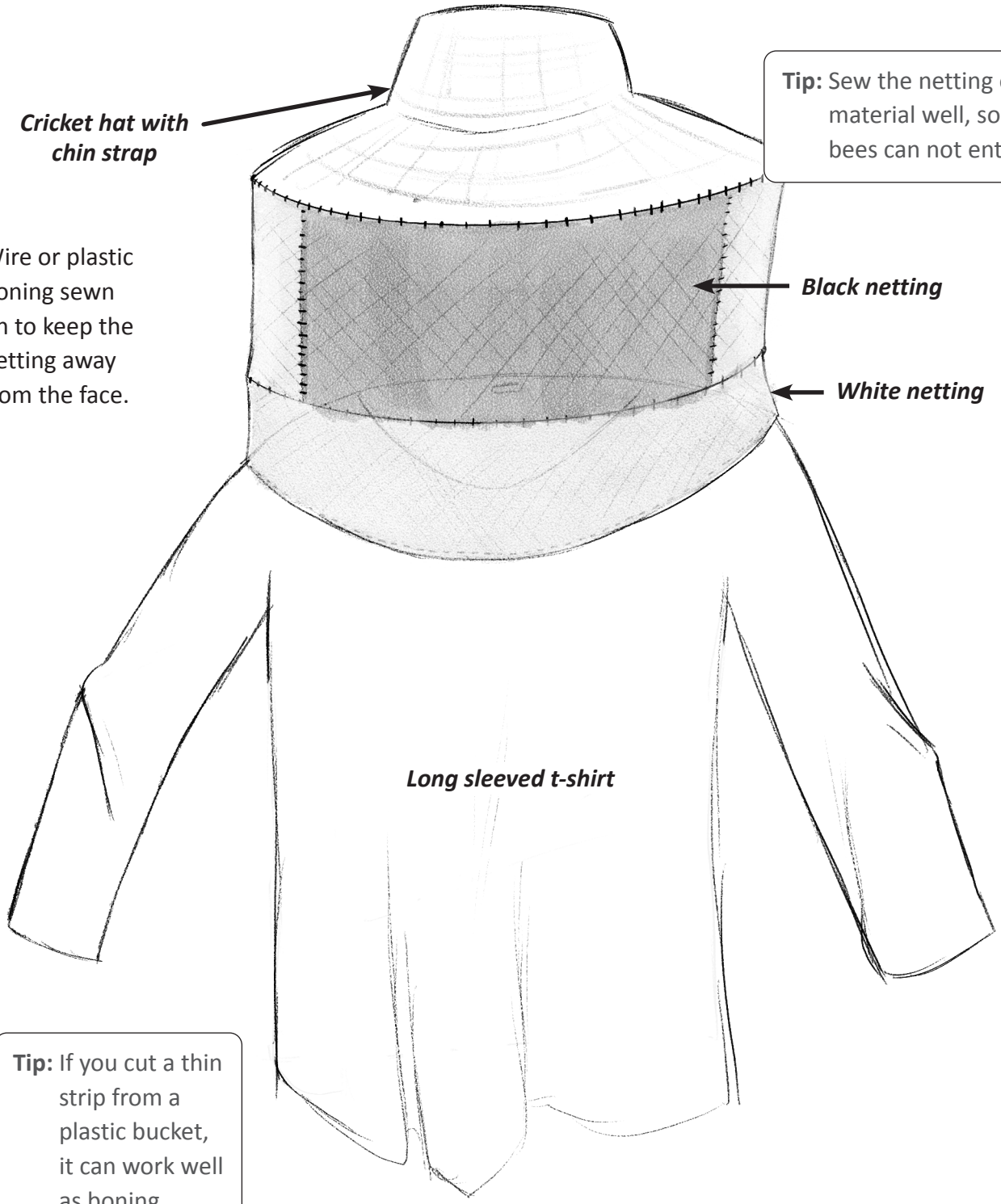


7. old vehicle grease

Beekeeping safety clothing



How to make a veil



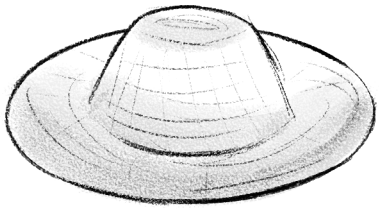
Tip: Sew the netting onto the material well, so that bees can not enter.

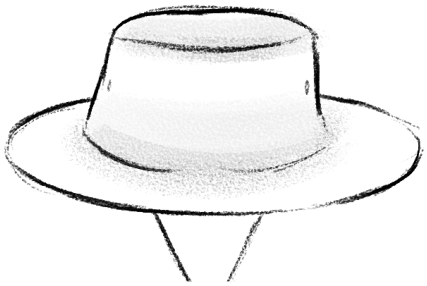
Tip: If you cut a thin strip from a plastic bucket, it can work well as boning.

Note: Boning is a semi-rigid plastic strip that can be sewn into a veil and act like a bone in a body to keep the veil open and away from the face. Wire also works but instead of bouncing back into its original shape, it stays in the shape that it has been bent into.

List of materials needed to make a veil:

1. 1 x Hat. A cricket hat or straw hat with a wide brim works well.





Cricket hat with a chin strap

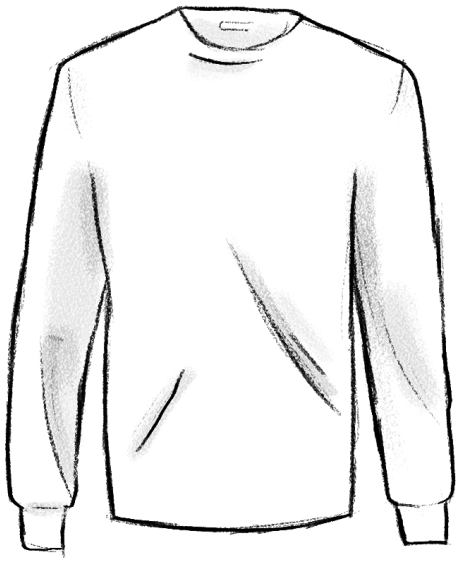
Tip 1: check that the hat is ventilated.

Tip 2: An extra piece of cloth on the inside of the brim helps prevent bees sting through material when its sweaty.

Tip 3: If you use a straw hat, check that the weave is fine enough not to let bees through.

Tip 4: A chin strap helps prevent the hat fall off when you bend forward.

2. 1 x Long sleeve t-shirt.

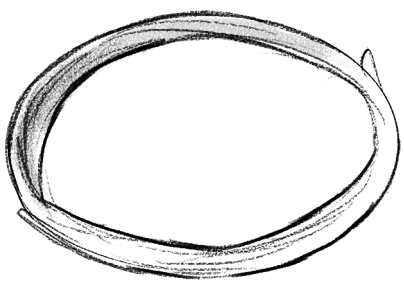


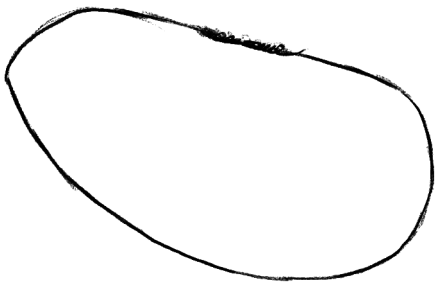
Tip 1: Choose one that is too big for you so that it can fit over other clothes.

Tip 2: Choose one with no zips or buttons.

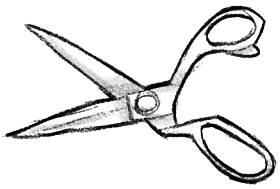
Tip 3: White and light colours agitate bees less than dark colours.

3. 2 x Wire (2.5mm galvanized bendy) or plastic boning (3mm) to
1) Loop around the rim of the hat and
2) To sew onto the netting at chin level to keep the veil away from the face.

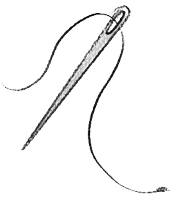




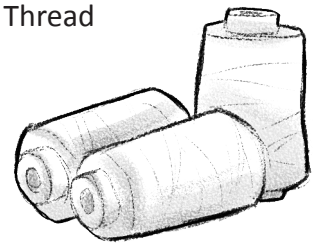
4. Clothing scissors



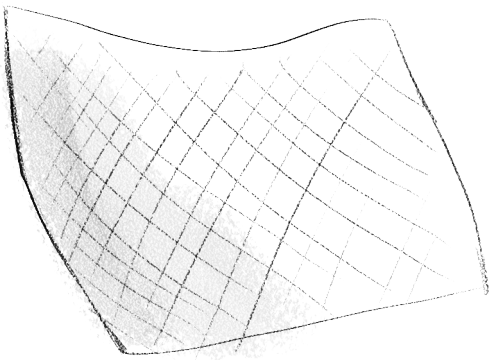
5. Sewing needle



6. Thread

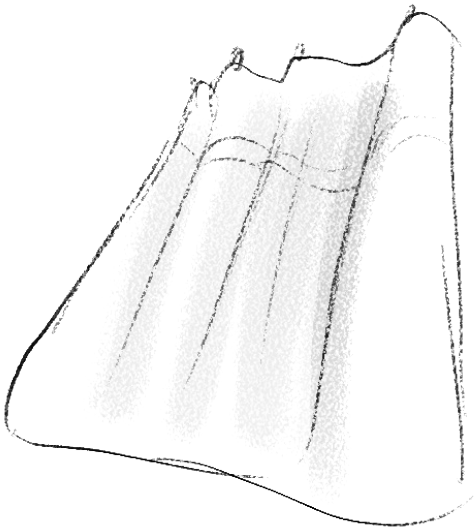


7. 1 x 500 x 300mm Black netting

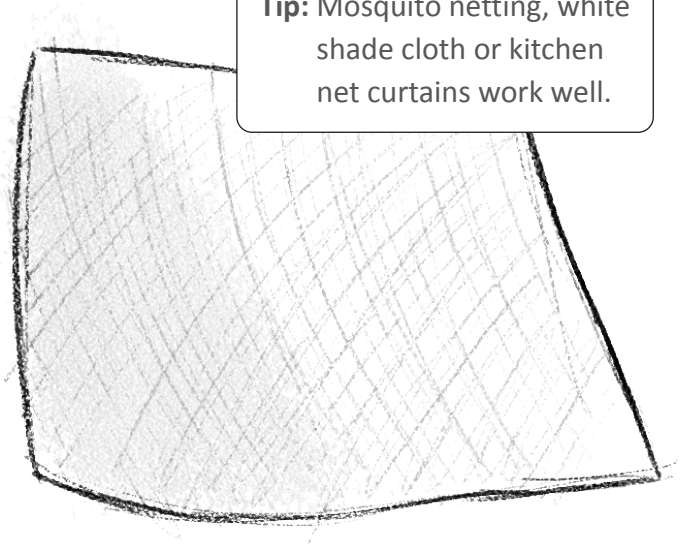


Tip: Dark shade cloth or fly screen work well.

8. 1 x 1,500 x 500mm White netting



Tip: Mosquito netting, white shade cloth or kitchen net curtains work well.

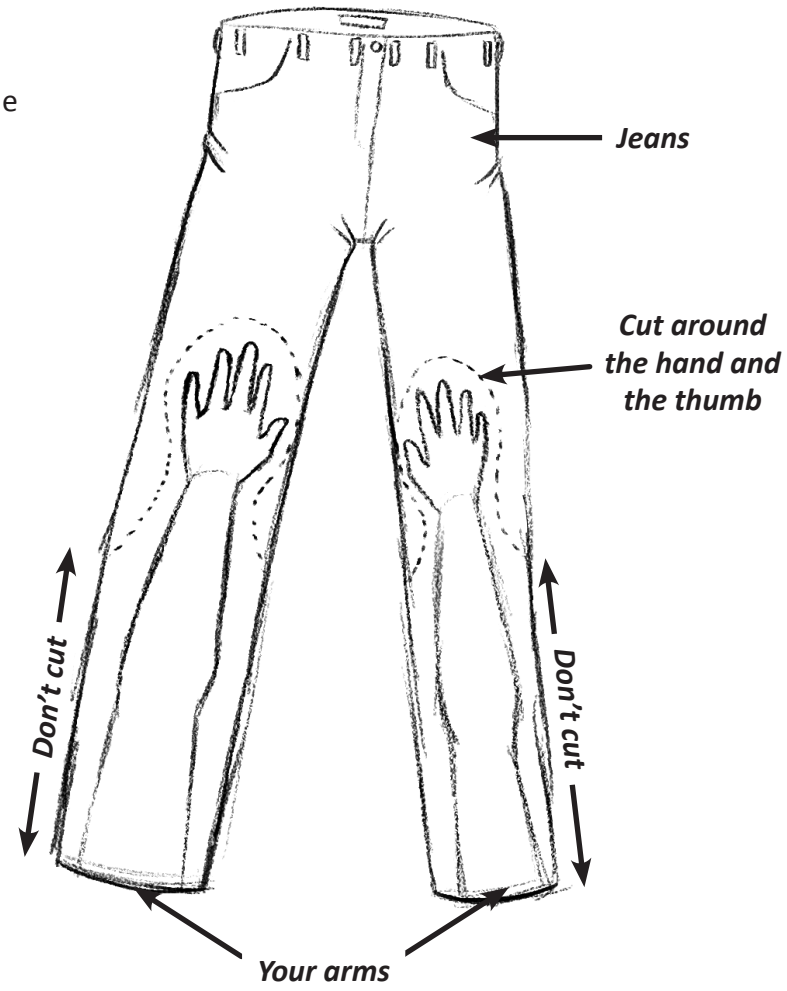


How to make beekeeping gloves:

Make the gloves long to cover as much of your arm as possible.

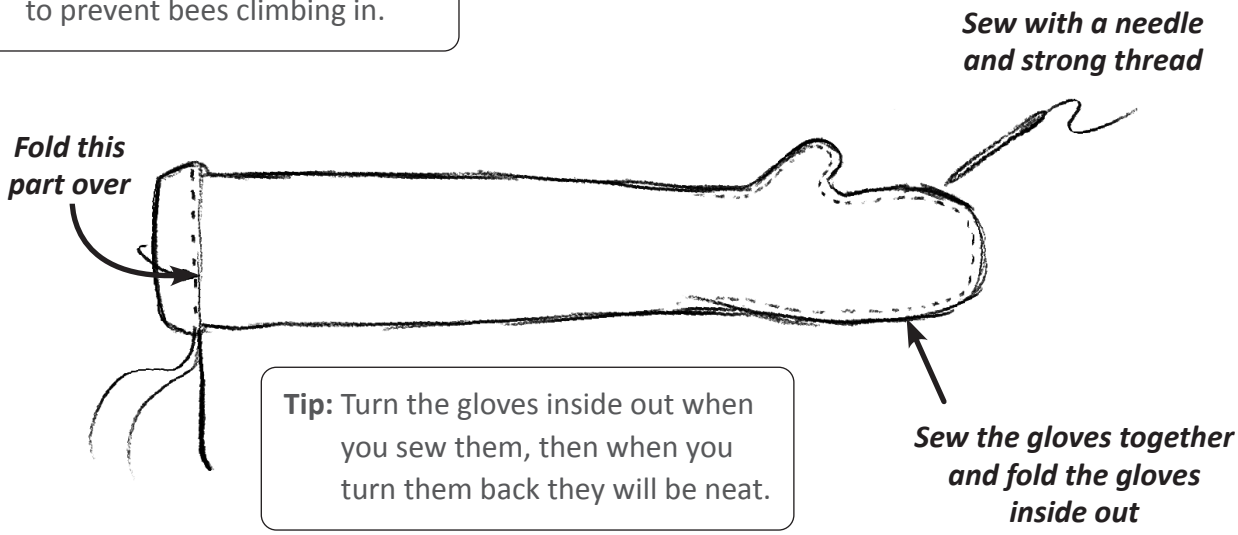
Stretch you arms as far as possible out on the jeans.

Keep it as wide as possible or your arms won't fit.



Tip: Use a double layer to prevent getting stung.

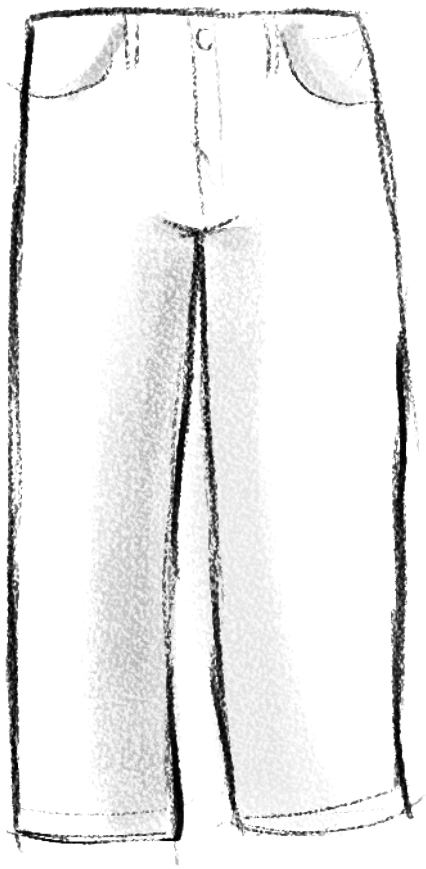
Tip: Cut thin strips of car tube or use sewing elastic to make your gloves fit tightly on your arm to prevent bees climbing in.

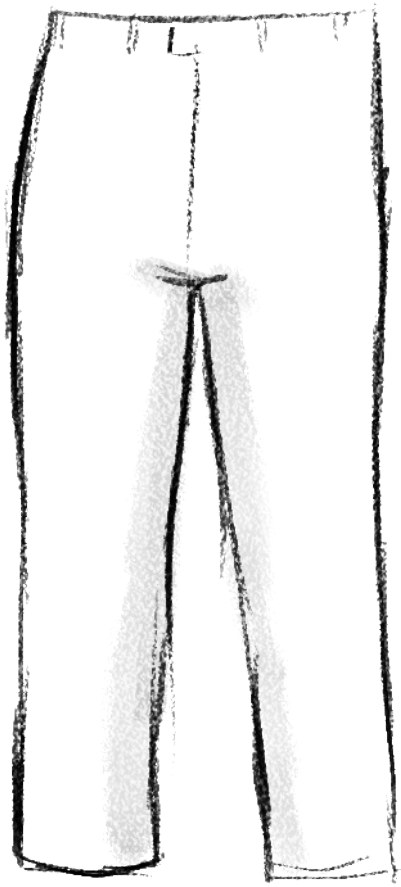


Tip: Turn the gloves inside out when you sew them, then when you turn them back they will be neat.

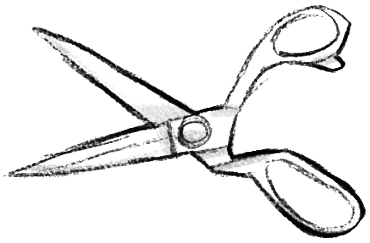
List of materials needed to make beekeeping gloves:

1. 2 x Old jeans or work pants

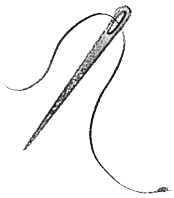




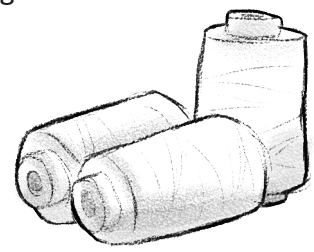
2. Clothing scissors



3. Sewing needle



4. Sewing Thread

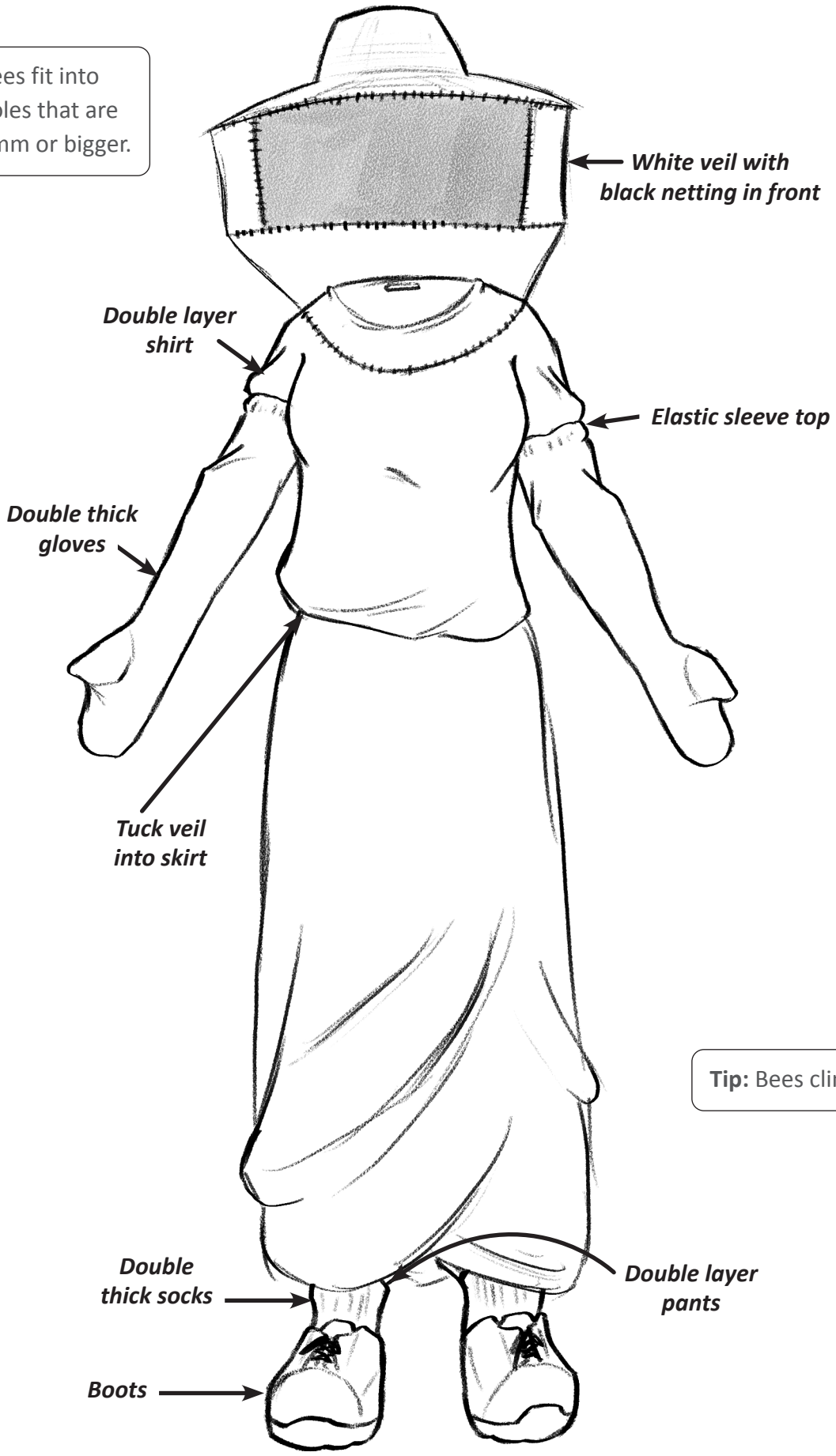


5. Marker pen

6. Sewing elastic or strips of bicycle / car tube

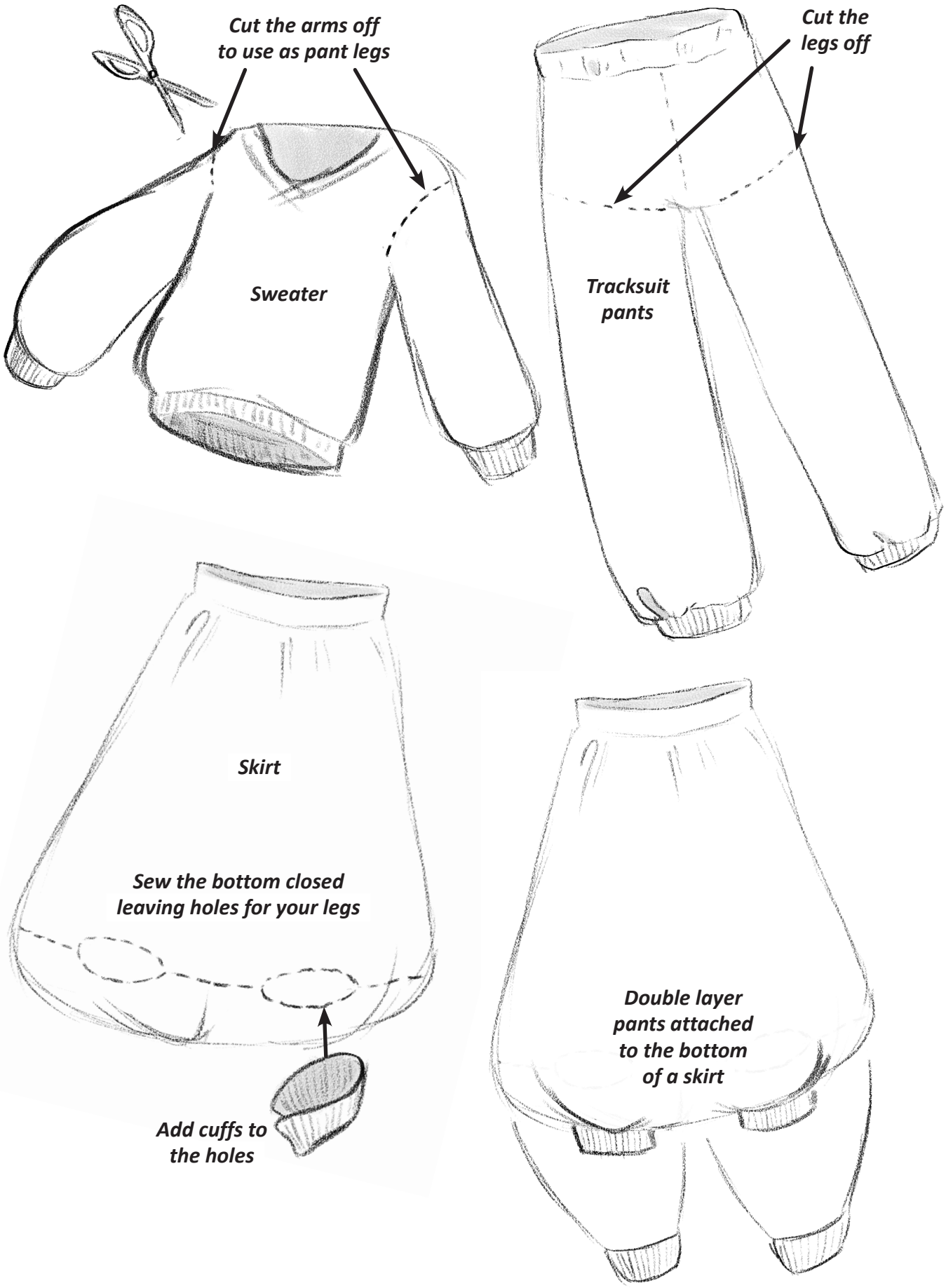
Beekeeping safety clothing for women

Tip: Bees fit into holes that are 4mm or bigger.



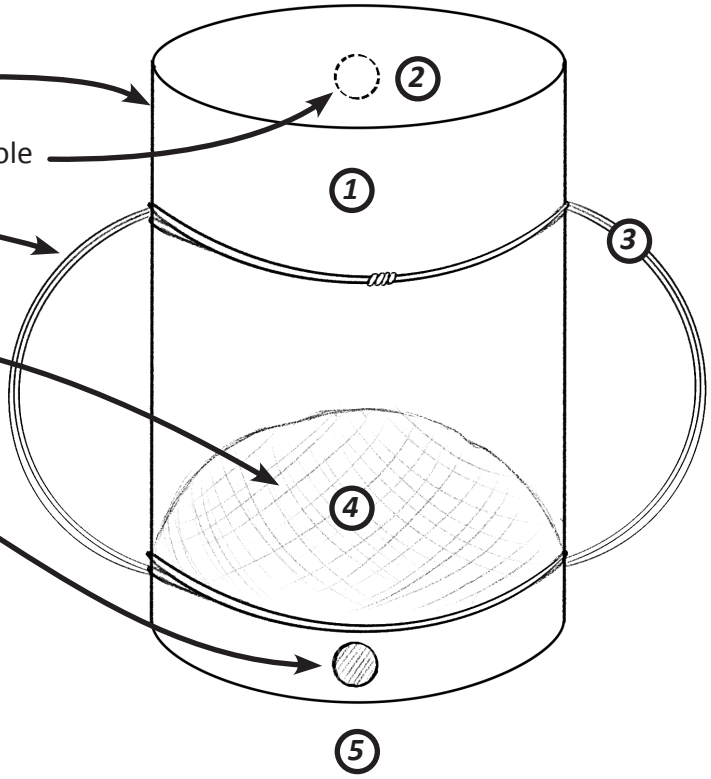
Tip: Bees climb up

How to make a closed skirt:

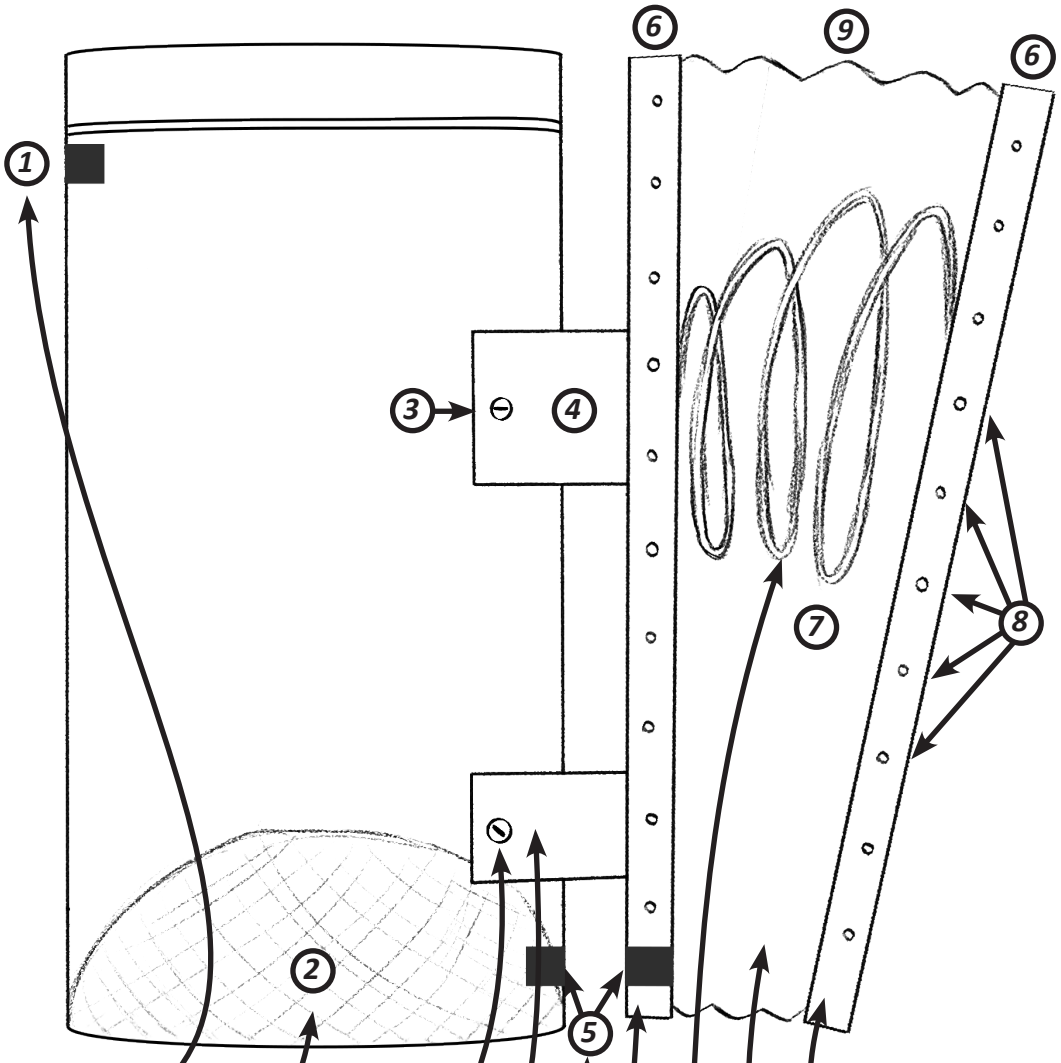


How to make a simple smoker:

1. Tin lid
2. Hole at top – opposite the bottom hole
3. Wire handles
4. Mesh at bottom of tin to allow air to circulate
5. Bottom hole
6. Smoke
7. Blow into the bottom hole



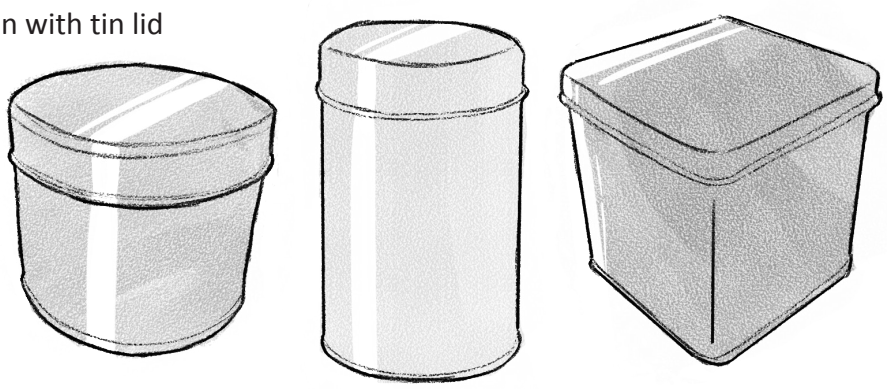
How to make an even better smoker:



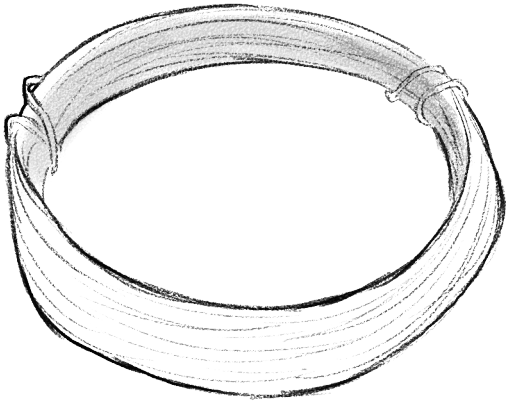
1. Hole
2. Mesh
3. Self drilling screws
4. Flexible tin
5. Holes
6. Boards
7. Bed spring
8. 10mm panel pin nails
9. Bicycle tubes
10. Strips of flexible tin to keep bicycle tube in place

List of materials needed to make a smoker:

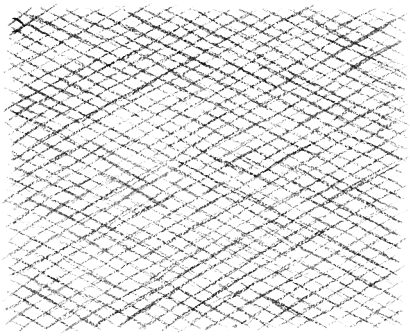
1. 1 x Tin with tin lid



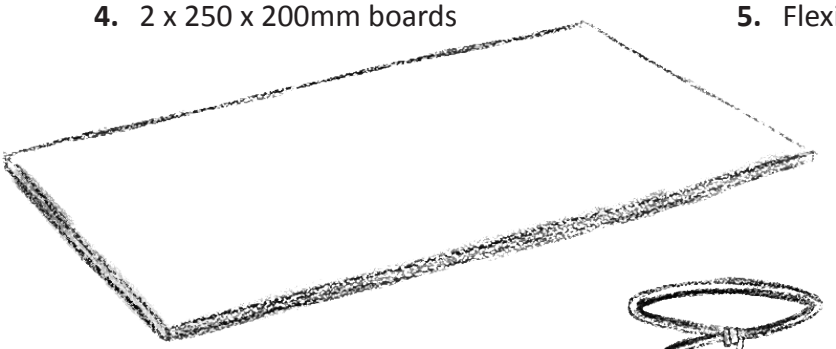
2. 2m 2.5mm galvanised wire



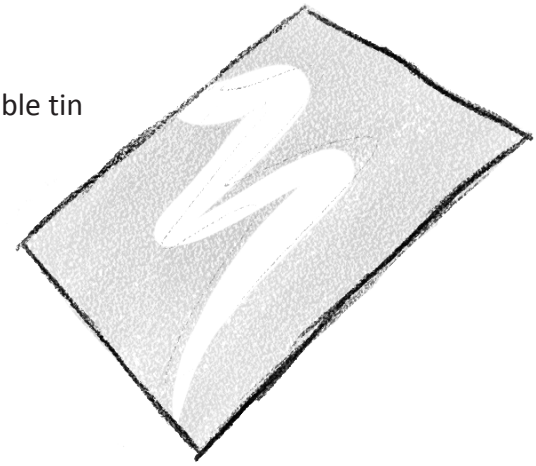
3. 100 x 100mm mesh or chicken wire



4. 2 x 250 x 200mm boards



5. Flexible tin

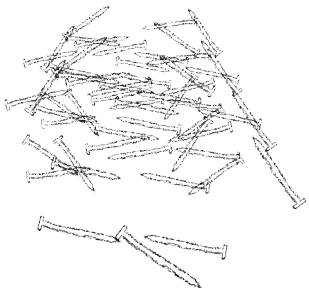


6. Twelve 20mm Self-drilling Screws

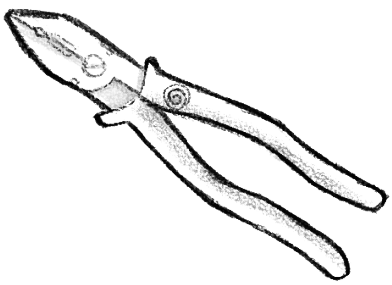
7. Bed coil spring

8. Screwdriver

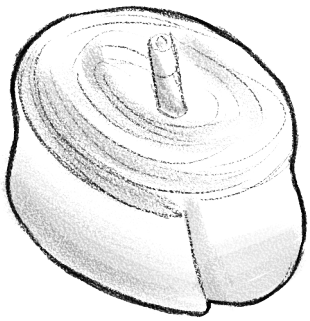
9. 10mm panel pin nails



10. Pair of old pliers



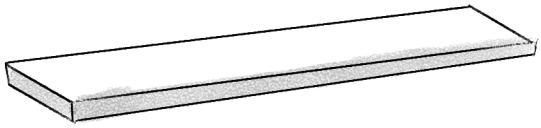
11. 15mm x 60mm bicycle tubing



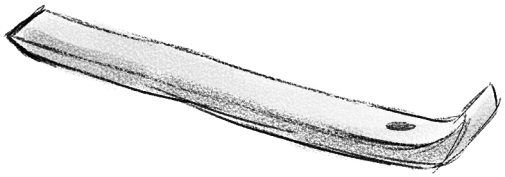
To make a hive tool:

Tip: If you drill a hole in your hive tool you can tie a piece of chord from the hive tool to your pants so that if you drop it while working with the bees, you can quickly find it again.

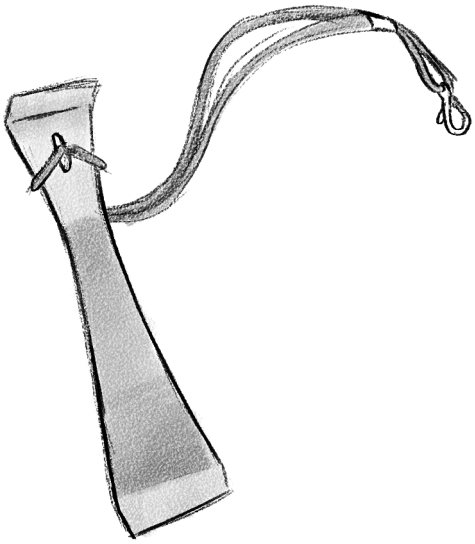
1. You will need some flat bar



2. Bend it at the end and grind the tips



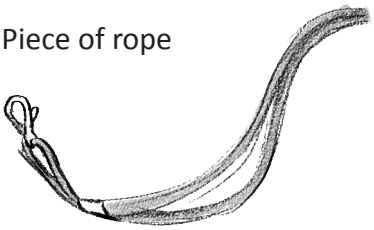
Tip: Tip: sharpen both ends



Make a hole in the side of the hive tool so that you can tie some cord through it that you can tie to your pants to avoid loosing the hive tool.

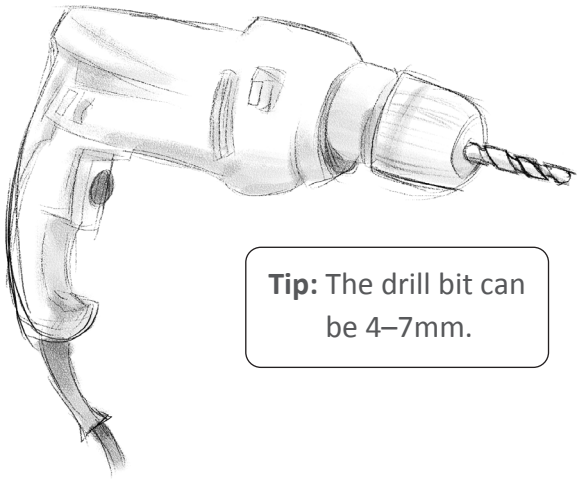
3. Or an old screwdriver

4. Piece of rope



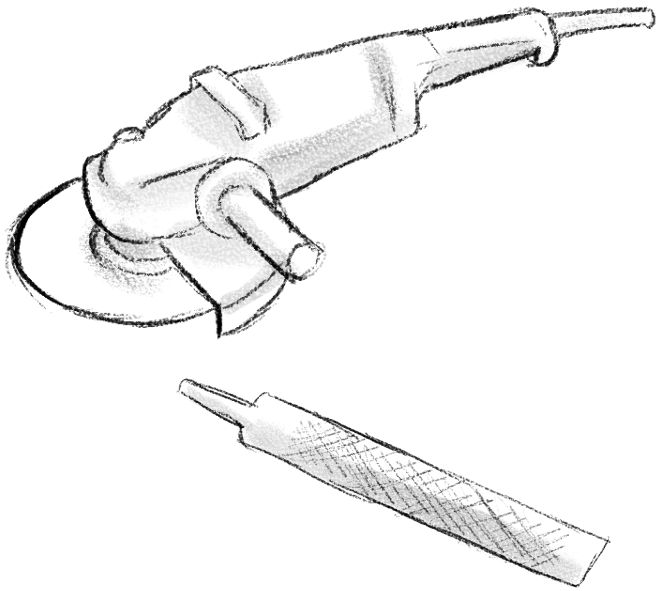
Tools needed to make a hive tool

1. 1 Drill with drill bit for metal



Tip: The drill bit can be 4–7mm.

2. 1 Grinder or metal file



Endnote

As you will have seen in this manual, we have offered some practical and accessible solutions for making essential beekeeping equipment. The sizes have been well researched for beekeeping with the African Honey Bee both in Ethiopia and South Africa and the methods have been trialed and tested in both countries.

The method used for problem solving is known as Asset Based Community Development (ABCD). ABCD is a methodology for the sustainable development of communities based on their strengths and potentials. It uses the community's own assets and resources as the basis for development; it empowers the people of the community by encouraging them to use what they already possess.

We have found the adage: "Give a man a fish, and you feed him for a day. Teach a man to fish, and you feed him for a lifetime," to only be true if you first teach a man to make the equipment he needs to fish. God has given each one of us the gifts we need to change our lives. We are blessed with relationships; we have families and communities. We are blessed with assets such as natural resources, waste that we can recycle, and the things we own. We are blessed with abilities, talents, the passion to learn, and the capability to work hard. This book suggests ways that we can use these gifts to change our lives, the lives of our families and those of our communities.

There are many books about more advanced beekeeping than what is suggested in these manuals. These will make a lot more sense once you have learnt the basics taught in these manuals. Treat the lessons learnt here as a foundation that you can build on.

Good beekeeping

Kibebew and Guy

IQQO
Oromia Agricultural Research Institute
Holeta Bee Research Center

AFRICAN HONEY BEE

Notes:

Notes:

Developed within project **Improved livelihoods of coffee and honey/bee by-product producers within conserved landscapes in Bale, Ethiopia**

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