Beekeeping

for

Beginners

Copyright 1949 and 1956
by
G. H. Cale, Jr.
Revised 1956
Reprinted 1962

Printed in U.S.A.

CONTENTS

		Page
Chapter 1	Beekeeping Is Pleasurable and Profitable	3
Chapter 2	Where, When, and How to Start With Bees	9
Chapter 3	Beekeeping Equipment	13
Chapter 4	The Honey Bee Colony	21
Chapter 5	Package Bees—From Arrival to Honeyflow	31
Chapter 6	The Honeyflow and Removal of the Crop	45
Chapter 7	Fall Management and Wintering of Bees	55
Chapter 8	Spring Management of the Overwintered Colony	63
Chapter 9	Source of Bee Pasture	77
Chapter 10	The Honey Bee and Pollination	85
Chapter 11	Transferring Bees—Moving Bees	89
Chapter 12	Rearing Queens—Queen Introduction	95
Chapter 13	Honey and Beeswax	103
Chapter 14	Disease and Enemies of Bees	107

CHAPTER I

Beekeeping Is Pleasurable and Profitable

KEEPING bees is a fascinating and desirable pursuit. Steeped in ageless time, it has survived since the early recordings of the Vedas in India, to be heralded as well in the Koran of Mohammed and the Holy Bible of Christianity. Equally it attracted the attention of Greek mythology, of Pliny and Aristotle and on down to the more modern investigations of Huber and Fabre.

The fascination of keeping bees lies in the fact that even the man of rudimentary training can get a liberal education in the objectives and accomplishments of this co-operatively organized group in the beehive called the colony; while the specialist in practical beekeeping or the scientist never will succeed in learning all there is to be learned about this little sacrificial trudging honey gatherer.

Here is a co-ordinating group of three types of bees acting in unison for the perpetuation of the bee colony, wearing themselves out in the summer rush for the harvest of pollen and honey. Apparently dormant though continually active during the winter season, the colony maintains a compact winter cluster by food and energy in order that the mother queen and her retinue of workers may survive again to build for another season. Thus the race is perpetuated, for generation after generation, for century after century.

Within the confines of the hive the eggs are laid, and develop into drones, queens, or workers. The worker bees pursue in their turn their housekeeping duties, their work in the field, or their efforts in defense of their home in case of attack.

Apparently without reasoning power and largely through instinct they communicate to each other when there is nectar in the field, in what direction it is and how far afield. Von Frisch, of Austria, has lately analyzed that peculiar tail-wagging, circular running activity of the worker bee within the

hive as a definite communication of the fact that the time for action has come—nectar is available.

All of these and many more equally as interesting phenomena of the honey bee colony are available to the merest beginner. He need only secure a hive of bees and handle them properly to be highly repaid for his investment and time, in enjoyment of the unfolding of one of those mysteries of life which go to make up our universe.

Bee stings may be a deterrent to many, but to those familiar with the bee and her habits, they are only a minor consideration. Proper care in approaching the hive, gentle and proper opening and handling of the bee colony will be rewarded by minimum danger from stings.

DESIRABLE PURSUIT

Beekeeping is a desirable pursuit as well as fascinating. If offers mild exercise or hard work according to its extent. It offers the reaction of the open air in the happy days from spring's opening to leaf fall of autumn, while it requires a minimum of attention and effort during the rainy days or the rigorous season of winter.

But there are other rewards of the products of the honey bee, the one, cross-pollination of fruits, legumes, and vegetables is intangible; the others, honey and beeswax, directly and profitably apparent.

Honey and beeswax we all know about; the former was our earliest sweet, used universally until Alexander the Great, returning from an Asiatic exploration, brought with him the first sugar cane. The latter, beeswax, equally as ancient, was used then as now as a medium of light; then, by necessity, now decoratively or in religious custom. Strangely, equally as prominent as the religious use of sacred candles, comes the use of beeswax for milady's complexion, for the face cream of today has as its base the nectar of the flowers transformed by the bees themselves into the beeswax of commerce and the substance of which their own combs—their own abodes—are built.

Yet, sweet as is the honey of the hive, smooth and refreshing as is the beeswax of the cold cream, neither of these exemplifies the honey bee's greatest contribution. For as the bee hurries from flower to flower, sipping the nectar from the

clover or the apple, the cucumber or the vetch, she simultaneously gathers on the hairs of her body and legs a bit of dust from the flowers called pollen. True, much of this pollen is brought into the hive to be mixed with nectar to form the food of the baby bees. But not all of it. As the bee trips from one flower to the other, leaving a bit of pollen as she drifts, she aids in the perpetuation of those trees, shrubs, and plants, through cross-pollination.

Some of our plants are self-pollinating, others are wind pollinated, but some fifty or more of our vegetables, fruits, and legumes must have insect carried cross-pollination to assure not only a sufficient quantity of fruit or seed but also a satisfactory quality.

Time was, probably, when our native beneficial insects could do the job of plant, shrub, and tree perpetuation. But all of our best authorities now recognize that the combination of intense cultivation, of large scale single crop acreages, added to the immense destruction of our beneficial insects along with the destructive ones through sprays and poisons has left the honey bee our sole hope for the future if we are to have adequate cross-pollination to secure good crops, ample and plump seed and fruit, and a perpetuation as well as improvement in our agricultural picture. Recent awakening of our agriculturists to the need of soil conservation for the proper retention of soil content means more legumes, more seed for seeding those legumes, and more bees to do the job of carrying those necessary pollen grains from one blossom to the other.

So, while it is undoubtedly true that the honey bee has been worth ten times as much in aid to pollination as for her products of honey and beeswax, equally is it true that our agriculture of the present and future requires the aid of our honey bees many times more than it did a hundred years ago.

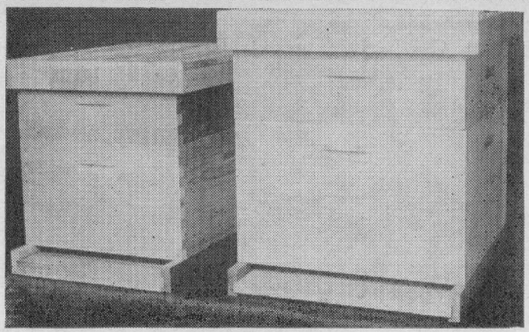
BEEKEEPING IS UNIVERSAL

Wherever flowers bloom, bees may be kept, the success of their efforts, of course, depending upon the rigors and length of the season and on the amount of bloom available. While the vigorous extremes may preclude profitable bee culture in the Arctic or the desert, yet some bees are kept in Alaska, and

nomadic tribes carry their rude colonies with them in the Near East as they wander across the sands with the seasons.

Fifty years ago the Dakotas and the western Canadian provinces imported honey. Bees apparently were thought unable to flourish there. Yet, today these very sections represent some of the best commercial honey producing regions of the American continent.

Nor has civilization and city congestion limited the possibility for keeping bees. For wherever there are flowers, honey bees may be kept.



The evolution of the modern beehive. Top—straw skep, log hive, wooden box hive. Left—Langstroth hive and Modified Dadant hive. Notice the difference in size between the Langstroth and the Modified Dadant.

BEEKEEPING MADE EASY

The beekeeper in antiquity knew little of the bee colony organization. His hives were rude log gums, crudely fashioned clay cylinders, or straw skeps. (These still *persist* in many countries of Europe, Asia, and Africa, and we still have our

share of box or log hives and "gums" in certain American localities.)

But we of present-day America may share the progress brought to beekeeping everywhere in the 1850-1870 period by the inventions of three men which have revolutionized the method and ease of keeping bees.

Our own L. L. Langstroth discovered the significance of a bee space in the interior of the beehive and subsequently invented the movable comb hive, a hive with frames made of wood, each of which contain a honey comb. The frame hangs by an extension of its top bar at both ends of the hive, leaving a 3/8 to ½ inch space at the ends and bottom of hive which serves as a passageway for the bees and is called the bee space. This space allows room enough for the withdrawal of the frames from the hive for examination or replacement but not enough space between the frame and wall of the hive to induce the bees to build comb attachments. Langstroth's hive was made with the top removable so that any or all frames might be lifted independently from the hive body. (Some European hives, particularly in Germany, have movable frames but a back or side opening so that it is necessary to remove all frames in order to look at the one farthest from the open side or back.)

Following Langstroth's invention, Johannes Mehring in Germany conceived the idea of furnishing to the bees a part of the beeswax they needed in forming their combs. His idea was to imprint into the flat thin sheet of beeswax, the impression of the cells of a comb. Thus, all the bees need do is to draw out these cells of wax, adding beeswax of their own production to finish the proper depth of the comb. So, we now have straight combs instead of the conglomeration of immovable cross-combs as in the skep, box hive, or gum. These sheets fitted into the Langstroth frame would be drawn out by the honey bee colony, making for ease of handling and examining the colony and ease of producing and removing the surplus honey.

Franz Hruschka in Italy, meanwhile, had discovered that combs of honey whirled centrifugally could be made to release their store of honey; and the third item for modern honey production was born with the invention of the honey extractor.

No more need the combs be cut out and squeezed to get the liquid honey. Merely slice off the cappings of full combs of honey, combs built on Mehring's foundation, in Langstroth's movable frame, place them in Hruschka's honey extractor with resultant clear liquid honey, free of all bees, larvae, and pollen.

And the beauty of it was, these combs after the honey was extracted could be returned to the colony to be refilled by the honey producing colony and used again, year after year.

On these three inventions, with improvements, of course, is built the ease of keeping bees and handling honey as practiced today.

Readily available also are college courses in beekeeping, even correspondence courses, as well as lectures and short instruction classes in many vocational educational schools. Bee books and bee journals as well as state and government bee departments stand ready to help answer the questions of the beginner or commercial beekeeper.

CHAPTER II

When, Where and How to Start with Bees

THE keeping of bees has been and is being practiced by men and women in all walks of life, whether located in city, suburb, on small farm or large acreage. The beginning may be made in a small way at a minimum of expense and with possibilities of early gain.

WHEN TO BEGIN

Whether starting with a fully established colony or with new equipment and package bees, the best time is early in spring, usually about fruit bloom time. Thus, the package is able for the most part to maintain itself from the start and gradually build up to a full colony, sometimes before the major honeyflow is too far advanced. While one need not be disappointed if the colony only succeeds in fully establishing itself the first season, yet the honeyflows may be so propitious as to give a harvest of fifty pounds, or even more, of honey with a good strong colony for winter quarters.

WHERE TO BEGIN

As previously explained, bees may be kept in almost any place that flowers bloom, the number of colonies to be kept in one location or locality depending upon the amount of flora available and the nectar producing possibilities of the flowers.

One should bear in mind in the selection of a location that bees do have stings, and while stings offer little impediment to keeping bees, yet the neighbor's rights should not be infringed upon. Select a location for your colony or colonies, therefore, so that the line of flight of the bees will not interfere with passers-by or with the neighbor's garden or yard activities. If the colony can be so placed that the bees will immediately fly upward through the openings in trees or shrubs, all the better.

Thousands of colonies are kept on porch roofs or in sub-

urban back yards very successfully. Raise the beehive from the ground a few inches on blocks to avoid dampness and if there is a good windbreak on the north and west in the form of a fence or shrubbery, take advantage of it. Usually hives are faced with entrances away from the prevailing winds. A south or east exposure is good.

HOW TO BEGIN

The beginner may get his start by purchasing a full colony of bees, preferably in spring, from a neighboring beekeeper, adding such handling material as desired. However, one always runs the risk of failure of an old queen, or of bee diseases (explained in Chapter 14).

Some beginners may be located where box hives or log gums are available for a nominal sum, but again the vigor of the stock may be under par, disease may be present, and the necessity of transfer of the bees and combs to new movable frame hives presents considerable difficulty for the beginning beekeeper. However, in Chapter 11, we give suggestions which will aid in transferring bees to modern hives.

The best way to begin is to purchase a package of bees with a young laying queen. These can be obtained from nearly all bee supply houses which also will have new hives, equipped with frames, and bee comb foundation, as well as other necessary material such as bee veils, hive tools, bee smokers, and bee books and magazines.

Preferably start with two or three colonies rather than one. With a single colony, though the chances of failure are rare, yet the beginner may be discouraged in such instances whereas the second colony might make a bounteous harvest, to equalize the rare loss.

There are available bees of several races, the most prominent of which are the Italian, the Carniolan, and the Caucasian. The Italian race has been most generally accepted as standard in America and should be your beginning choice. Later, other races may be tried if desired.

Line breeding and hybrid crosses are rapidly being developed in bee raising. Thus, such good attributes as gentleness, high honey gathering qualities, color, disease resistance, etc. are combined into strains of bees of superior quality.

Instructions on preparation of equipment and on receiving, installing and caring for your package of bees will be outlined in Chapter 5.

It is best in advance of this, however, for the beginner to acquaint himself with various types of hives, supers, and other bee equipment (Chapter 3); as well as with the inner working of the colony itself, its various members, their structure and their duties as outlined in Chapter 4.

The beginner's outfit should include:

Modern beehive with frames
Bee comb foundation for these frames
3-lb. package of bees with queen
Bee smoker
Bee veil
Hive tool
¼-lb. spool of wire to hold foundation in frames
Bee gloves
Bee magazine

Later, when the bees start making more honey than is needed for their own requirements, storage room will be necessary. This is provided by either comb honey supers with section boxes and thin surplus foundation or frame supers with either thin foundation for cut comb honey or heavier weight foundation for extracting.

CHAPTER III

Beekeeping Equipment

INTEGRAL parts necessary for successful beekeeping are the bees themselves with their queen, and a beehive in which they may locate and raise their brood. The beehive should be large enough to accommodate a prolific queen, thus helping reduce crowding and minimizing swarming.

This may be provided by a large brood chamber hive in one story like the Modified Dadant or with the smaller but more standard 10-frame Langstroth style hive where generally

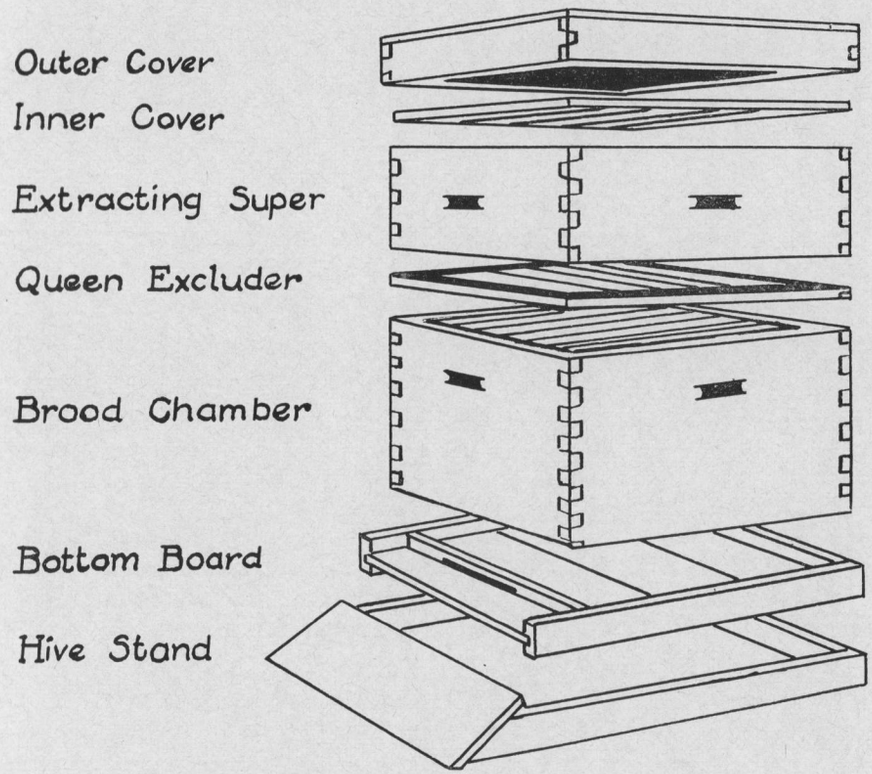
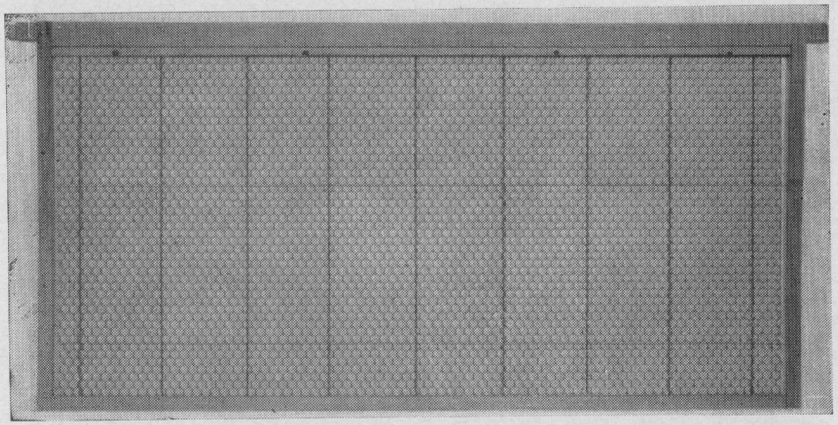


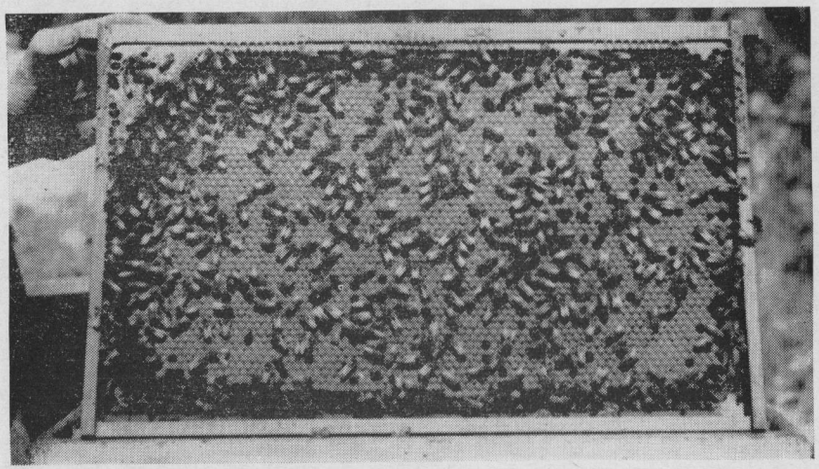
Diagram of the various parts that comprise the beehive

a second story or hive body is added when needed. However, this need not be considered by the beginner in his first season.

The beehive will consist of a bottom board with provision for entrance, the hive body itself with frames in which the bees will live and work, and a hive cover over all. All frames within the brood chamber should be provided with full sheets of bee



A frame with wired foundation. The wooden portion on the outside is the frame, the center portion the wax foundation. Notice the crimped wire in the foundation which adds strength to the finished bee comb.



A beautiful comb of brood—result of foundation well built

comb foundation (thin sheets of beeswax bearing the imprint of cells of the comb). This foundation assures that when drawn out and added to by the bees, the beekeeper will have nicely spaced straight combs of brood, honey and pollen. These combs may then be easily withdrawn by the beekeeper to enjoy observations of the queen, the bees, and the drones, and to determine the status of the colony as to brood, honey, and pollen stores.

This hive, then, with its top, bottom and hive body with frames and combs of bees, brood, pollen and honey constitutes the bee colony.

Additional equipment consists of supers with frames and foundation to be placed on the hive as is needed in which the bees may store the nectar from the flowers and evaporate or thicken it into the honey which will be removed.

Here the beginner has a decision to make. He may decide to produce honey in the little pound boxes called sections and consume or dispose of it in section or comb honey form. In such case, he will order comb honey supers with comb honey sections and foundation to fit.

Or he may wish to produce for his own use in shallow frames (5-3/8 or 6¼ inches deep), comb honey which he can cut out of the frames for home consumption, to give to friends, or to sell wrapped in cellophane. In such case, he uses shallow supers with frames and thin foundation. Thus, the combs may be cut out when filled, new foundation inserted, and the frames returned to their supers for the balance of the crop.

The beginner may ultimately wish to produce liquid or extracted honey. In such case, the same shallow supers may be equipped with medium brood foundation, which is heavier; or added hive bodies with full depth brood frames may act as storage space for surplus honey. This extracted honey production, however, will require additional removal equipment such as an uncapping knife and honey extractor.

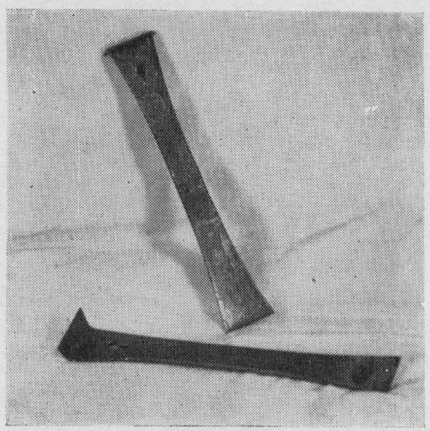
Perhaps the first season, in any case, the beginner would be better off as his colony builds up, to order his surplus honey storage space for either comb honey or for bulk honey in shallow frames. The latter has the added advantage that such storage equipment may be used for extracted honey production if a change to that type of production is made later.

Equipment for handling the colony of bees is a necessity. A bee veil should be worn protecting the face from the attack by any occasional angry bees. Bee gloves, while not necessary, do give a feeling of security until the amateur has become acquainted with the manipulation of the colony.

The bees use beeswax and *propolis* to stick the frames together which makes it necessary to have some kind of an all-

The bee veil protects the face and neck from stings. While some beekeepers actually work with bees without any protection for the face, this is not advised for the beginner. There are several types of veils, but the wire veil which stands out from the face offers the best protection. The wire is stiff enough to keep the wind from blowing the veil and to keep branches of trees from brushing it against the face. Any type of hat may be worn with this type of veil; it is recommended however, that a lightweight, well-ventilated summer or straw hat be worn.

Wire Veil



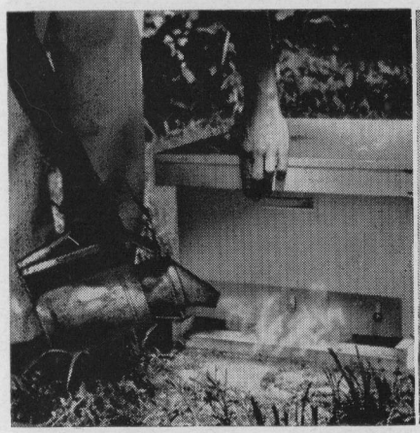
Hive Tool

The all-purpose hive tool. Used for pulling nails, scraping beeswax and propolis, prying frames apart, taking off the cover, inner cover, and super, and other utility purposes. Notice the hole used as a nail puller and the angle end which is used for scraping wax and propolis. Beekeepers sometimes use such things as screw drivers and car springs in place of the hive tool, but such substitutions are never so desirable a tool.

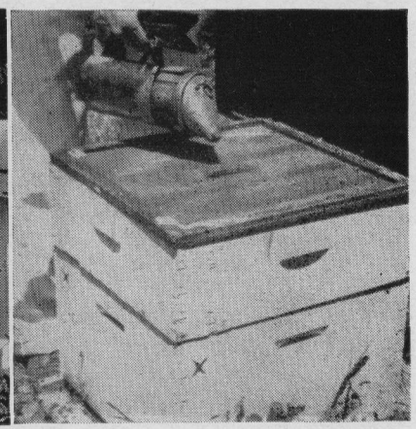
purpose tool to use in working the hive. The modern hive tool is the answer to this necessity. In addition to having a cleaning and scraping edge, it also has a nail puller as a built-in feature.

By all means, a bee smoker must be on hand before any

The bee smoker is one of the most important tools that the beekeeper uses. It helps to subdue and quiet the bees and they sting very little when the smoker is used properly. On the other hand, excessive use of the smoker may tend to irritate and anger the bees to the point where they will sting readily.



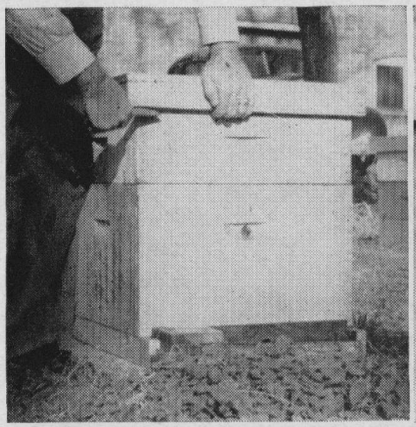
Before starting to work a colony of bees puff a little smoke in the entrance to the hive. This smoke at the entrance disrupts the guard bees and causes the bees within the lower parts of the hive to gorge themselves on honey.



The bees in the top of the hive will not have been warned of your approach and will not have their honey stomach filled with honey. After removing the outer cover, puff a little smoke into the hole in the inner cover.

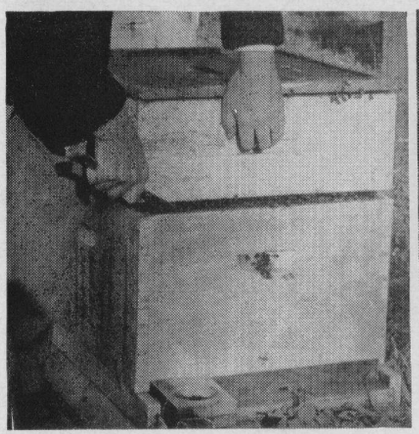
operations around the colony are attempted. The smoke causes the bees to fear that the colony is going to be destroyed by fire and they rush into their hive to gorge themselves with honey preparatory to flight. Bees, like men, are much more docile with a full stomach than an empty one.

A puff or two of full rich smoke at the entrance, followed by similar puffs over the frames of the hive as top or supers are removed, is a great aid in keeping bees gentle and facilitates handling the colony without getting stung. But use a mini-



Taking off outer cover

Prying up inner cover



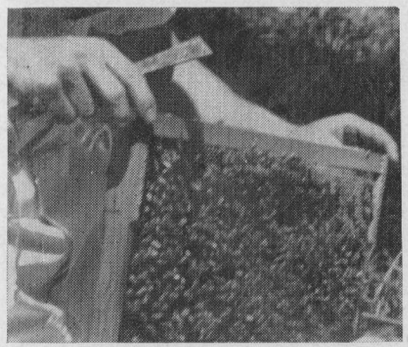
Removing the super

Prying apart and removing comb

mum of smoke, just enough to subdue the colony; with an occasional puff or two over the tops of the frames as you proceed with the examination.

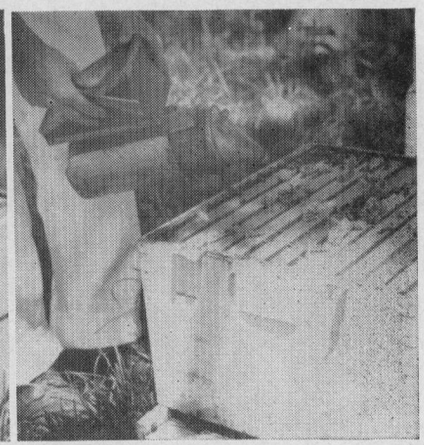
Too much smoke or too hot a blast is apt to make the colony "run" even to the point of all congregating on the front of the hive and in the air around it.

Rolled corrugated paper, clean burlap sacks or partly rotted



Many beginners find tools like the smoker and the hive tool in the way when not in use. Notice in this picture how the hive tool is held in the hand yet still leaves the fingers free for manipulation of the brood frames. Holding the hive tool in this manner keeps it handy and ready to use and does away with groping around in the grass trying to find the hive tool when you want it.

If there is a super on your colony of bees, puff smoke on the frames in the super after removing the inner cover. Always remember that a little smoke will go a long way.



After removing the super you are down to the brood nest of the colony. Smoke the top of the brood frames and put your smoker where it is handy. You are now ready to work the colony.

wood make good smoker fuel. They ignite easily and give a comparatively heavy, cool smoke.

OTHER EQUIPMENT

For a single colony or two of bees, perhaps no removal equipment is needed, though an inner cover between the top of the frames and the cover is desirable. It has a hole in its center into which can be fitted a bee escape, thus serving as an escape board to be placed between the full supers of honey and the hive body itself when honey is to be removed. The bees run down through the escape into the body of the hive and cannot return to the super.

For the producer of extracted honey, an uncapping knife for cutting away the capping surface of the comb is necessary. These knives are made in various styles, either plain or steam or electrically heated. Likewise honey extractors for whirling the honey from the comb after it has been uncapped may be had in a wide range of sizes.

CHAPTER IV

The Honey Bee Colony

THE honey bee colony is made up of three individual types of bee—the worker, the queen, and the drone. These three carry on the functions of the colony, but before we look into the colony itself, let us first examine each of these types of the honey bee.

THE WORKER BEE

As its name implies, the worker bee is the laborer of the bee colony. The worker is an undeveloped female that is adapted for nectar and pollen gathering but is not capable of reproduction. When you see a bee on a flower it is the worker bee which you see.

Like all other insects, the worker bee follows a complete metamorphosis in its development. It starts as an egg, which hatches into a larva. The larva grows and matures, spins a cocoon around itself within its waxen cell, and then changes into a pupa. The pupa spends its allotted time maturing and finally emerges from its cell as a full-grown adult.

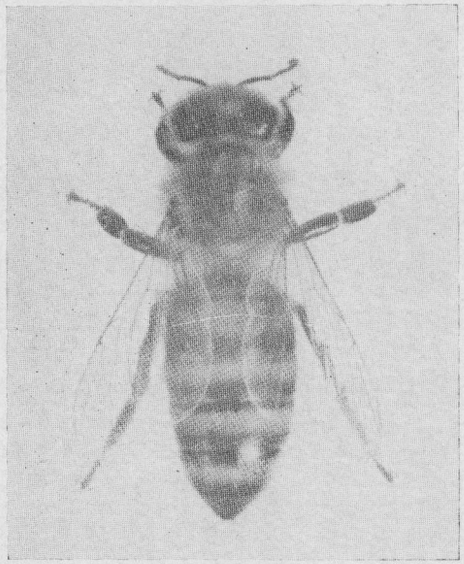
The function of the worker bee is clear from the name. All the work of the colony, with the exception of laying eggs. is carried on by these worker bees. They protect and warm the eggs, larvae and pupae; feed the young larvae; build comb: bring water to the hive; gather pollen and nectar from the flowers; transform the nectar into honey; and countless other tasks.

Because of this tremendous amount of work, their lifetime is short, and in the heart of the summer honeyflow worker bees seldom live longer than six weeks.

Such a variety of tasks as is assigned to the worker bee is reflected in her anatomical make-up. The head, or front segment of the bee has two compound and three simple eyes so the bee can be equally proficient in seeing within the hive and on the wing while in search of honey or returning with it

to the hive. In addition there are located in the head, glands which secrete a substance used in feeding the larvae of the colony, particularly the young embryo queens which require a specially rich food called royal jelly.

Here in the head are also located the feelers or antennae which apparently have the senses of smell, touch and hearing;



The worker bee

also the mouthparts with muscular pump arrangement which allows the honey bee to sip with equal ease, the nectar from the flowers or the water from the watering trough, or pump the nectar back into the comb within the hive.

The sense of direction of the bee must be remarkable. Once she has located her hive by her first play flight, she leaves ever after without apparently looking back, only to return with uncanny accuracy to the home entrance. In fact, if the hive be moved only a few inches, the bee will be cognizant of it, and a move of several feet loses her almost completely. The honey bees of a colony usually forage little beyond a two-mile radius from the hive; in broken, hilly country, probably less;

on a flat plain possibly several miles, though their economic honey gathering ability is lessened on account of the time factor on the longer trips. We have all heard the remark "a bee line" as if it were the shortest distance between two points. Yet seldom is the bee line a straight line. More often it is the line of least resistance to get from hive to forage and back, taking advantage of wind protection, land contour, tree openings, creek bottoms, etc.

In the thorax or second part of the bee's body are located the muscles which operate the wings and legs, all of which are attached to this part of the body.

The honey bee is also remarkable in its appendages. Its two pair of wings, hooked together on each side, can carry tremendous loads, while its three pair of legs have sticky pads to facilitate crawling on a smooth wall, hairy baskets to collect and carry the pollen to the hive; a short spike to help in scraping the pollen from the pollen baskets into the cells of the hive and even a small notch in one of its pair of legs enabling it to clean its antennae and perform its personal toilet.

The third part of the body is the abdomen. Immediately in the forward part lies the honey stomach, the container for the nectar as it is gathered and from which it may be pumped out into the cells for nectar and honey storage within the hive, or may go on down into the stomach proper to serve as the bee's food or be transformed chemically into beeswax to serve in building the bee's comb.

In the abdomen is located the stomach; the wax secreting glands; the intestines; rudimentary sexual organs which at times allow a worker bee to lay a few eggs which hatch only drones; and the sting with its barbed point and its little sac of poison. The worker bee loses her sting in the act of stinging, the bee sting remaining in the flesh of the individual, and the muscles of the sting pushing the sting itself more deeply into the wound. If a person is stung, the sting should be removed by rubbing it off the flesh, rather than trying to pinch it out of the wound since in the latter case, the poison in the sac is squeezed out into the flesh, thus increasing the danger of swelling.

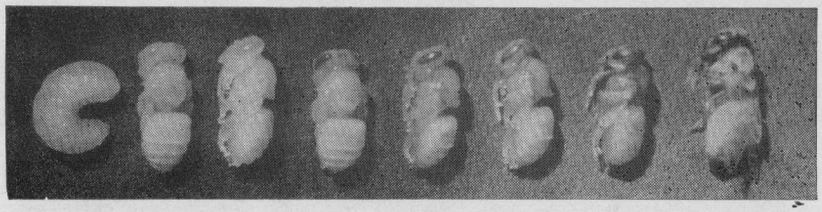
Every colony is always on the alert for marauders, be it the human, the straying animal, or the worker bees of another

colony, for honey bees are arrant robbers, especially when there is nothing in the fields for them to gather. Weak colonies are apt to be overpowered in times of dearth, even though wary guards are stationed at the entrance of the hive to ward off intruders.

From the time the tiny egg is attached to the bottom of the cell until the mature, downy, hairy young bee emerges from the cell by cutting the waxy capping away, a period of twenty-one days has elapsed.

From left to right—the egg which hatches into the larva and the stages in growth of the bee larva.

(Photo courtesy U. S. D. A.)



From left to right—the stages in development from the larva through the pupal changes.

(Photo courtesy U. S. D. A.)

The following table gives the duration of development of the brood from the egg to the perfect insect:

		Queen	Worker	Drone
In the egg	days	3	3	3
Growth of larva	days	5	6	6½
Spinning of cocoon	days	1	2	1½
Period of rest	days	2	2	3
Change to pupa	days	1	1	1
Change to winged insect	days	3	7	9
Av. duration of changes	days	15	21	24

These figures represent the time required in summer weather; in cool or cold temperatures the time is somewhat lengthened.

THE QUEEN BEE

The queen bee is truly the mother of the colony. The entire colony life is dependent upon her efforts, for without the eggs she lays the colony would soon die. She is the only perfect female in the hive, differing from the workers in that she has perfectly developed sexual organs and has the ability to lay eggs.

The queen bee

She passes through the same stages of development that the worker bee does. The difference between the queen and the worker is determined during the larval stage. A larva which is fed an extremely rich mixture of food, called royal jelly, develops into the queen bee, while the workers are fed a less con-

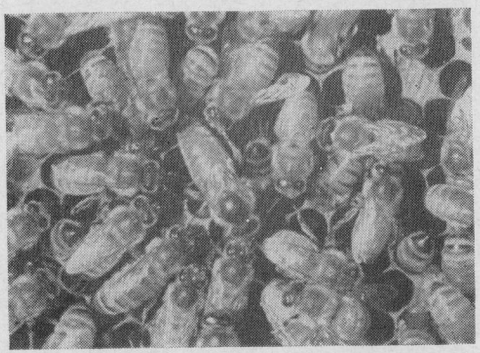
centrated food and remain as sexually undeveloped females. The time consumed in development from the egg to the adult is 16 days for the queen.

The queen bee has but one function in the colony and that is to lay eggs. Day after day the queen continues her tireless efforts, laying thousands of eggs which will develop into more bees. A superior queen has been known to lay as many as 3000 eggs a day, but the usual average is from 1200 to 1800.

Though the queen rightly deserves her name through the fact that she is responsible for the success or failure of the colony she heads through her egg laying ability, she is by no means a ruling tyrant. Not only does she not go to the fields to gather pollen and honey, but she is even dependent on the bees of the hive for her daily food. They wait on her hand and foot, surrounding her in an amicable circle, feeding her from their own mouth parts and removing her excrements as fast as deposited.

But she is virtually a prisoner within the hive, never leaving it after her nuptial mating flight, unless she goes out with a swarm; and if she becomes old or incapacitated, she is replaced and disposed of without ado by the workers of the colony.

While she has a sting, it is never used in stinging other bees or animals or other objects, but is reserved for her possible battle royal with another hostile queen. Under such circumstances, the battle of the queens may be likened to the battle of hostile male deer or moose in the forest. May the better win, and evidently the bees do not interfere.

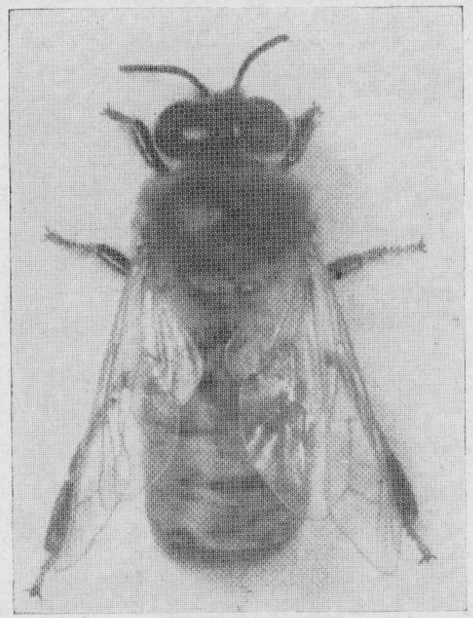


Note the comparative size of the queen and the workers. The queen is the large bee in the center. See how the worker bees surround and face the queen as they care for and protect her. Wherever she goes in the colony the workers make way for their queen.

THE DRONE BEE

The drone bee is the male. He is easily distinguished from the others by the prominence of the two large compound eyes, larger than those of the queen and the worker (one on either side of the head), and by his blunt abdomen. In size the drone falls between the queen and the workers—being larger than the worker and smaller than the queen.

The drone passes through the same stages of development as the queen and the worker—the only difference being that it takes the drone 24 days to develop from the egg to the adult bee.



The drone bee

The drone has only one function in the colony, that of mating with the queen bee. The queen mates only early in her lifetime (shortly after emergence as an adult) so it can be readily seen that after the queen is mated and laying the drone is a useless burden to the colony. The majority of the time the drone is in the way in the colony and as winter ap-

proaches the workers drive the drones from the colony so that they perish from cold and starvation.

This big bumbling male has neither a sting to protect himself and his colony, nor proper mouthparts for securing honey from the flowers. He does help himself freely to the bounty within the hive which has been collected by the worker bees. And he is welcomed by them as long as there is nectar in the field and there may be need for new queens to head new colonies on account of the crowded condition within the colony. He may even enter a strange colony unmolested.

But woe be to him when the summer wanes and the breath of winter is in the air. The drone seems to sense his fate, and opening the hive you may find the drones grouped in the very far upstairs corners of the hive evidently hoping that in that isolated spot they may be unnoticed and thus gain a few more days of respite before the day of reckoning comes.

And yet, in a queenless colony, these same drones may be allowed to remain throughout the winter. Something tells the bees of the colony that drones are necessary for the development of the egg-laying powers of a new queen, and they retain the drones in the hope that in some way these big harmless gluttons may solve their problem.

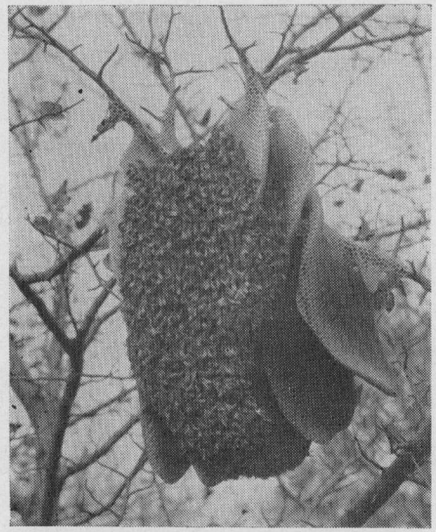
Even in the fulfilling of his mission in life—mating with the queen while in flight in the air—there is a bit of irony. For the successful drone never lives to see the birth of his progeny. His sexual organs are torn from him by the ravished queen, and he drops to the earth, his mission accomplished at the cost of his life.

THE COLONY

Put the workers, the queen and the drones together, give them a home and allow them sufficient time to build their combs and you have a colony. The number of bees in this colony may vary all the way from a few thousand to a hundred thousand or even more. Bees may be described as social insects, that is, they band together and have a division of work among themselves.

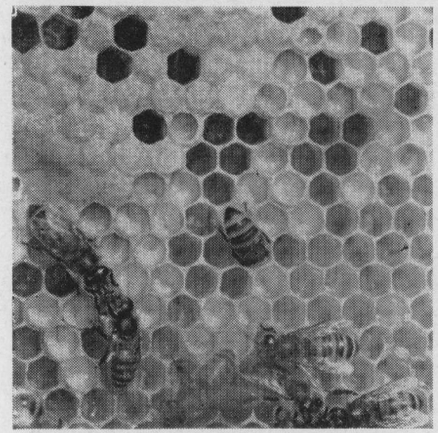
In its natural environment, the colony is found among the limbs of trees, in a hollow log or tree, in a cave or on the side of a cliff. Even in our advanced time of modern hives and

modern method of handling, bees have changed little in a thousand years. The colony will swarm, and the swarm will seek



A natural colony among the limbs of a tree.

for itself the most convenient place possible for starting the new colony, be it house attic, side walls or gable roof, bird box, or even the top of an automobile.



Bee comb, showing worker bees carrying on one of their functions of feeding young larvae. Notice the concise, geometrical design of the cells. The young larvae may be seen coiled in the bottom of the cells. The bee in the center of the picture is placing food in a cell containing a young larva. To the left of the picture a field bee can be seen delivering nectar to a house bee.

But be it in an improvised hive or in a modern hive, the colony is comprised of three kinds of bees and the comb in which is contained the honey, pollen, eggs, larvae, and pupae of the honey bee colony, the only marked difference being that in the one instance the combs are built straight and are easily removed for examination, while in the other they are built crisscross and make entry difficult.

CHAPTER V

Package Bees — From Arrival to Honeyflow

A PACKAGE of bees as its name implies, is a number of bees shaken into a screened cage, in which a queen is included. Though the queen may be shipped loose with the bees, she is usually suspended in a queen cage in the cluster of bees. This package may have a net weight of two, three, or more pounds of bees. All things considered, the three-pound package is to be preferred.

There are also produced packages of bees containing besides the bees and the queen, one, two, or more combs of honey, brood, and pollen. These are called comb packages. While these latter give the bees a better start when installed, they have never become popular on account of the possibility of transmission of disease through the combs. In fact, some states prohibit the importation of comb packages.

Since spring opens earlier in the South, that region has become our chief source of package bees and queens. Bees can be built to strength, queens reared and packages ready to ship by the time warmer weather arrives farther north.

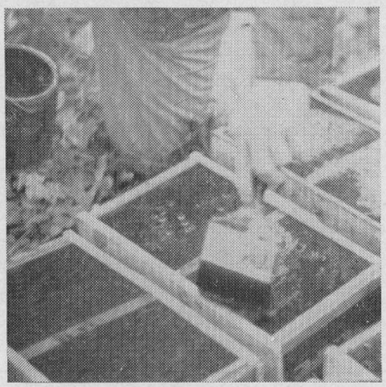
The packages of bees should reach you at the time of early fruit bloom, which usually starts with apricot and pear and ends with apple bloom some four to five weeks later. The exact time will depend upon your location. Be sure to have your equipment ready for the bees upon their arrival, the hive set up and painted and the comb foundation placed in the frames. The equipment needed for installing a package of bees is a hive body, frames with full sheets of foundation, bottom board, empty supers or feeder shell, cover, entrance closer, and a feeder. The feeder commonly used is a 10-pound size, friction-top tin pail with about six small nail holes punched in the lid. Use nails of about the same size as those with which you nailed your frames together.

Packages of bees are shipped by railway express and upon their arrival should be examined carefully in the presence of the railway express agent. They usually arrive in good con-

dition but occasionally will arrive with part or all of the bees dead, or with the queen dead. When such a situation occurs, accept the shipment but always remember to call the loss to the attention of the railway express agent and insist that he make a bad-order notation as to the extent of loss on the railway express receipt that he signs and gives to you. This receipt should immediately be sent to the shipper of the packages so that you may receive an adjustment. Package bee shippers guarantee safe arrival and invariably make replacements and adjust claims with the express company if bad order receipts are sent them.

A claim filed with this bad-order receipt — and only if accompanied by this receipt will be properly acknowledged and an adjustment made by the express company.

Of late years the losses of package bees while in transit have become negligible except in the case of careless handling



Brushing sugar sirup on the screen of a package of bees. Brush on as much as they will take.

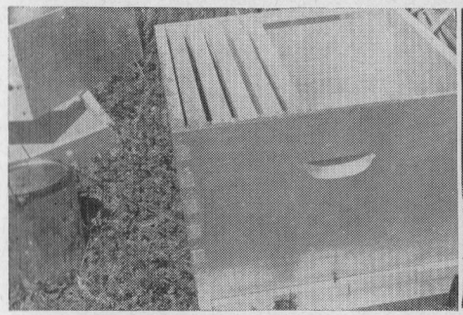
or crowding the packages too closely together in the express cars; or through suffocation due to extreme heat.

These package bees during the heavy spring shipping season, originating as they do in a relatively constricted area of the South, are moving north in such quantities that the shipments may be given the advantage of "pooling," even full car-

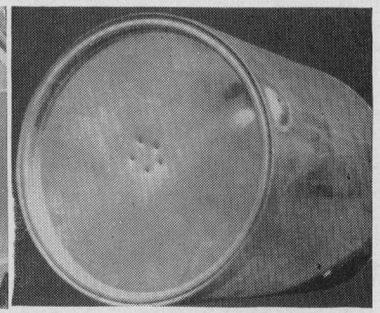
loads being assembled at transfer points, as the move northward is made.

Express authorities have cooperated by special instruction to express agent and messengers on necessary procedure in package bee and queen shipments, so the shipments have maximum speed and care.

There is no particular rush about installing a package of bees after it is received. It is best to place the package in a cool, dry—and preferably dark—room, a basement answering well for this purpose, where they are fed sugar sirup. The sirup is made by mixing together one part of granulated sugar to one part of warm water. This sirup is fed to the bees by dipping a clean paint brush in the sirup and rubbing the brush on the wire cage. Caution should be taken not to apply too much sirup while the bees are confined in the package. When the bees do not remove the sirup quickly from the wire they have had enough.



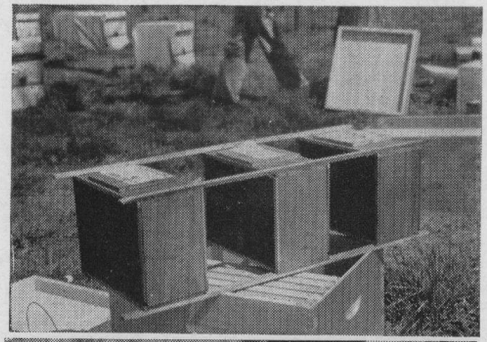
Hive body with some frames removed, ready for package.



Friction-top pail with holes in lid. The full feeder can is inverted over the frames in an empty super.

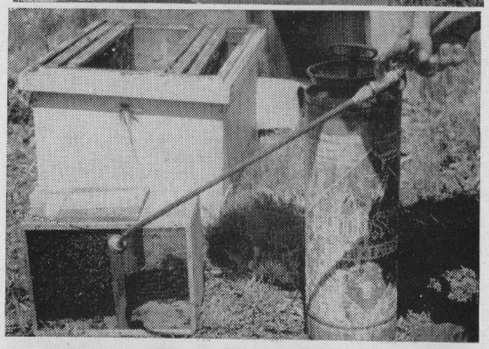
The next step is to take your equipment (hive body, frames, bottom, cover, empty supers or feeder shell, feeder, and entrance closer) to the spot where the colony of bees is to be kept.

The following pages will show you step-by-step pictures telling how to install a package of bees.

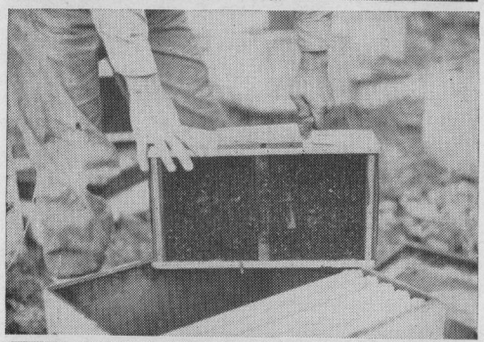


EVERY STEP IN

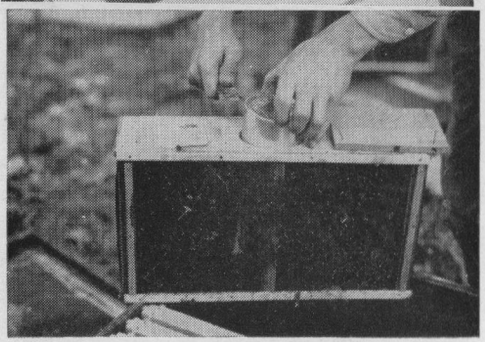
The best time to install a package is in the late afternoon or early evening. Take your packages of bees to where you have placed the hives and remove the wooden strips which fasten the packages together.



Wet the bees thoroughly with warm water. This can be done with a chemical or hand sprayer, or you may dip a large paint brush in a bucket of warm water and sprinkle the water on the bees. This wetting prevents the bees from flying.



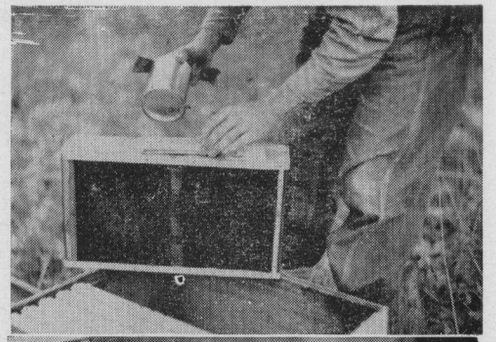
Using the angle end of the hive tool, the next step is to pry up and remove the wooden cover from the top of the package. Be sure to keep the cover near you because there is need for it when the feeder is removed.



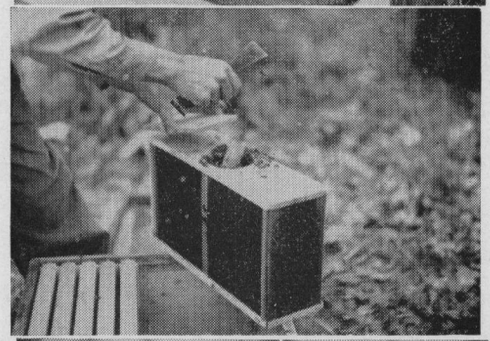
After removing the wooden cover, take the sharp end of your hive tool to lift up and remove the small feed can that was shipped with the package of bees. The remaining sirup in this can may be added to that which you have prepared for the bees.

HIVING PACKAEGS

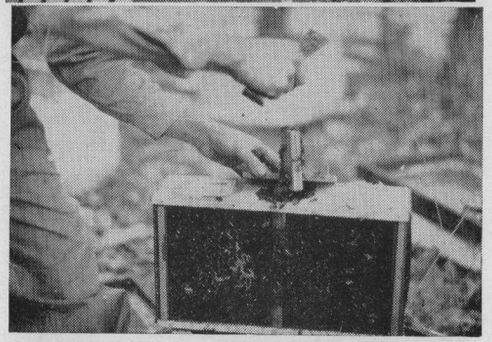
When the feed is removed, place the wooden cover over the opening in the top of the package. This prevents the bees from getting out of tne package while you are disposing of the can.



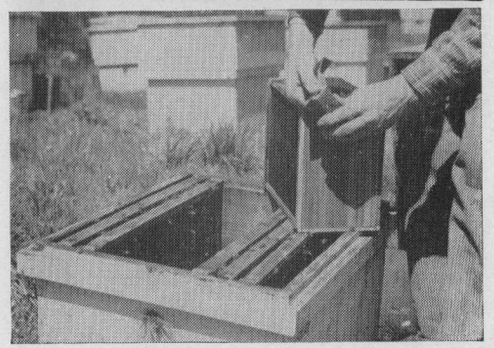
The next step is to take out the queen cage, which is sometimes suspended from a small wire or hung through a slot by a metal strip. Whatever method is used in preparing the package for shipment, the queen cage comes out easily.

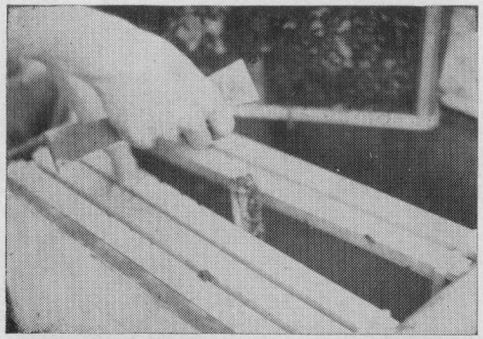


When the queen cage is removed, the bees clinging to it may be shaken back into the package. This will prevent you from getting stung while you are working with the queen cage. Replace the wooden cover before you prepare the queen cage for the hive.

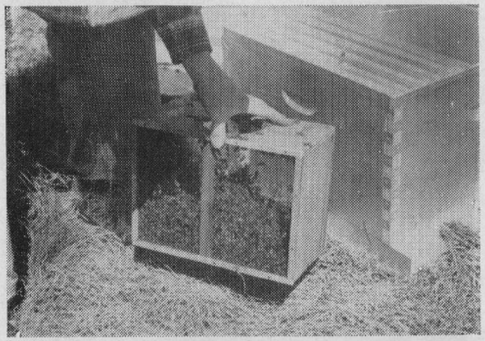


You will notice that one end of the queen cage has some white candy in it. The cardboard covering the hole which leads to this candy should be removed and a small hole, about the size of a match, punched through the candy.

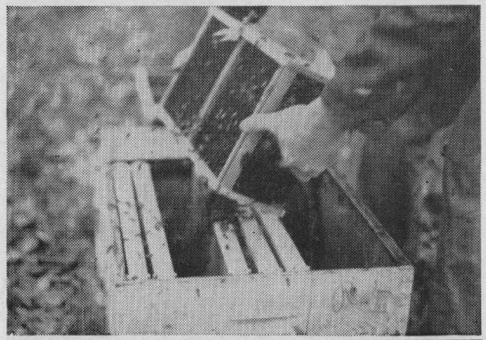




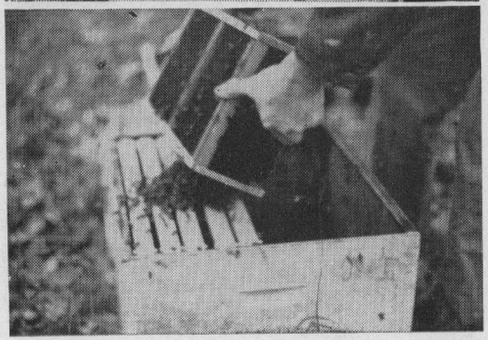
Now suspend the queen cage in the hive. The proper place for the cage is between frames numbered two and three, or between frames numbered three and four. Be sure that the end containing the candy is toward the bottom of the hive.



Leave the frames widely separated at the point where you suspended the queen cage. Then take the package cage containing the bees and bounce it on the ground. This will jar the bees to the bottom of the package cage.

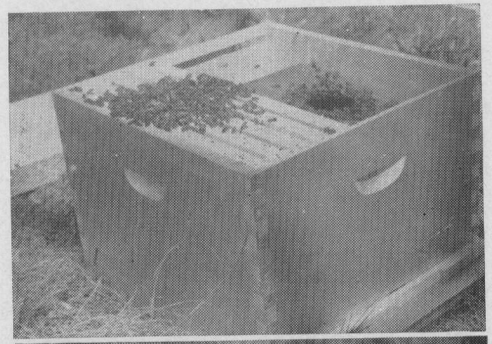


After jarring the bees to the bottom of the package, pour about half of the bees in the package between the frames where the queen is suspended. Then push the frames together, being careful not to crush and kill too many bees.



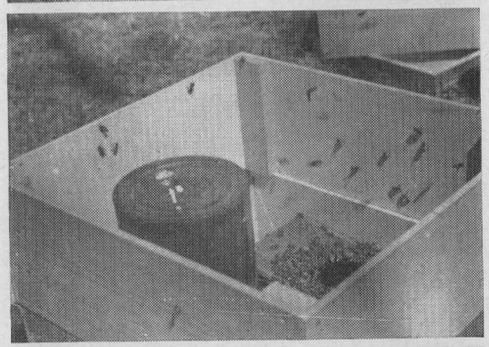
The next step is to jar the bees into the bottom of the package again and pour most of the remaining bees over the frames. The bees on the top of the frames will find the queen almost immediately and begin to eat the candy and release her.

There will still be some bees left in the package which you will be unable to shake or pour out. Place the package with the remaining bees inside of the hive with the open top up. The few bees left in the package will crawl out.



At this time it is best to use an oilcloth in place of the inner cover. (A piece of burlap or canvas will also work.) Place the oilcloth over the frames and turn back one corner, then invert the feeder pail directly over the frames.

After the feeder and the oilcloth are in place, put the feeder shell on top of the hive. This feeder shell may be two empty supers or a specially constructed rim such as the one shown in the picture.

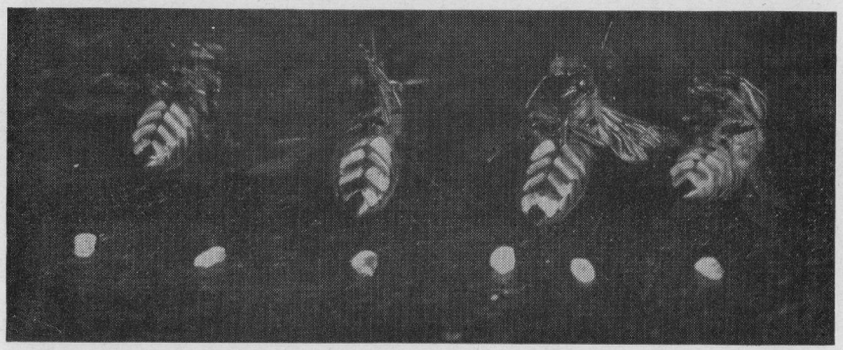


The last step is to place the cover on the colony and stuff the entrance with a little green grass. The grass keeps the bees from getting out of the hive too soon, and thus allows them to become accustomed to their new home.

HOW TO MANAGE THE PACKAGE UNTIL THE HONEYFLOW BEGINS

The day after the bees are placed in the hive you should examine the entrance of the hive to make sure that the bees have been able to work their way through the green grass that you put there. If the bees have not yet been able to get out of the hive loosen the grass slightly, but do not pull it out. Be sure that you do not remove the cover of the hive or disturb the bees in any way. It will take the bees some time to settle down in their new home. They have to eat through the candy in the queen cage and release the queen, and they have to build comb on the foundation you have given them. All of these operations will take time. After a week has passed you may safely take the cover off the colony and refill the friction-top pail with sirup.

Two weeks from the day that you installed the package it is safe to open the colony and examine it. By this time the queen bee should have been released by the workers and will probably be laying eggs in the newly built comb and the bees

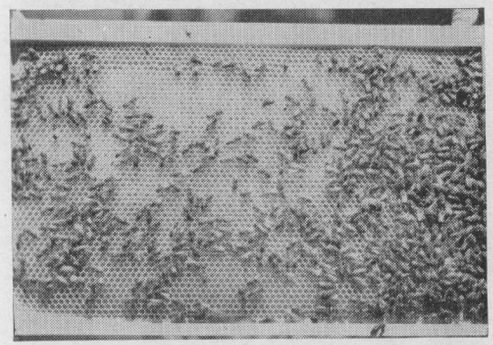


Worker bees showing the wax scales secreted on the lower surfaces of the abdomen.

should have made some progress toward building comb on the foundation which you furnished them. In building this comb the worker bees take the wax scales which are secreted on the under surface of their abdomen and shape and form them on the foundation until this wax conforms to the pattern of the cells.

In making the two-week examination remove the feeder, and, smoking gently, roll back the cloth to where the queen cage is suspended. Then spread the frames at this point and remove the queen cage, examining it to see if the queen has been released. Then lift out one of the center frames which has faced the suspended queen cage. If you see eggs or larvae you can be sure the queen is present and laying. Do not bother to look for the queen. Remove the empty package, place the remaining frames in the hive (on either side of the original five) and close the hive, replacing the feeder and the cover as quickly as possible—but with easy motions.

To help you in colony manipulation it is advised that the original five frames be numbered one through five consecutively. When the bees start to build comb on frames numbered one and five it is advisable to turn them around so that the sides which were not facing the bees previously now face toward the cluster of bees. Place a frame with foundation between the frames numbered one and two and between the frames numbered four and five. In this way the bees are partially forced to expand their comb-building efforts.

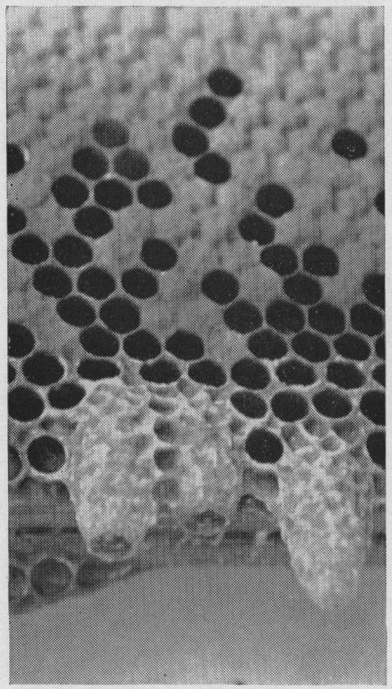


Worker bees in the process of drawing foundation. Usually worker bees will start their comb building efforts in the approximate center of the frame from end to end and closer to the top bar than to the bottom bar.

Three weeks from the day you hived the package you may again make an examination of the colony. Be sure to refill the feed pail during every examination. The bees need lots of food when they are in the process of wax secreting and building. When there is enough bloom so that they may secure nectar from flowers they will no longer need the sugar sirup and, in fact, will no longer take the sirup from the feeder pail.

Let the bees be the judge of whether or not they need sirup. Do not take the feed away from them simply because you have seen numerous flowers. There are many factors which influence nectar secretion and an abundant bloom does not necessarily mean an abundance of nectar.

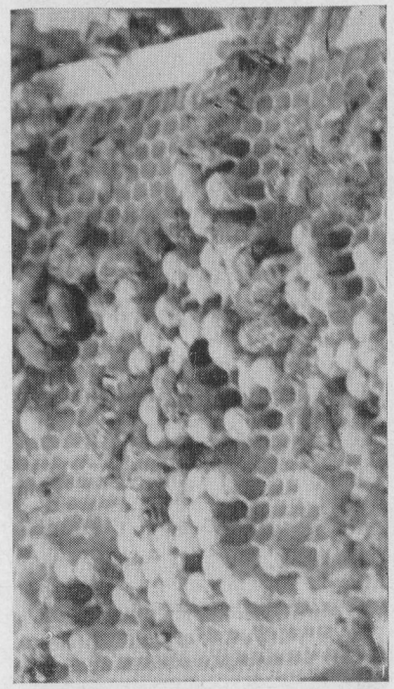
During this three-week examination check again to make sure that the queen is laying well. By this time there should be considerable sealed brood in the combs. Do not attempt to change the position of any of the frames in the hive at this time. Three weeks after the package has been hived is the period of lowest ebb in colony strength. Some of the bees which were shipped in the package have died and none have yet emerged from the cells to take their place. Toward the end



Worker and queen cells, approximately natural size. The worker cells are horizontal in the comb while the queen cells (there are three of them in the illustration) are larger and are built vertically in the shape of small-sized peanuts. Sometimes they are found suspended at the bottom of the combs, sometimes they are developed by the bees in the middle of the comb. The queen emerges with her head facing downward. Queen cells are found in the hive only under certain conditions (discussed in the following pages) while worker cells are always present. There are approximately five worker cells to the linear inch.

of the fourth week young worker bees will start to emerge from the cells, and during the fifth week they will emerge in great numbers. From the fifth week on the number of worker bees will increase fairly rapidly.

From previous information you now know the difference between the three types of bees in the colony—the worker, the queen, and the drone. Nothing has been said, however, about



Drone brood—smaller than natural size. With a good queen very few drone cells will be present in your colony. Notice the characteristic bullet-shaped appearance of the sealed drone brood in this picture. They may easily be distinguished from worker cells by the way in which they protrude beyond the rest of the cells in the comb. The overproduction of drones is one thing that should always be discouraged. Usually the bees will build drone cells in any section of the comb that has been damaged. Because of this the beekeeper should be careful when working his colony not to damage the comb.

the difference in the cells from which these bees emerge. A careful examination of the accompanying pictures should reveal this information to you.

During the fifth week you should conduct another examination of the colony. Check again for the queen and make sure that the brood nest is expanding and that the bees are drawing their foundation well. It will help if you will move sheets of foundation that have not been drawn, up next to the brood nest. A word of caution here—always put frames with empty comb or foundation *up to* and *not into* the brood nest. If the frames of the brood nest are separated there is danger of some of the larvae being chilled if the weather is cold.

By the end of the sixth week the fruit bloom is over and clover or other bloom is close at hand. It would be well to talk with neighbor beekeepers and find out from their experi-

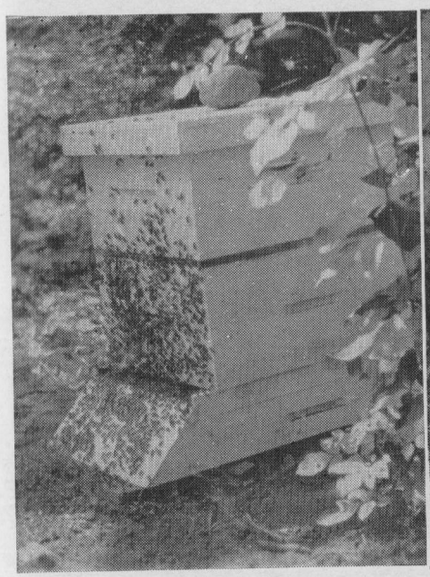
ence just when you may expect the main honeyflow to start. Usually by the end of the sixth week you may stop feeding sirup. There should be plenty of bloom present by that time to supply natural sources of food for the bees. When feeding is stopped it is neither necessary nor advisable to remove the feeder shell. If the shell is left on and the corner of the oilcloth left turned back it provides the bees with an empty space in which they may cluster. If the weather is warm, or the colony large in numbers, this space will do much to prevent swarming.

Swarming reduces the worker population, and therefore, reduces the amount of honey crop, and if at all possible should always be prevented.

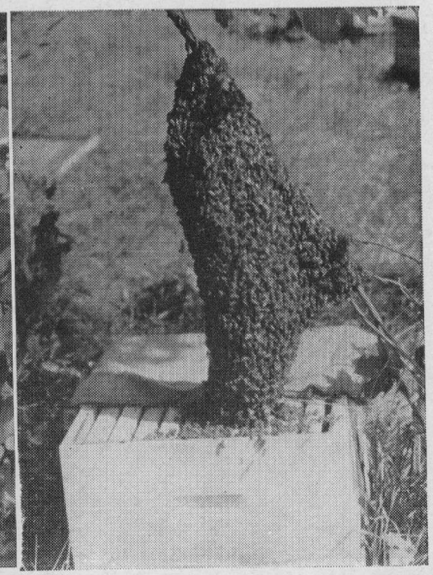
There are many ways to prevent swarming of bees. Giving them plenty of room for normal expansion is just one of them. Another aid is proper ventilation of the hive. As your colony of bees grows and increases in size, give it a larger entrance opening. The entrance closer supplied with your original outfit has two separate openings. When the package is first hived it is best to use the small opening, but by the end of the fourth week the larger opening should be used. As the honeyflow approaches you should remove the entrance block entirely and let the bees use the full entrance to the hive. This should provide adequate ventilation, but if the weather is extremely warm it would be well to place two small blocks of wood between the hive body and the bottom board. This will raise the hive and tilt it backwards and allow ventilation along the sides as well as increased ventilation in front. The use of a cover designed to lower hive temperatures and increase ventilation will aid you in your efforts to keep the colony from becoming too warm.

Just before the main honeyflow begins there is usually a lull in activity within the colony. By this time the colony has reached its numerical peak and without abundant flowers in bloom there are thousands of bees with little or nothing to do. This is a good time to put on your first super. It gives the bees plenty to do for they must draw the foundation out into comb before they can store honey. Putting on the first super is a swarm control measure that is effective if properly timed and executed. Be sure your bees have sugar sirup at this time if natural sources of nectar are not yielding.

Supersedure of the queen is nature's way of replacing a failing queen. The worker bees take matters in their own hands and construct queen cells in an attempt to replace their failing mother.



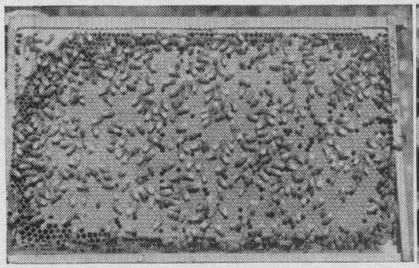
Here is a case where swarm prevention measures were not applied in time. The swarm is just leaving the colony. Weakened by the loss of the swarm, this colony will not make a profitable crop of honey without a considerable amount of help from the beekeeper.



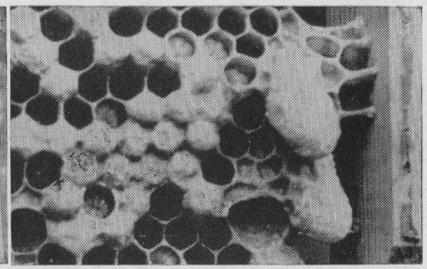
Fortunately, this swarm lit among the low-hanging branches of a nearby tree. It may now be captured and hived. After the honeyflow has started it may be placed back in the colony from which it emerged — thus increasing the population of the original colony.

A queen's quality may readily be recognized by the way in which she deposits her eggs in the cells. A good queen will lay in a compact area so that the sealed brood presents a solid mass of wax cappings. A poor queen usually lays irregularly with eggs scattered throughout the comb leaving many cells empty. Occasionally a queen will become a drone-layer—i.e., she will lay unfertilized eggs which will develop into nothing but drones. Such a queen should be replaced as quickly as

possible. Order a new queen, and when she arrives kill the old one and place the new queen in the colony. (Instructions for introduction of a queen are included in shipment of the queen cage.)



Good brood — the result of an excellent queen.



Poor brood — the result of a drone-laying queen.

Your package of bees should now be a full-grown colony, humming with activity and ready for the honeyflow.

CHAPTER VI

The Honeyflow and Removal of the Crop

WARM days, cool nights, plenty of moisture, an abundance of blooming flowers, a colony of bees humming with life, activity, and strength—there is your honeyflow! It is time to get those surplus supers on and filled with honey.

Every beginner in beekeeping is confronted with the problem of what kind of honey to produce—section comb honey, bulk comb honey, or extracted (liquid) honey. (No matter what kind is produced the beginner should have at least two supers per colony available for the bees to store honey in.) Each of the three kinds of honey have their followers who are able to give lengthy discussions as to why the kind they produce is the best. We will attempt to give you a brief and unbiased summary of the three types of honey production.

MANAGEMENT FOR COMB HONEY

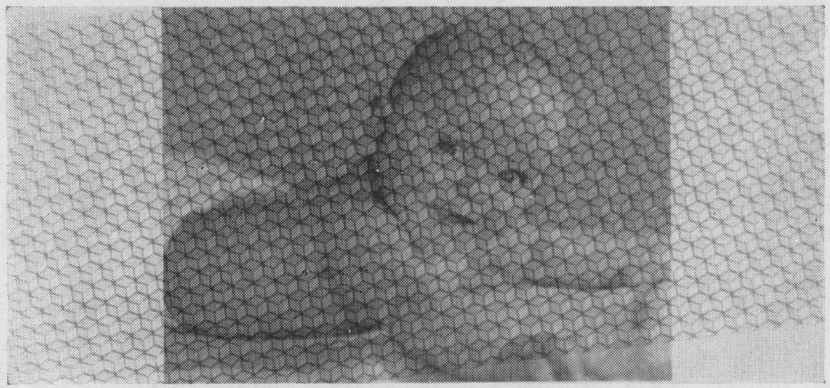
Comb honey is a natural and a fancy food product. It may safely be said that few things are more beautiful than a snow-white section of comb honey. It has a delicate aroma all its own—the perfume and nectar of the flowers sealed in individual cells.

Only strong colonies should be used for comb honey production. The weaker colonies will not do a good job of drawing the foundation and collecting nectar.

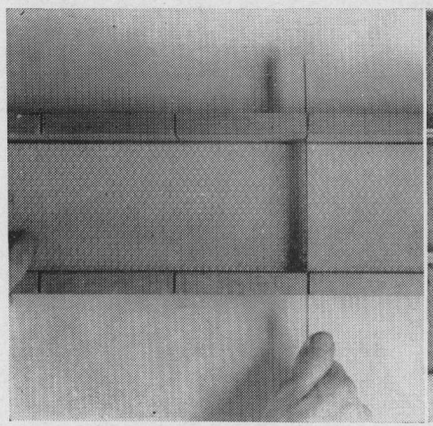
The early spring management used to produce comb honey is no different than that for the production of any other kind of honey. The difference in management comes during the honeyflow. In addition to the difference in honeyflow management, it takes more time and skill in the preparation of equipment for section comb honey. One should provide well in advance enough supers with sections to take care of the largest expected crop of honey. The exact number cannot be determined, but any excess supers may be set aside, protected from heat and dust, and used during the next season's honeyflow.

One of the prime considerations in producing comb honey is the type of foundation to use in the sections. Only the clearest, lightest colored, and thinnest grade of foundation should be used. This grade of foundation is known as thin super or thin surplus.

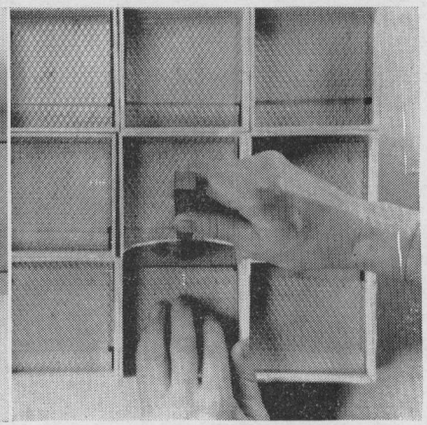
If you have previously placed a super on top of the strong colonies to give them room and to act as a safety valve against



Notice how the picture may be seen through the thin surplus foundation.



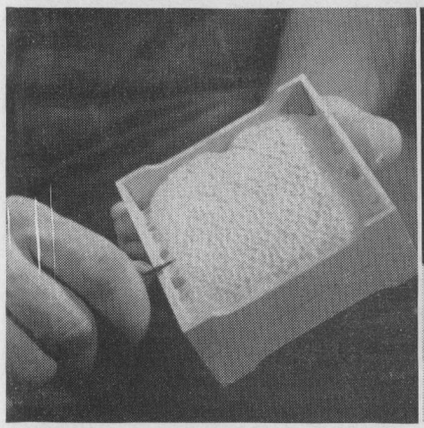
The foundation is placed in a foundation cutting box and cut into the proper lengths with a knife.



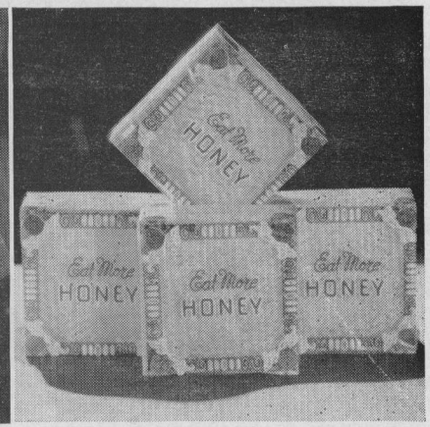
After cutting, the foundation is fastened in the sections with an aluminum hot plate.

swarming, you must now remove that super from the colony to be managed for comb honey. When the first comb honey super is given the bees it should be placed directly over the hive body and the inner cover placed on top of the super. The super which you originally placed on the colony is examined and, if brood is present, the super is placed on top of the inner cover and left there until the brood has emerged. If there is no brood present in the super, the bees may be shaken out and the super stored in a safe place.

When the first comb honey super is about one-half full a new super should be placed on top of it. On your next examination of the colony, the second super should be placed down next to the brood nest and the first super raised to the top



When the sealed sections of honey are removed from the super, the wooden sections should be scraped with a knife to remove the beeswax and propolis.



If comb honey is to be packed for sale, it should be wrapped in an attractive cellophane wrapper. This makes a beautiful and easily marketable product.

of the hive. Before giving a third super the first super should be nearly full and the second super at least one-half full. The third super is then added to the top of the colony and, after the bees has started to work in it, is placed next to the brood nest. Each additional super is manipulated in the same manner. Supers are removed from the hive as soon as the cells have been sealed with a wax cap.

MANAGEMENT FOR BULK COMB HONEY

Since the beginner usually has only one or two colonies of bees, it is recommended that bulk comb honey be produced. Production of bulk comb honey does not require the high degree of professional "know-how" that is needed to produce section comb honey, nor does it require the additional equipment needed to produce extracted honey. Later, if the beginner wants to expand and go into extracted honey production, the bulk comb honey supers may easily be converted to extracted honey supers.

Bulk comb honey usually is produced in shallow supers similar to those used in producing extracted honey. The frames are filled with a high quality of thin surplus or bulk comb foundation, that is made especially for that purpose. The resulting combs of honey are as delicate as that of section honey. The only difference between bulk comb honey and section comb honey is the size of the combs—the slabs of bulk comb honey weighing from 3½ to 4 pounds, while the sections of comb honey weigh from 13 to 16 ounces.

The first bulk comb honey super should be put on as soon as the main honeyflow has started. The second super is placed

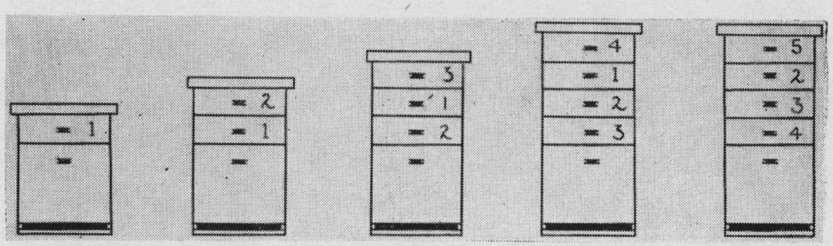


Diagram showing the method of supering. The supers are numbered in the order in which they are given.

on top when the first one is about half filled with honey. When the bees begin to draw the foundation in the second super it should be placed down next to the brood nest and a third super added on top. Additional supers are added and manipulated in the same manner. This method of super manipulation keeps the bees spread throughout the supers. They have work ahead of them all the time and there is little tendency on their part

to clog the brood nest with honey. Toward the close of the flow care should be taken not to put on too many supers. This will force the bees to fill and finish the ones that they have so that there will be a minimum of partially filled and sealed combs of honey.

Sometimes the bees will fill with honey and seal the combs in the center of the super and leave the outside combs untouched. When this happens you should reverse their position by moving the outside frames to the center of the super and the center frames to the sides of the super. This will force the bees to draw out and fill all of the combs.

The supers of bulk comb honey are removed as soon as the combs are fully capped. If they are left on too long they will become soiled and travel-stained by the numerous bees that must pass over them.

Honey in combs kept for any length of time without the protection of the bees may be attacked by wax moth. Such supers of honey should be tightly closed on removal and preferably fumigated to protect against wax moth (See Chapter 14).

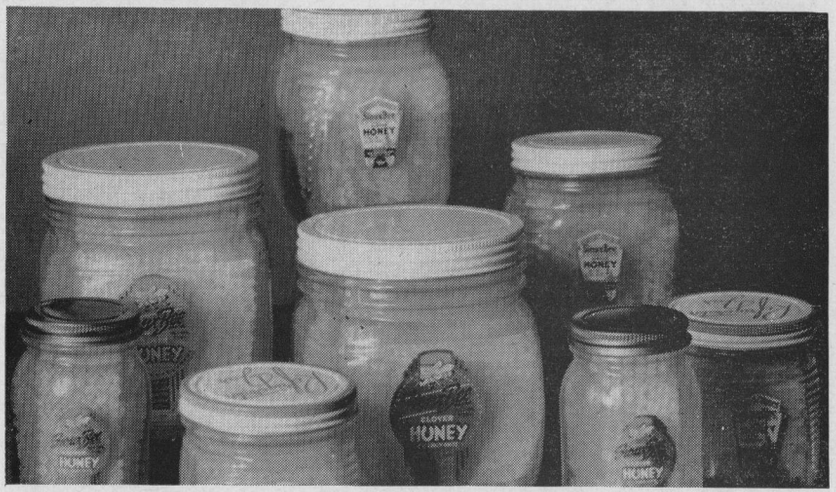
If the producer is to use the honey produced for his own consumption it may be kept in the large frames and cut out whenever more is needed for the table. If the honey is to be sold there are various ways of preparing bulk comb honey for the market.

CHUNK HONEY

When packing chunk honey, the bulk comb honey is cut into rectangles which fit into the mouth of a glass jar. The remaining space in the jar is then filled with liquid honey which has been previously heated to 150 degrees F. and allowed to cool quickly to 110 degrees F. before it is poured over the honey chunks in the jar. As soon as the jar is filled the lid should be placed on tightly and the jar laid on its side. This will prevent the comb from being crushed while the honey is hot. When the honey has cooled thoroughly the jar may be packed in a shipping case.

Chunk honey should not be stored for too long a time since it is apt to granulate. Jars of honey that have granulated may

be liquefied by placing in a warm oven. (The temperature should be kept below 145 degrees F. which is the melting point of beeswax.)

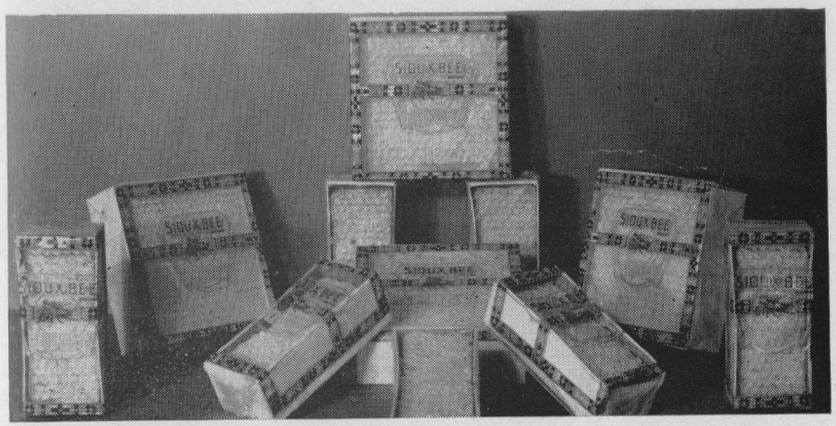


Chunk honey packed in a jar is a fancy honey. The beekeeper should always be sure that the finished product is neat, clean, and attractive. The comb should be white and free from pollen or stains and the liquid honey should be clean and clear.

CUT COMB HONEY

Cut comb honey is bulk comb honey cut up into varying sizes or pieces. Cut comb usually varies in size from a small 2-ounce individual serving to larger ones weighing as much as a pound.

The pieces of cut comb honey are drained on a screen in a warm room for 24 hours. If an extractor is available they may be placed in a screen basket in the extractor and the liquid honey along the cut edges may be thrown off by centrifugal force. The pieces of cut comb honey are then wrapped in cellophane and placed in cartons of cardboard. The finished product resembles section comb honey.



Packages of cut comb honey packed and ready for the market.

MANAGEMENT FOR EXTRACTED HONEY

Because of the initial expense involved, the beginner is not urged to produce extracted honey. Extra equipment required to produce extracted honey includes such items as an extractor and an uncapping knife. In a large apiary, or from the standpoint of commercial beekeeping, extracted honey is the cheapest to produce, since one man may care for more colonies in less time than with the two previously mentioned systems.

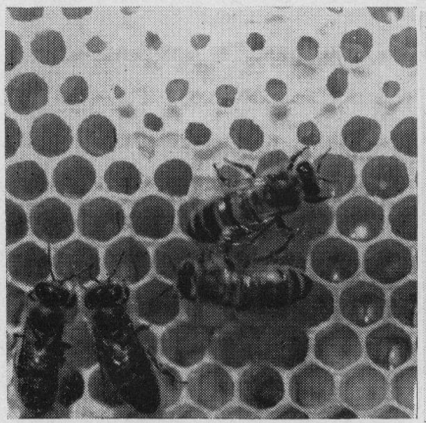
The early management of colonies to be used in extracted honey production is no different than that of section and bulk comb honey. No matter what type of honey is being produced, the colonies involved should be at the peak of their strength when the honeyflow begins.

The foundation used in the extracting super frames differs from section and bulk comb foundation in that it is made of a somewhat darker and heavier wax. It is also wired to prevent the comb from breaking in the centrifugal extractor. In producing extracted honey the same combs may be used year after year, while in bulk and section comb honey the supers are filled with new foundation each year.

Supers of drawn comb are added to the top of the hive in extracted honey production. As the top super is filled with honey and the bees have started to whiten the comb and seal

the cells, another super is added on top of the one already on the hive. The beginner, starting out with all new equipment and supers of foundation instead of comb, should follow the same supering procedure and manipulation as given for bulk comb honey production. Usually four supers per hive are enough. If the honey crop is larger, and more supers are needed, the full supers may be taken off and extracted and the supers with empty combs placed back on top of the colony.

In extracting the honey from the combs the first step is to remove the wax seal over the top of the cells. This is accomplished by means of an uncapping knife. The knife slices the wax seal from the cells so that the honey may be thrown out by centrifugal force in an extractor. For best results the honey should pass from the extractor, through strainers, and into a storage tank. After settling for 24 hours, the honey may be drawn from the storage tank into cans or bottles to be used by the producer or sold on the market.



Notice how the cells at the top of the picture are white with new wax and how the bees are sealing the full cells of ripe honey.

Jars of extracted honey after drawing from the storage tank. With the addition of a colorful label, these jars will make an attractive display.

REMOVING THE HONEY CROP—COMB HONEY

Comb honey is removed by means of an escape board. The escape board is your inner cover with a bee escape placed in

the hole in the center. The bee escape allows the bees to go down out of the super but prevents them from returning.

The super to be removed is first placed on top of the colony and given a few quick puffs of smoke to start the bees running down. It is then lifted off the colony and given a few vigorous shakes in front of the hive. The inner cover with the bee escape in place is then placed on top of the hive and the super to be removed placed on top of the inner cover. The outer cover is placed on top of the super, taking care that there is no crack big enough to allow bees an entrance to the super. Usually the bees have completely left the super within 24 hours.

BULK COMB HONEY AND EXTRACTED HONEY

Bulk comb and extracted honey may be removed by the same process as that described for comb honey. Another way is to take the full supers of honey and brush the bees from each individual comb with a bee brush. For the beginner, either of these two processes will be satisfactory.

Many large commercial beekeepers find it to their advantage to use a repellent in removing supers of extracted or bulk comb honey. Properly used, a good repellent saves much time and labor in the commercial apiary.

ROBBING

During any period of the year when there is no nectar coming into the hives the bees are apt to rob. The bees from a strong colony will attempt to get into another which is weak in numbers and obtain the honey. Strong colonies in a yard, if given an opportunity, will steal all of the stores of honey of the weaker colony. This usually results in the death of the colony which has been robbed. Weak colonies should have the hive entrance reduced to a minimum in order to discourage robbers. The possibility of robbing is likely just after the honeyflow is over. Because of this, particular care should be taken when removing supers of honey not to get robbing started.

One good way to prevent robbing is the use of cloths dipped in a mixture of water and kerosene and the excess liquid wrung

out. The damp cloths are then used to cover the hive and supers while working a colony. Be sure the cloths are damp and not wet enough to drip water and kerosene on the honey.

Worker bees which act as guards are present at the entrance of hives at all times. They detect the presence of and repel bees which do not originate from their own colony. When worker bees are seen flying around the entrance to the hives and being repelled by the guards it is an indication that the bees are trying to rob. Whenever there is an indication of robbing it would be best not to smoke the entrance of a colony before working it. The smoke will disrupt the guard bees and allow robbers to gain an entrance to the colony.

EXAMINATION FOR DISEASE

Periodical examination of the colony and its brood should be made to protect against brood diseases. This subject is treated in Chapter 14. Suffice to say that while diseases, when they appear, may cause great damage to the colony, the use of disease resistant bees and the use of sulphathiazole, terramycin and fumidil in the colony feedings have done a great deal to keep down the incidence of disease.

CHAPTER VII

Fall Management and Wintering of Bees

THE end of the midseason flow is usually followed by a period when there is little or no nectar coming into the colony. This period of relative inactivity is followed in many localities by the fall flow—usually coming from such flowers as heartsease, commonly called smartweed, aster, goldenrod, Spanish needle, white boneset, wild cucumber, and climbing milkweed.

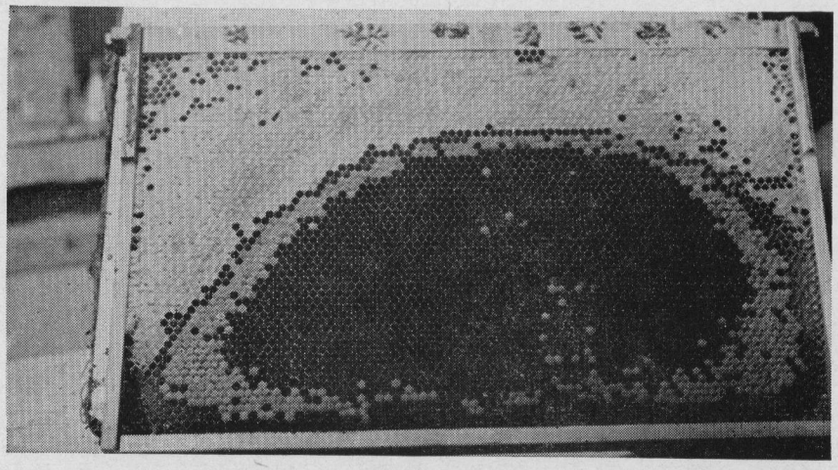
The beginning of the fall flow is one of the times during the year when the influence of the queen is felt greatly. An inferior queen at this time will leave you a colony weak in worker population and incapable of successfully surviving through the winter. If there is the slightest indication of a poor queen, the colony should be requeened during the fall flow, or preferably, towards the end of the spring flow.

If you are in a country which has little or no fall flow, or if you have been unable to obtain queens during the fall flow, you may safely requeen colonies after cold weather has set in and brood rearing has ceased. Go into the colony to be requeened on a cold day in late September or early October, remove the old queen, and place the new queen in the mailing cage in the center of the cluster of bees. Make sure that the cardboard has been removed from the candy end of the queen cage.

Care must be taken during the fall flow not to place too many supers on the colony. Additional supers should be added only when the one on the colony is practically full of honey. This prevents the bees from spreading the incoming nectar throughout more supers than they will fill. When the fall flow is over—usually after the first killing frost—the supers may be removed from the hives.

During the removal of the fall crop, one super completely filled with honey should be left on the colony. In addition to this super, the colony should have from twenty to thirty pounds of available sealed honey in the brood nest. This honey in the

brood nest will usually be found along the tops of the brood combs. The honey in the super, plus the honey in the brood nest, should give the colony from sixty to seventy pounds of honey for their winter and early spring consumption.



A colony ready for winter should have a rim of honey along the tops of the brood combs as well as a full super of honey.

If you are in a locality where fall flows are uncertain and where little fall surplus honey is gathered you will have to resort to feeding a sugar sirup for the bees to use during the winter. The minimum amount of stores (either honey or sugar sirup) necessary for the winter consumption of the colony is fifty pounds. The beginner will find it convenient to take a pair of scales, similar to ice scales, and weigh his colony of bees. A hive with top, bottom, inner cover, eleven combs, and bees will weigh about forty pounds. Any weight over that may be considered as stores. For example: if a colony weighs seventy-five pounds then it has thirty-five pounds of honey. To gain the additional fifteen pounds necessary for minimum stores sugar sirup should be fed to the colony. The best feed for winter stores is made by mixing two parts of sugar to one part of warm water. A gallon of this mixture increases the weight of the colony about seven pounds so a colony weighing seventy-five pounds would need two gallons of sugar sirup to bring it

up to the minimum stores standard for successful wintering.

Common practice with the ten-frame hive is to leave a second hive body on each colony, one with sealed stores and pollen being desirable.

UNITING WEAK COLONIES

Occasionally time for winter arrives with some of the colonies in a weakened condition. This may have been caused by a failing queen, or by a bad season with a minimum of honey for the bees to gather. Even with the best of protection, these under par colonies will find difficulty in surviving the wintry blasts.

It is better to throw all the strength of two such colonies into one hive by uniting than to try to winter the two misfits. If such condition has been discovered early enough so that new queens could be supplied, or ample feed provided, or both, it may be possible to pull such colonies out of their doldrums and make them fit for wintering.

In a honeyflow uniting gives no difficulty. Nectar gathering bees unite very nicely with a minimum of fighting. It is a different matter in the short days of fall. In such a case the two colonies may be united by the newspaper plan.

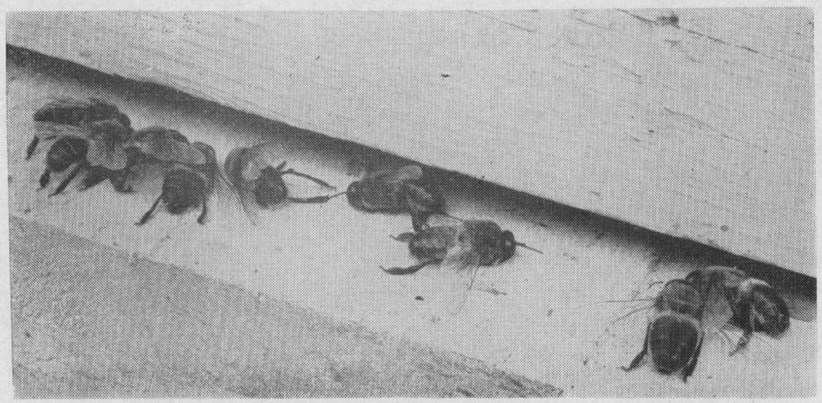
Find the poorer of the two queens in the two hives to be united, and kill her. Or if uncertain, do not bother. The bees will see to a proper choice, or the queens will fight it out for themselves. Remove the cover and inner cover of one of your hives, exposing the tops of the frames. Place immediately over these a single sheet of newspaper. Over this place your second colony with its bottom board removed, and the job is done. In the course of a few hours, the bees of both colonies will have gnawed through the newspaper, getting acquainted a bit at a time, and amicably. After they have been completely united, it may be best to remove one of the supers or hive bodies. This can readily be done by smoking the bees down, or shaking them into the brood chamber which may consist of only one hive body; preferably two for winter.

With a good queen, plenty of young bees, and careful attention to the amount of available stores the beginner should have little or no trouble in bringing his colonies through the winter.

As plant life becomes dormant, brood rearing and the field

activities of the colony decline until they finally cease entirely. The population of the colony decreases rapidly in the fall until only bees from four to six weeks old are left in the hive. Since they have done little or no work these young bees are capable of living through the winter.

At a temperature of around 57 degrees F. the bees start to form their winter cluster. When the temperature has dropped as low as 43 degrees F. all of the bees have joined the winter cluster. With the formation of the cluster one of the first indications of approaching winter is the action of the colony in relation to its male population—the drones. The worker bees chase the drones out of the hive where they soon die from starvation and cold. Since the drones have no useful task in



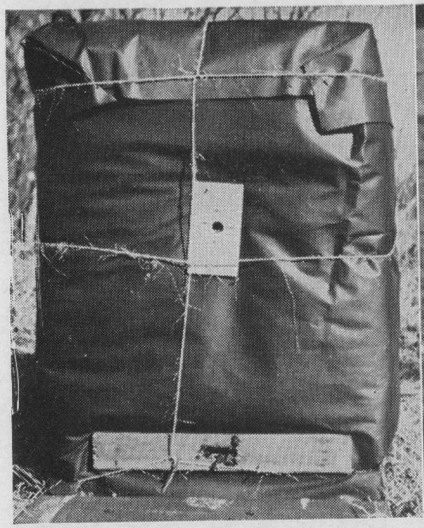
Dead drones at the entrance to a colony in late fall.

a normal functioning colony they are a useless burden most of the time. The worker bees tolerate the drones during the spring and summer when there is a chance that they may be needed to mate with a queen, but the first hint of cold weather is the signal for a general forced exodus of the drones.

There has been much controversy in this country on the question of whether to pack bees or not to pack them. For many years the standard practice was to pack the hives in a heavy coating of straw, leaves, or some other insulating material. The material used to insulate was usually held in place by a tar paper pack which went around, under, and over the colony. The theory was that this packing would so insulate

the colony that the natural colony warmth would be retained within the hive and allow the bees to move freely to their food reserve wherever it was stored in the hive. Some even insulated too heavily with the result that during warm days in the winter the colony was so warm that it was forced to move outside the hive.

During the last fifteen years there has been a general trend away from the heavy packing and insulation of the colony during winter. Lighter packing was tried and when that proved successful, colonies were wintered with no packing. The unpacked colony wintered as well as the packed colonies had



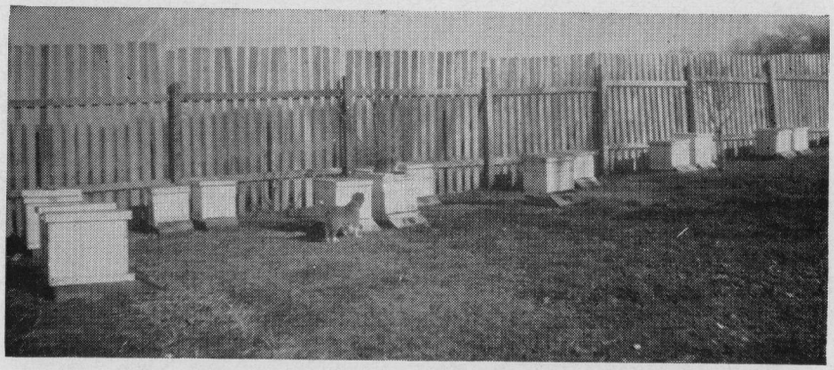
A hive packed with tar paper and straw. Note the reduced lower entrance and the auger hole top entrance.

A close-up view of the top entrance in early autumn. On warm days in the winter the bees will fly from this entrance before using the bottom one.

done and today the majority of the commercial beekeepers do not pack their colonies.

Whether the colony is packed or not packed, two of the requisites for successful wintering are a reduced bottom entrance and a small top entrance. The entrance closer supplied with the original hive should be placed in the bottom entrance

of the colony leaving only the smallest opening for the bees to fly from. It should not be necessary to close the entrance down so far until cold weather has set in for the winter. In addition to the reduced bottom entrance the bees should be supplied with a top entrance. A one-inch auger hole is bored just below the hand hold in the front of the super which is left on the colony. This top entrance allows the bees to fly freely from the top of the cluster during days when the temperature rises to 45 degrees or higher and also allows some circulation in the hive to help dissipate excess moisture. If the bottom entrance should become choked with dead bees or other material the top entrance will then act as a safety exit from the hive.



A wooden fence used as a windbreak for wintering bees.

The beginner will have to use his own judgment about wintering his bees. If it is felt that the climate is too cold and severe for successful wintering with unpacked colonies then by all means take the time and trouble to place some kind of light packing around the hives. But remember—packed or unpacked always use the reduced bottom entrance and the auger hole top entrance.

Beekeepers in many localities are bothered during the winter by field mice. The mice enter through the lower entrance and remain in the hive during the winter, usually chewing up the combs during their stay in the hive. If mice abound in your particular locality it may be well to use some sort of a guard at the entrance to the hive.

Although some beekeepers ignore wind protection, there are many who prefer to have some protection from prevailing winter winds. This is accomplished by several means: placing the hives on the southern slope of a hill, in a grove, or putting a snow fence or some other windbreak between the hives and the direction of the prevailing winds. Natural windbreaks are best since they entail no extra management or work on the part of the beekeeper.

If no windbreak is available, moderate packing is likely desirable. Remember, that with a packing case, a small entrance should always be provided, so the bees may fly on moderate days during the winter thus being able to remove the dead, and to void themselves of accumulated excrement, since bees never void themselves within the hive.

Generally, no packing is considered necessary south of the Mason and Dixon line.

The conditions necessary for successful wintering may be put down in a brief form, as follows:

(1) A good queen early in the fall.
(2) Plenty of young bees.
(3) A minimum of fifty pounds of stores — honey, sugar sirup, or both.
(4) Reduced lower entrance and a 1-inch auger hole in super.
(5) Protection from prevailing winter winds.
(6) Exposure to winter sunshine.

CHAPTER VIII

Spring Management of the Overwintered Colony

EARLY SPRING MANAGEMENT

IF your bees were packed for the winter, the first thing to do in the early spring (late March or early April*) is to remove the packing and dispose of it. Next, whether the bees were packed or not, you should tilt the hive back, remove the bottom board and scrape it clean of debris or dead bees. Replace the hive on the bottom board and be sure to replace the entrance reducer. Bees will rob readily in the spring and examination of colonies should be conducted with the use of robber cloths.

During the first spring examination of the overwintered colony you should check for evidence of a laying queen, supply of honey, and pollen stores. If the colony has a laying queen you will find that brood rearing will start comparatively early —usually sometime in February or March. If an examination shows the colony to be strong in worker population, but queenless, you should order a new queen at once so that she will arrive in time to place in the colony during the first of the fruit blossoming period. As both pollen and honey are necessary for brood rearing, adequate supplies of both must be available if the colony is to build up in strength for the main honeyflow. If wintering instructions were followed carefully there should be plenty of honey for the colony at the time of this first examination. It is easy to tell when a colony of bees is short of food. A safe rule is to make sure that there is some sealed honey in the comb at all times. When there is no sealed honey to be seen, the bees are approaching starvation. If the colony is short of honey it should be fed sugar sirup. (Sugar sirup is prepared by mixing one part of sugar to one part of hot water, allowing the mixture to cool before using.) With no honeyflow on and brood rearing increasing, a colony will consume approximately ten pounds of sugar sirup during a one-

* All references to seasonal dates refer to central Illinois. Spring moves northward at a rate of approximately ten miles per day. If you use this figure you will be able to change the dates mentioned in this text to conform with your own particular locality.

week period. Continue feeding sugar sirup until the natural supply of available nectar is sufficient for colony needs.

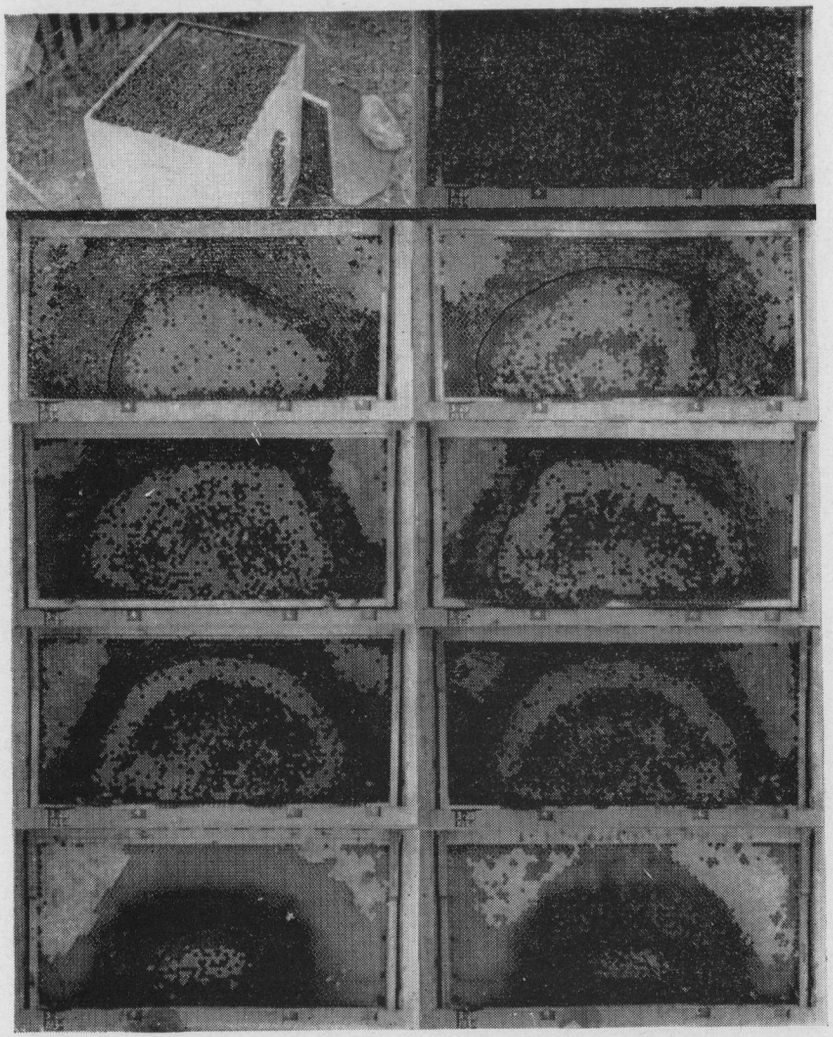
Pollen cake on colony in early March
(Photo courtesy U. S. D. A.)

Considering that pollen is essential for brood rearing, the early spring period, when natural pollen either is not available or inclement weather prevents the bees from gathering it, is a critical time in the build-up of your colony. Check each comb carefully for pollen reserves. If the supply of pollen is low, feed a pollen substitute. Pollen substitute is made by mixing one part animal type brewer's yeast with two parts of expeller - processed soybean flour by weight. One-to-one sugar sirup is then added to the dry mixture until it is of a paste-like consistency, just short of being runny. Spread about three pounds of this mixture over the tops of the frames directly above where the bees are clustered, and cover with wax paper to keep the pollen substitute from drying and becoming hard. Continue to feed freshly prepared pollen substitute in this manner until natural pollen becomes available.

It is recommended that ¼ teaspoon of sulfathiazole sodium powder be added to each pollen substitute cake and each pail of sirup given your bees during the spring period. The use of this drug serves as a very effective preventive for American foulbrood.

MIDSPRING MANAGEMENT

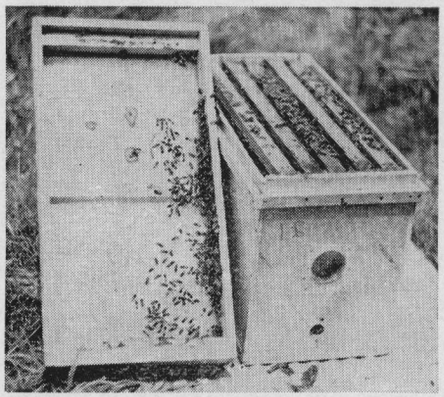
The period of fruit bloom—starting with the apricot and pear, and ending with the last of the apple blossoms—bringing with it an abundance of natural pollen and nectar, is a period of great increase in colony strength. Stronger colonies may be given a full entrance at this time, although it would still be



Brood nest of a colony on March 28, central west location. This colony had a fall pollen reserve of 632 square inches. Plenty of stored honey and an abundance of pollen reserves are responsible for this large, early brood rearing.
(Photo courtesy U. S. D. A.)

advisable to keep the entrances of weak colonies somewhat reduced. It is during this period that the results of a queen's

egg laying should be full combs of solid brood. You should, therefore, watch closely for poor queens—distinguished by their spotty or small amount of egg laying. Such a queen should be replaced at once so that the new queen will have a chance to build up the colony during fruit bloom. It is always wise to have a few extra queens on hand at this time of the year.



A transport or nucleus hive made from quarter inch lumber. The hive has screened holes in both ends as well as a false screened top and bottom to allow for ventilation. When being moved about, the entrance is closed and the bees still receive air through the screened portions of the hive. Such a hive allows a queen nucleus room to grow until you are ready to use it.

A very good practice which will maintain a supply of extra queens is to take a frame of brood and bees from each of your strongest colonies at the beginning of fruit bloom, replacing with a frame of foundation or drawn comb. Place two frames of brood with adhering bees, along with an empty comb, in a nucleus box and introduce a queen. This queen nucleus is allowed to build up and whenever you have a colony that is weak or has a failing queen, you may kill the old queen and place the nucleus with the new queen in with the old colony. This serves a dual purpose — bolstering the strength of a weak colony and at the same time giving the colony a young laying queen.*

If one of your colonies seems to have a good queen but is weak in worker population, it may be helped by exchanging an empty comb from the weak colony with a good comb of emerging brood and bees from a strong colony that can spare the loss of a few bees. When doing this, check the comb closely to make sure that you are not taking the queen from the colony. Combs of brood added in this manner should be placed

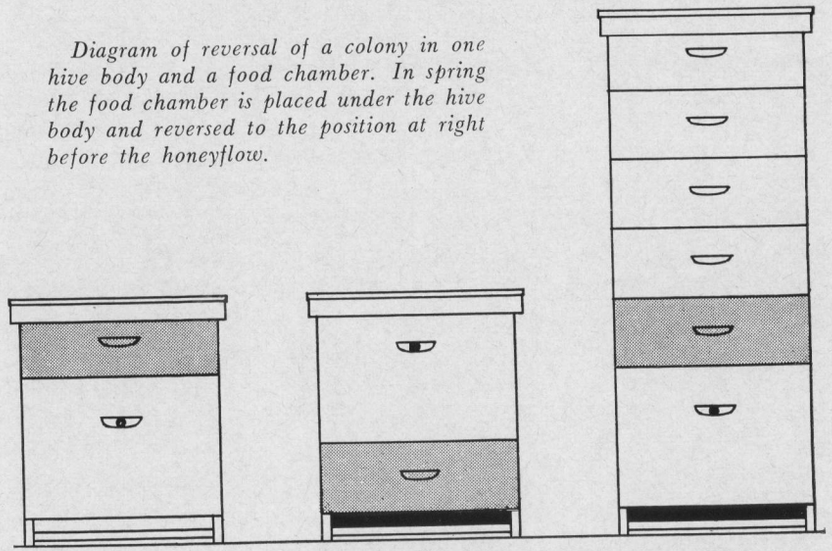
* This method is good practice for the beekeeper with ten or more colonies, but should not be attempted by one having only two or three colonies.

on one side of the brood nest so there will be little danger of the strange bees killing the queen.

The worker bees of a colony which leave the hive to gather nectar, pollen, or water are called field bees. They are accustomed to the position of their own hive in an apiary and should the hive be moved to a different location they would return to the old location rather than to the hive itself. This habit of the field bees gives us still another method of building up a weak colony—which is called "switching." In this method a weak colony is exchanged in apiary location with one which is strong. Since the field bees will return to their old location, the weak colony will gain considerable strength in numbers. This should be done when bees are gathering nectar.

As the fruit bloom period progresses you will probably find that many colonies have brood in the super which was

Diagram of reversal of a colony in one hive body and a food chamber. In spring the food chamber is placed under the hive body and reversed to the position at right before the honeyflow.



left on for winter stores, while the hive body of combs below will be only partially used and in some cases may be deserted entirely. If this is the case you should reverse the position of the body and the super — placing the super below the body. This will cause the queen and bees to move up into the partially

deserted hive body where there is plenty of room for the queen to lay her eggs. If there is honey left in the super, the worker bees will move it up into the body and in so doing will stimulate the colony to faster growth.

An occasional colony will be found in which the queen confines her egg laying efforts to the center combs even though there may be side combs which are completely empty. This is especially true if there are frames of honey or pollen blocking the expansion of the brood nest and effectively preventing the queen from laying in all of the combs. In such a case the empty side combs should be moved up to the brood nest and the combs of honey or pollen moved toward the sides of the hive. Do not, however, separate the frames of the brood area. Remember that word of caution—always put frames of combs *up to* and *not into* the brood nest.

LATE SPRING MANAGEMENT

From the end of the fruit bloom period until the beginning of the major honeyflow there is usually a period of dearth, often between the blossoming of dandelion and clover, when there is little or no nectar gathered by the bees. Many colonies which did not need additional feed during the early spring or mid-spring, may need sirup during this period. Some colonies may need only one feeding of sirup to carry them through, while others may require as many as three ten-pound feedings of sirup. Here again it is advisable to add ¼ teaspoon of sulfathiazole sodium to each ten pounds of sirup given to a colony.

This period is truly called the danger period since many cases of colony starvation and swarming occur at this time. Starvation is easy to prevent and the wise beekeeper will make sure that his colonies have plenty of natural stores or sugar sirup during this period.

Swarming presents a number of different problems, all of which may be overcome by the beekeeper. The urge to swarm is probably inherent and instinctive and is stimulated by environmental conditions. Swarming usually occurs when the brood nest of the colony is crowded with worker bees and the queen is forced to slow down in her laying, although bees are known to swarm out of their hive for other reasons; for example, bees will swarm from their hive when they have reached the point of actual starvation, or a large, populous colony, approaching the honeyflow, but having a failing queen, may very quickly develop the urge to swarm.

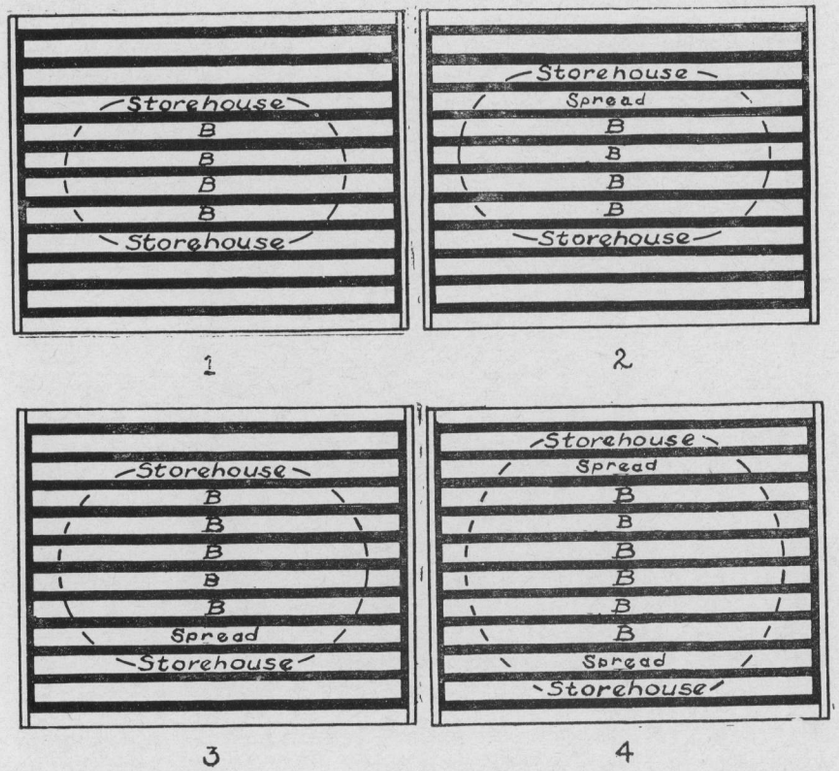


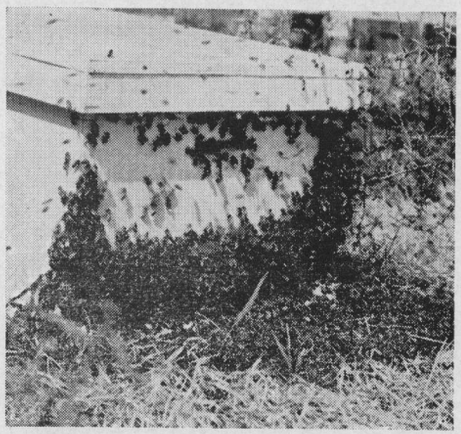
Diagram of expanding the brood nest. With four fairly well-filled brood combs flanked by stores in fruit bloom, one empty comb is moved in; a week later another is moved in, and about 10 days later two empty combs are moved in as diagramed.

Although some beekeepers talk proudly about having all of their equipment full of bees, the good beekeeper will have some extra equipment which is available at all times. It would indeed be poor management to allow a colony to swarm simply because you did not happen to have the bottom board, body, frames, cover, and a few pounds of comb foundation that are

necessary to divide the colony. By the time the equipment could be ordered and arrive at its destination the swarm would have long since departed.

SWARM CONTROL METHODS—CLEARING THE BROOD NEST

Since a crowded condition of the brood nest is one of the prime factors in swarming, the beekeeper should watch his bees carefully during the late spring period and make sure that the queen has plenty of room to lay. At this time of the year the



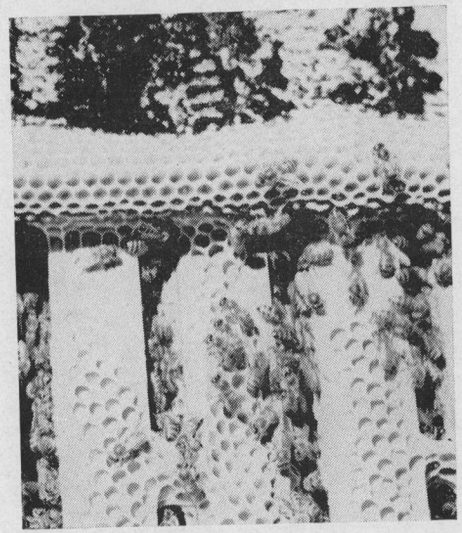
Notice the crowded condition of the bees. This hive should have at least two supers on at this time and one of them should be a foundation super to help relieve the crowding in the brood nest.

super, which earlier was reversed beneath the body, should be placed back on the hive body. In addition to this the deep brood combs should be inspected and side combs containing pollen or honey should be removed and empty combs or frames of foundation placed in the hive. This will give the queen room to expand her egg laying into combs which would otherwise not have been available to her. The placing of the super back on top of the colonies will allow the worker bees to move excess stores from the brood chamber and again will make more room

for the queen to lay. No matter what style of hives is used, the same system of reversal should be followed.

ADDING A FOUNDATION SUPER

Worker bees between the ages of twelve and eighteen days supply the beeswax for the colony. It is at that age that beeswax is secreted most freely by the glands on the undersurface of the abdomen. This habit of the bee gives the beekeeper another method for swarm control. A colony which is going through a rapid build-up will have many worker bees of the right age for wax secretion. A strong, crowded colony may be given a shallow super of foundation. The super of foundation is "baited" by taking out two or three drawn combs from another super and placing them in the foundation super



Burr comb placed on the top bars of frames. A foundation super should have been given this colony so that this wax could have served some useful purpose.

and placing the foundation frames in the lower super. This gives the wax secreters a useful task to perform and at the

same time removes them from the brood nest which, of course, reduces the amount of crowding in the brood area.

RELOCATION

An easy and very effective measure of swarm control is the practice of relocating or switching colonies. As described previously, the weak colonies exchange places with the strong. Not only does this cut down the field force of the crowded strong colony, and hence help to eliminate swarming, but it also helps to build up weak colonies that would otherwise not be able to make much of a honey crop. If no weak colony is available, the strong colony is simply relocated in a new spot so that the field bees will drift away from it.

DIVISION

As a last resort, the colony attempting to swarm may be divided into two parts and the queenless part given a new queen. When making the division, it is advisable to give a majority of the sealed brood to the new queen, leaving the old queen and part of the brood at the old location. The new divide can be placed three or four feet from the parent hive and the new queen introduced. Most of the field bees will return to the old location, leaving only the new queen, the young worker bees, and the brood in the new hive. They may be run as two separate colonies during the honeyflow or may be united as one colony shortly after the start of the main honeyflow. In the latter case, frequently one queen will disappear shortly after uniting or, both queens will continue to lay until the end of the honeyflow when one of them will disappear.

WAYS TO MAKE SPRING INCREASE—PACKAGE BEES

The established beekeeper is in a far better position to make increase with package bees than one who is just beginning with his first few colonies because he can use his established colonies to help his package colonies. Packages should arrive as early as possible, preferably during the first half of April, earlier or later according to location. Fruit bloom will just be starting at this time. Three weeks after the packages are hived, during the period of their lowest ebb, they should be

bolstered if possible by the addition of a comb of sealed brood and the adhering bees. If old colonies can spare it, the new packages should have a second comb of brood and bees added some time during the fourth or fifth week of their growth. Packages taken care of in the above manner, and supplied with an ample amount of sirup and pollen, will garner a fair honey crop the first year.

INCREASE BY DIVISION

As described under "Swarm Control Methods," strong colonies can be divided and the queenless half given a new queen. It also is possible to take combs of sealed brood with the adhering bees from strong colonies, replacing them with empty drawn combs or frames containing full sheets of comb foundation. These combs of sealed brood need not come from the same colony but may be taken from a number of colonies. Three frames of sealed brood and bees, given a new queen the first half of April, will grow into a good colony for the honeyflow. Later, divides may be made by taking four or five frames of brood and bees and introducing a new queen the first of May. It is best to place the brood and bees in the hive in a new location and to wait twenty-four hours before introducing the new queen.

EQUIPMENT NECESSARY FOR EXPANSION

The serious beginner will now want to expand his number of colonies from two or three on up to ten or more. For the man just starting in with bees, two or three colonies is enough to occupy his spare time. There are many things to be learned by one just starting with bees. You have finished an entire season by now and are more adept in frame and colony manipulation. Tasks which formerly took an hour to perform are now simple ten-minute jobs which come to you naturally. Brood, queens, workers, drones, all are stamped in your memory and a quick glance tells you what you want to know. The results of a good queen are quickly discernible and no longer must you ponder over somewhat meaningless words in a semi-text to discover whether a queen is good or poor. All of this knowledge you have accumulated and all of your increased

adeptness in manual manipulation mean that you are now able to care for at least ten colonies in the same length of time in which you formerly cared for only two.

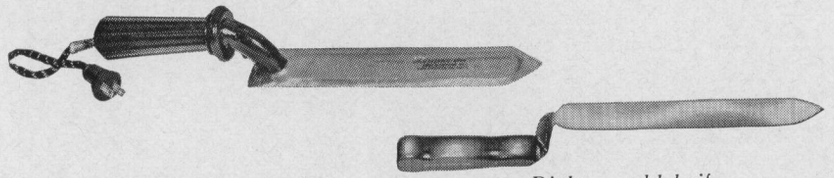
To expand your apiary you will need, of course, a hive body, cover, bottom board, inner cover, and a complete set of frames with foundation for each additional colony. In addition to this, you will need at least three supers for each new colony. Many beginners prefer to start with bulk comb honey supers, since they do not entail the added expense of an extractor and an uncapping knife needed if producing extracted honey. The beekeeper who wishes to expand, however, should carefully consider the type of honey he wants to produce. You will find that the production of extracted honey means that more honey can be produced with the same number of colonies and that less labor will be involved for each colony in production. There is a point which should be emphasized, however. Comb honey production gives you a finished section of honey that has no competition—it is a beautiful and easily marketable product.

The production of extracted honey means some added expense for equipment that would not be justified with two colonies but which is more than justified by the amount of honey produced from ten or more colonies. The only additional expense that need be considered for the first few years is the cost of an extractor and uncapping knife.

In extracting the honey from the combs, the first step is to remove the layer of wax over the top of the cells, called "cappings." This is accomplished by means of an uncapping knife. The knife slices the wax seal from the cells so that the honey may be thrown out by centrifugal force in an extractor.

There are a number of different kinds of uncapping knives, ranging in price from a few dollars on up to as high as twenty dollars. Most beginners start out with a type of uncapping knife that may be used cold—that is, it is not heated by either steam or electricity. However, a warm knife works to better advantage. With the cold type of uncapping knife, it is best to have two knives available—keeping one in a pan of boiling water while the other is in use, exchanging knives for each frame to be uncapped, much on the same principle as the flat-iron which is heated on a wood or coal-burning range. For

complete ease and speed in uncapping combs of honey, the beginner will find the electric knife desirable, as after hooking into the electrical circut and warmed, the knife may be used continuously without waiting for a warm-up between combs. The hot knife slices through the cappings with a speed that is amazing.

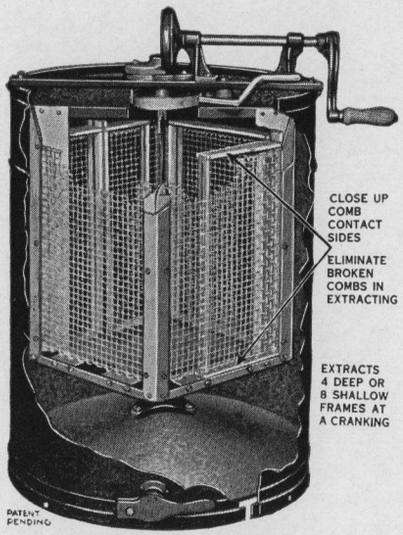


Top — electric knife *Right — cold knife*

The cappings from the comb may be caught in a wash tub, or some similar metal container. A good practice is to take an old wash tub and cut out the bottom, replacing it with wire hardware cloth fastened to the sides of the tub with rivets or bolts. Then place the tub on a wooden frame and place a large metal tray under the hardware cloth. If the cappings are caught in a container such as this you will find that considerable honey will drain down through the cappings and accumulate in the tray below. A wooden paddle or board may be used to stir and break up the cappings so that more honey will drain from them. This honey may then be added to that which comes from the extractor. *Always remember to save your wax.* The wax which comes from cappings is a light lemon color and commands the best price of any wax on the market. To obtain the most money for your wax you should separate it from the honey by placing the cappings in a large tub of hot water after you have first drained or squeezed all possible honey from the fresh cappings—allowing it to cool after the wax has all melted. The solidified wax may then be removed from the top of the water. Send the wax, properly labeled with your name and address, to your bee supply dealer. You will be amazed at the amount of money your beeswax will bring.

There are a number of different extractors available ranging in price from about twenty-five dollars up to four hundred dollars. One of the smaller extractors, run by hand, will easily take care of the production from twenty colonies. The bee-

keeper with a mechanical aptitude may readily take a small hand extractor and convert it into an electrical powered extractor by the addition of an electric motor, belt and pulley. After the honey is extracted, it may be drawn from the ex-



Honey Extractor

tractor into sixty-pound cans. When the complete crop is extracted, the inside parts of the extractor may be removed, a filter made of various meshes of hardware cloth and bolting cloth placed on top of the extractor, and the honey poured through the filter back into the extractor. In this manner, the extractor may be used for a settling tank, allowing the honey to stand for twenty-four hours to allow it to clear before drawing it off into pails, jars, or other containers for use or for sale.

CHAPTER IX

Source of Bee Pasture

THE extent to which profitable beekeeping operations can be followed in any locality will depend upon the plants within flying range, their time of blooming, quality of honey which they yield and the acreage within reach. Honey for family use can be produced almost anywhere flowers bloom, even in large cities, but commercial honey production is only profitable where large acreages of heavy yielding nectar sources are present.

In most localities surplus honey comes from only a few sources and usually within a short period of time. Plants which support the bees before and after the main honeyflow are of equal importance since their presence or absence will determine whether the bees are ready for the flow when it comes. Some areas which provide heavy main honeyflows are poor beekeeping territories because there is no supporting flow in advance to enable the bees to build up strong colonies. Since the household duties of cleaning and ventilating the hive, building combs, feeding young bees, and guarding the entrance require a considerable number of bees, there can be but a small field force in a weak colony. It is only the strong colonies that have enough field bees to gather a worth-while harvest.

Where there are flowers within reach, the field bees will be bringing in supplies whenever the weather permits them to fly. From the time the first skunk cabbage or witch hazel opens in late winter until frost cuts down the last asters in autumn the bees will be seeking nectar and pollen to feed the young brood.

Although we are unable to see any accumulation of stores in the hive as the result of these early or late visits, they are of very great importance to the success of the beekeeper.

Where there is a large field force the bees are often able to store a substantial surplus from very short honeyflows such as come from black locust or the even shorter blooming honey

locust. Weak colonies can only make use of such flows to increase the population of the hive.

When colonies are weak they often use a heavy honeyflow, such as comes from the tulip tree, for building up the colony instead of storing surplus. Thus, they build up on the honeyflow instead of for the honeyflow as has been noted by some of our leading authorities.

In regions where the honeyflow comes in midsummer there is likely to be a favorable opportunity to build strong colonies before the flow. In the Southeast where the flow comes early as it does from tulip tree, commonly called tulip poplar, it requires expert beekeeping to get the bees ready in time for the flow.

IMPORTANT POLLEN PLANTS

Pollen which provides the protein for the growing larvae is consumed in large quantity and without an abundant supply there can never be profitable commercial honey production. In a country as large as this, with so great a variety of plants, it is difficult to give a proper outline of the subject which will be useful everywhere. In the accompanying chart an attempt is made to present the important bee pasture for the season. Many exceptions will appear in even these smaller areas. Plants which are given as minor sources of nectar for the region as a whole may be the main source of surplus in some sections. Other plants, which in some sections serve as early support, may yield a surplus in another locality. Only general statements are possible for such large areas.

Over a very large part of the United States the maples are among the first to yield either nectar or pollen. In limited regions plants like skunk cabbage may come earlier. The willows are very important for early spring support in all the northern states but in many southern localities they come into bloom much later, in some places as late as June. The native elm trees bloom very early in spring and yield a great abundance of pollen. In many places they are the principal source of early pollen.

As spring advances a wider variety of plants come into bloom and nectar and pollen both are more readily available.

Too often the weather is rainy or cold and the bees are confined to the hives when the nectar harvest is on. At this season the fruit trees and the dandelions offer an abundance of forage and when weather is favorable, surplus honey is sometimes stored by strong colonies.

SOURCES OF SURPLUS—SWEET CLOVER

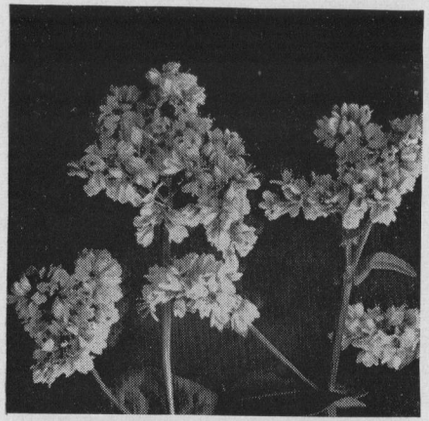
There are only a few plants which yield surplus honey in large quantity that are widely grown. There is a much larger number of plants which provide good crops in limited areas, but honey from these sources are seldom found in the markets of the large cities.

Sweet clover is probably the source of more marketable honey than any other crop. It is at its best in the Midwest, as it requires a rich limestone soil and low humidity. The honey is very light in color and mild in flavor. The common varieties of sweet clover are biennials. They make a vigorous growth the first year and come into bloom the second season after which they die. There are annual varieties, the best known of which is the white flowered "Hubam."

The yellow flowered sweet clover blooms a few days earlier than the white and in neighborhoods where both are grown extensively there is likely to be a honeyflow of extended duration which insures large yields in favorable seasons. Sweet clover is grown from Texas to the far north in western Canada. It is drought resistant and often yields good crops of honey in seasons too dry for satisfactory development of staple grains.

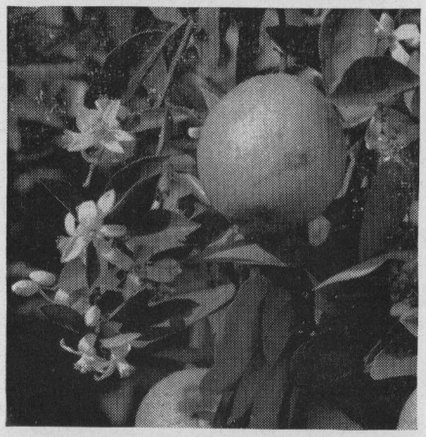
ALFALFA

Alfalfa is also the source of large quantities of white honey from the mountain regions of the West. In the lower altitudes of the Southwest, the honey from alfalfa is darker in color and more highly flavored. It yields nectar freely on rich soils with abundant moisture at the roots and a dry atmosphere. In some seasons alfalfa is reported as yielding in the East but it is not dependable in humid climates. In seasons where a wet spring is followed by dry, warm weather the nectar often flows freely for a time until the soil becomes dry.



Buckwheat

Most of the buckwheat honey is produced in the region of the Great Lakes in Ontario, New York, Michigan, and Pennsylvania. Buckwheat does best on sandy or light soils and seldom yields on clay or heavy soil. Buckwheat yields a very dark honey of pronounced flavor which is popular with many. It is so different from the mild-flavored light honey from the clovers that it seldom appeals to the same people.



Orange

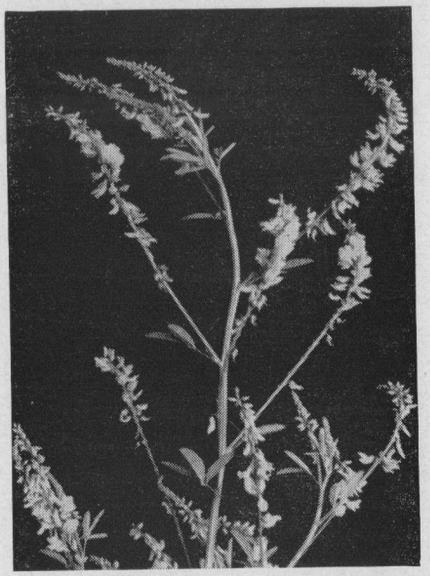
Although the bees gather honey from a large variety of fruit blossoms, only the orange is a major source of surplus honey. While some honey comes from it in Texas and Arizona, the bulk of orange honey is harvested in California and Florida where it is one of the principal sources of surplus. Orange honey is light in color and of marked but pleasing flavor, and is usually much in demand.

Aster

There are more than 125 species of aster found in this country. Most of them are attractive to the bees. There is a large area in the Southeast, including portions of Kentucky, where asters provide a larger share of the crop than any other plant. There are few localities where bees do not get something from asters. Pure aster honey is often of light color and good quality.

Sweet Clover

In the early days of beekeeping sweet clover was known as the "bee plant" or "honey plant." For many years the beekeepers tried to spread this plant as pasture for their bees while the farmers sought to stamp it out as an undesirable weed. It was not until the last fifty years that sweet clover was given a place on the farms as a soil builder. Sweet clover is a midseason source of nectar. The honey is light in color, many times being water white, and of a very mild flavor. It may be listed as the nation's main source of surplus honey.



Most markets pay a premium for white honey of mild flavor such as comes from sweet clover and alfalfa. The large acreage of these legumes offers bee pasture of such extent as to make available this high quality honey in carlots in the principal markets.

There are few other plants sufficiently common to support the large apiaries now commonly operated by commercial honey producers. Outfits operating 1000 or more colonies are now common in the states where these plants are widely grown.

Alsike Clover

Alsike was brought to this country about 1839 and was met with widespread acceptance. The beekeepers were largely responsible for its spread although the farmers quickly saw the value of this clover and adopted it. Alsike is grown principally in the dairy regions of Minnesota and Wisconsin, and to a less extent throughout the northeastern states and eastern Canada. Alsike clover honey is similar to that from white Dutch clover.

Dandelion

The lowly dandelion is almost nationwide in its distribution and is a good source of both nectar and pollen. It blooms early, before most colonies are strong enough to harvest a crop or it might prove to be a good surplus honey plant.

WHITE DUTCH CLOVER

Fifty years ago the white clover was the principal source of white honey. It grows over a wide expanse of country from the Missouri River to the Atlantic Coast and southward. Much honey still goes to market from white clover but it no longer holds first place since the sweet clovers and alfalfa have been planted over such a wide area. Honey from white clover is slightly darker in color but of mild and pleasing flavor. Alsike clover yields well in neighborhoods where dairying is important or where it is grown for seed. The quality of the honey is similar to white clover. Neither yield as dependably as in former years before soil fertility had been reduced.

MINOR SOURCES OF SURPLUS

It would require more space than is available here to describe the long list of plants from which surplus honey comes in limited areas. In the Southwest the mesquite yields a light amber honey of good flavor. In the region from south Texas to southeastern California mesquite is important to the beekeeper in desert areas.

In the Southeast the sourwood tree yields a honey which is so popular in the region from which it comes that little goes to outside markets. Heavy yields are reported from the Carolinas and western Tennessee. The tree is found from West Virginia to Georgia and west to Arkansas but the big crops are seldom reported outside a limited area.

In Florida heavy yields come from tupelo along the Appalachicola River, from black mangrove along the east coast and from the palmettos in the interior.

California boasts of her orange honey which is famous far beyond her borders. Sage also yields heavy crops. Surplus is reported from a variety of sources including blue curls, eucalyptus, manzanita, lima beans, incense cedar and several others.

Washington and Oregon report surplus from cabbage and turnip grown for seed, fireweed, peppermint, black locust, snowberry, vetch, and several others along with honey from alfalfa and the clovers.

Since there are so many plants which are important locally, it will be to the reader's advantage to ascertain whether a bulletin on honey plants of his state may be available from his college of agriculture.

HONEYDEW

At times when nectar is unavailable the bees gather a sweet which is excreted by aphids feeding on the leaves of forest trees. This honey dew is usually of poor quality and of little value. It is bad for the bees when left in the hives for winter stores where winter weather is too severe to permit the bees frequent flight. At times when aphids are abundant they eject honeydew in such quantity as to cover leaves on lower branches with the sticky substance. The bees gather this material and seal it in their combs the same as honey. When mixed with good honey it spoils the quality of the whole output.

BITTER HONEY

Fortunately, the areas where unpalatable honey is harvested are relatively small. In the Ozark region of Arkansas and Missouri and eastward in Kentucky and Tennessee the bitterweed yields an abundance of bright sparkling honey which is as bitter as quinine. It is important that the beekeeper remove such honey from the hives before the harvest of good honey. It can be fed back to the bees for winter stores after the other is taken from the hives.

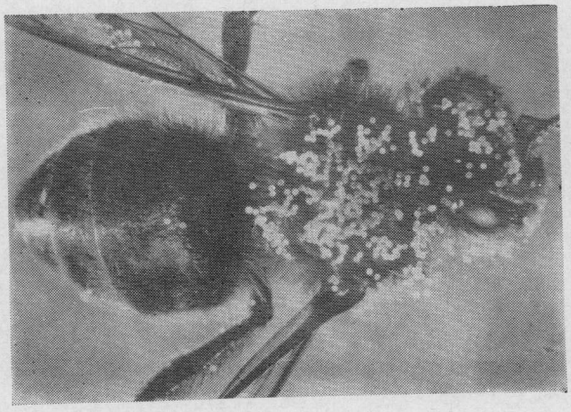
	Earliest Pollen & Nectar Flowers	Late Spring Build-up Flowers	Main Honeyflows	Minor Sources	Fall Flowers
Northeast	skunk cabbage willows maples	fruit bloom dandelion black locust	clovers goldenrod fireweed buckwheat	sumac buttonbush Canada thistle milkweed purple loosestrife	asters wild carrot goldenrod Spanish needle
Southeast and Gulf Coast	alder yellow jasmine wild plum	fruit bloom holly tulip tree chinaberry	clovers tulip tree sourwood aster persimmon gallberry	holly black-gum tupelo black locust basswood cotton	golden aster asters goldenrod summer farewell
Texas and Southwest	mistletoe creosote bush pinkmint	fruit bloom dandelion arrow wood	cotton mesquite catsclaw huajillo	horsemint sweet clover alfalfa	rabbit brush asters Spanish needles
Central West	maple willow elm (pollen)	dandelion fruit bloom Virginia waterleaf	white clover sweet clover heartsease	basswood Spanish needle coralberry	wild sunflowers asters bonesets
Plains States	prairie crocus willows wild plums	dandelion box elder cottonwood black locust	sweet clover alfalfa	gumweed Rocky Mt. bee plant	goldenrods wild sunflowers ironweed
Northwest	vine maple willows	orchard fruits dandelion	alfalfa sweet clover fireweed	dogbane turnip cabbage black locust cascara snowberry	goldenrods rabbit brush
California	willows dandelion	cantaloupe onion fruit bloom	orange alfalfa sage clovers star thistle	eucalyptus lima beans mustard manzanita blue curls	rabbit brush Spanish needles
Florida	wild pennyroyal Spanish needle	citrus blackberry chinaberry	gallberry tupelo palmetto black mangrove	ti-ti manchineel purple flower mint citrus	summer farewell goldenrod asters

CHAPTER X

The Honey Bee and Pollination

ALTHOUGH the honey bee has been famous for centuries for her labor in the production of honey and beeswax, she is of far greater service to mankind in the distribution of pollen.

A large number of plants are fruitful only when pollen from the flowers of one plant is brought to the flowers of another to insure fertilization. Under present day conditions the honey bee is by far the most efficient agent in this pollen distribution, commonly spoken of as pollination.



A pollen covered bee

Many of our most important food plants are dependent upon the bees for this service. The grains are largely wind pollinated and do not depend upon insects; but most of the

fruits, many of the legumes, including the clovers and alfalfa, and such garden vegetables as cucumbers, melons, and cabbage require the help of insects to insure that fruit will be formed or seed set.

In a recent publication of the United States Department of Agriculture, Circular E-584, is given a list of fifty plants which are important in present day agriculture, all of which either depend upon the honey bee for pollination or are helped by her visits.

In the days of the self-sufficient farm we knew little of the problems which have developed along with the present day specialization. Every farm raised a little of a great many different things and the family provided a home market for about sixty per cent of the farm output. Now a farmer will devote himself to the production of two or three crops and often to only one. The large areas devoted to special crops provide ideal conditions for the spread of insect pests with the necessity of heavy expense of time and money in the effort to control them. The poisons used in their control often destroy the wild insects which serve a useful purpose in the distribution of pollen. With the disappearance of the many wild bees, ranging in size from smaller than a housefly to the bumblebee, we have come to be dependent upon the honey bee which is the only insect whose numbers can be controlled and which can be moved to the spot where her services are most needed.

In neighborhoods where there are large areas of wasteland and where little spraying is done, there may be plenty of wild insects still present to serve the need of small acreages. However, it is common practice at present to grow special crops in such a large acreage as to require a far greater number of insects than are present in the wild.

LOSS FOR LACK OF POLLINATION

It often happens that unprofitable crops will result from lack of pollination when growing conditions are favorable and the grower is at a loss to understand his failure. In many localities where farmers once harvested five to eight bushels of red clover seed per acre, they now get less than one bushel, and seed production is no longer profitable. This change came

with the disappearance of the bumblebees which were once plentiful in the area.

The honey bee is not as efficient in the pollination of red clover as the bumblebee but when enough honey bees are present they do provide the necessary service. Since the corolla tubes of the red clover are so deep that it is difficult for the honey bees to get the nectar, they are likely to visit other flowers in preference if any are open. The remedy is to bring in so many honey bees that other pasture will not be sufficient and they must visit the red clover to provide their needs.

It would be difficult to estimate the extent of losses to agriculture from lack of pollination. The difference in yields in fields or orchards after the honey bees have been brought in, has shown that such losses run into hundreds of millions of dollars. The loss of soil fertility through continuous stirring of fields that should be sown to meadow or pasture is even greater and this loss is permanent and cannot be replaced.

COMPETITION FOR ATTENTION OF BEES

In any program of pollination it is necessary to bear in mind that the bees are likely to show preference for flowers with nectar of the highest sugar content. Thus, we cannot be sure when we bring bees to our orchards or gardens that they will visit the flowers which we are so anxious for them to serve.

The nectar from some flowers is rich in sugar while others may have a low sugar content. Since the bees are constant to one kind of flower while it is in bloom and visit only that species while its flowers are open, it is important for the grower that they start visiting the crop to be pollinated when its flowers open. This constancy greatly increases their value as pollination agents since they carry only pollen from apples when they are gathering from apples or from dandelions when that is the source of their nectar.

Some red clover seed growers have decided that the honey bee is a poor pollinator for red clover when the insects flew over their fields to visit sweet clover over the hill. Likewise, the owners of pear orchards are often disappointed when the bees fail to notice their fruit trees and seek apple orchards farther away. In turn the apple grower may be disappointed

when the bees find dandelions in nearby pastures more attractive.

The remedy, as already stated, is to make sure there are enough honey bees in the neighborhood to insure visits to the flowers with low sugar content when that is necessary.

There is great variation in the number of bees necessary to insure pollination of the various crops. Much will depend upon the acreage within flying range, the length of the flowering period of the plants to be visited and the number of wild bees already in the neighborhood. The weather at flowering time is also important. At times when weather is chilly and cloudy with brief periods of time suitable for bee flight, far more bees will be needed than when weather is balmy and bees can fly from early to late.

Under favorable conditions one strong colony of bees per acre may be sufficient where five would be needed if the weather is bad at time of bloom. There are so many unpredictable factors that it is good policy to bring in more bees than are thought to be necessary. Extra bees bring added assurance that the crop will be pollinated.

Every crop offers problems peculiar to itself and every neighborhood has a different set of conditions. It should be borne in mind however, as stated earlier, that only strong colonies offer efficient pollination service. The beekeeper who rents bees for pollination should be prepared to give service on this basis to insure that his customer will get the value of his money.

CHAPTER XI

Transferring Bees — Moving Bees

THE term transferring means the changing of bees from one hive to another. It may be only changing the frames and bees from an old worn-out hive to a new one placed in the same location. Usually, however, the word "transferring" means getting the bees out of an old hollow log gum or an old box in which the bees have built criss-cross combs. Such box hives or "gums" are practically useless since neither can they be looked into to determine the condition of the colony, nor do they usually produce much more than enough honey to sustain the colony.

Purchasing such box hives or gums should, therefore, be at a conservative price, since new hives and equipment must be bought and assembled; plus the additional work of transferring these colonies to their new and modern abode. However, the beekeeper may have box hives available which he wishes to transfer, or he may wish to buy bees which are in boxes in his neighborhood.

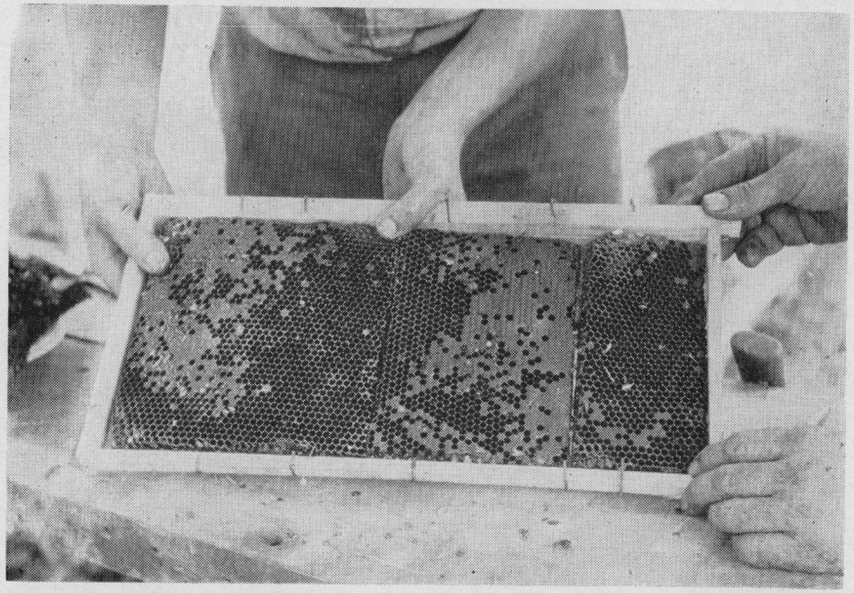
WHEN TO TRANSFER

The best time to transfer bees is about fruit bloom time in early spring. At that time the box hives will be as light as they will ever be in honey, and the comb transfer will be most readily made. Also, there will be a light nectar flow so there should be a minimum of trouble from robber bees. In addition, early transferring will allow the colony to repair the transferred combs during the honeyflow, build new ones and perhaps make a crop of honey for its owner before the season ends.

HOW TO TRANSFER

The first step is to move your box hives to the exact locality where you will want your new transferred hive to be permanently. After they have been there a few days, the bees will

have become cognizant of their location and transferring may proceed. Your next step is to remove the box hive several yards or more away, and put in its place the new hive, facing the same way and with its entrance as near to where the old entrance was as possible. A few frames with foundation for the returning bees to cluster upon should be left in the new hive. Turn the box hive upside down, smoking the bees thoroughly as you do so. Tear off the bottom of the box hive and in its place invert over the exposed combs of the colony, an ordinary



The worker comb is cut to fit the inside of the frame and tied in place with string or other means.

box of about the same size as the box hive, making everything as tight as possible between the two.

You now have your box hive without a bottom, and immediately above it an empty box into which the bees of the hive may run when they are driven into it. With a stick, hammer, or chisel rap vigorously on the bottom box hive, smoking the bees a little if necessary to keep them from getting angry. In a very few minutes, most of the bees and the queen will have forsaken their combs and run into the upper box. This

box may be provided with a couple of cross sticks, making it easier for the combless bees to cluster. The box with the bees is then taken to your already prepared modern hive and dumped either directly into the hive or upon a sheet immediately in front of it, just as you would do with a new swarm.

Your old box hive is now minus its bottom and minus the bees and the queen. Take it inside where there will be no danger of possible robbers and proceed to cut out all the combs in the box. All combs with brood may be saved and combined into frames, properly fastened with wires. In spring, especially, the colony needs all the help it can get from freshly emerging bees, so all sizable patches of worker brood should be saved. It is also wise to make up a comb or two of dry or partly filled worker comb, as to build out comb at this early date may delay the egg laying of the queen. Oftentimes, twine is used instead of wires to wrap around the newly made up combs of brood, though the wires are stronger.

These frames of comb and brood are now given to the transferred colony, filling out the rest of the space with frames of bee comb foundation. The cover is replaced, entrance reduced to keep down chances of robbing, and feed supplied if there was no honey in the transferred combs. The colony can now be left to shift for itself for a few days. Eventually it will have all its combs filled out and will need surplus room. Also, in due course of time you will have opportunity to gradually work these transferred combs to the edge of the hive, whence they can be removed the following spring or whenever convenient, to be replaced by other drawn combs or by frames with full sheets of foundation.

OTHER METHODS

If it is found inexpedient to cut out all combs, the beekeeper may "drum" out the bees as above, then remove the combs of the box hive entirely and dispose of them. This is a loss of good helpful brood, however. Or he may take this box hive without the bees and invert it immediately over the frames of the modern hive into which the bees have been transferred, first placing a queen excluder between the two so that the queen of the transferred colony cannot return to the old combs which she would be bound to prefer. Care must be

taken in this method, to make all tight between the hive and the upper box, to avoid robbers and also avoid the possibility of the queen of the colony crawling up the outside of the hive and into the old box with its combs.

Instead of "drumming" the bees out, the box hive with both its cover and bottom removed may be placed over the new modern hive and the bees driven down with a cloth saturated with carbolic acid crystals which have been liquefied, and diluted in water, after which the excluder may be resorted to as explained previously. However, because carbolic acid is caustic and will burn flesh quickly, care must be taken when using it.

Log gums and bee trees do not lend themselves so readily to transferring, though the bees may be drummed out after a fashion, the log split in two and the combs removed much as is done with the box hive.

Transferring bees is generally a "messy" job, but we know of no better fashion for the beginner to get initiated into beekeeping than by transferring a colony of bees or two. However, both the labor and the possibility of queenless colonies as well as diseased ones being the subject of the transfer, it is likely that the beginner at least should be advised to start with new hives and packages of bees secured in the usual manner.

MOVING BEES SHORT DISTANCES

It may become advisable to change the position of your one or two colonies of bees, a few feet in your back yard. Do not do it all at once. Move the hive a few inches each day and the bees will pay little attention. In such a manner a colony may be completely turned around in a few weeks, without loss of field bees and without creating any commotion in the vicinity.

MOVING BEES LONGER DISTANCES

For moves of longer distances, when the weather is not warm and the period of confinement of the bees not too long, the hives may be either closed or left open and picked up early on a cool morning, loaded on a truck and transported to the new location. For moves of very long distances, it is advisable

to make special screen tops for colonies to be transported, to take the place of regular covers. Make the frame on which the screen is nailed two or three inches deep so there will be plenty of room for the bees of the colony to cluster if they get too warm on the frames in transportation. Unload as soon as destination has been reached.

It is always desirable either to have some breaks in the apiary site such as trees and shrubs, or lean a hive cover in front of the hives. Thus, the bees on leaving for their first flight in the new location will recognize that a change in location has been made. Such action is always especially important where the move has been less than two miles, for in such cases, many of the bees will return to their old location only to find it deserted. Oftentimes, when several colonies have been moved, it is a wise precaution to leave a hive or two in the old location, or at least an empty hive as a decoy to catch the bees which return. These may later be added to one of the colonies in the new location or if sufficient in numbers, may be treated as a swarm, given a hive with frames and foundation and a queen to start a colony of their own.

Colonies of bees are often moved several hundred miles. On the longer hauls, both top and bottom of the hives may be screened. It is desirable to leave plenty of room between the rows of hives on the truck or car, and particularly between the colonies themselves, so they may not suffocate and so they may be sprinkled with water at the opportune time.

CHAPTER XII

Rearing Queens — Queen Introduction

IN successful beekeeping and for maximum honey production it is desirable, naturally, to have the colony at maximum strength at the time of the opening of the major honeyflow. Inasmuch as every emerging worker bee owes its existence to the queen, it is logical that the condition of the colony will depend upon the quality of the queen which heads that colony and the vigor with which she proceeds to furnish the eggs from which evolve the potential honey and pollen gatherers for the honeyflow to come. In fact, "the queen is the soul of the colony."

Owing to various causes: poor mating, chilling, accidental damage, heavy demand through long protracted flows, or winter chilling, the queen is apt to show signs of failing, even though she has not reached the age at which queens ordinarily deteriorate. Such a queen should be replaced as soon as the beekeeper becomes aware that her best days are over.

In a state of nature, the bees will take care of this themselves by making provisions within the hive and raising queen cells for a new queen. This is called supersedure. These "supersedure cells" are usually few in number. When the new queen has emerged, she is subsequently mated and takes her place as the new egg-laying fountain of the hive. The old queen either is destroyed by the new one or she disappears, probably disposed of by the bees of the colony, although the old and new queens (mother and daughter) may remain in the hive from several days to a few weeks.

Some beekeepers leave it to the bees to take care of requeening by these supersedure methods. The difficulty is that many times the bees do not become aware, in time, of the failure of their queen and the colony dwindles in strength, taking considerable time to bring it back to nectar gathering strength, during which time the major honeyflow could have waned and passed with insufficient bees in the hive to make a satisfactory crop.

So, more and more, the beekeeper lends a hand in seeing that the apiary is headed by queens, young and vigorous, for egg laying. Such requeening is ordinarily done every two years, but should be done in each colony as needed.

When bees are transported from one honeyflow to the other during the season so that a full harvesting force is needed over

The queen at right is a large, long and well proportioned, good queen. The queen in the middle is satisfactory but of medium size. The queen at the left is a a stubby-type and a very poor layer. Medium-size and stubby-type queens seldom have the egg-laying capacity of a queen of the type illustratea at the right.

a long period, the queen's laying powers, even though she may have proved to be a superior queen, may be taxed to the point where she may last only a season, while in other seasons with lighter flows, the call on the queen may not be so great. In any case, it is up to the beekeeper to judge whether or not a new queen is needed to head the colony for maximum efficieny.

Ordinarily most queens are secured from commercial queen breeders in the South who are situated where they can rear good queens in quantity and at a reasonable price. These breeders have the added advantage that, being in the business, they have an opportunity of choosing queens which will be the best breeders. There is the added advantage that they may surround their queen rearing yards with drone producing colonies headed by superior mothers, for the virgin queen is

mated only in flight and the beekeeper has little choice of the drones selected except by providing maximum possibilities of desirable drones. This practice of supplying proper drone flight is particularly practiced by those queen breeders offering instrumentally developed hybrid bees. Indeed, future improved strains of bees will probably all be the result of scientific hybridization using controlled instrumental insemination.

However, home requeening is sometimes practiced by the beekeeper. He may either have a queen which has headed a colony of exceptional value, whose qualities he wishes to perpetuate in his apiary, or he may, with innate interest and curiosity, want to do a little queen rearing "on his own."

When a colony is suddenly made queenless, it immediately proceeds normally, to rear queen cells from the eggs still within the hive; sometimes only a few, sometimes a goodly number. Thus, all the beekeeper has to do to raise queens is to make his choice colony queenless. The bees build of the chosen larvae special queen cells, and give them special food called royal jelly during the first few days of their growth. This eventually leads to the sealing of the special cells, and their emergence as virgin queens fifteen or sixteen days after the laying of the egg.

The amateur queen breeder will want to have his colonies or nuclei (small two or three-frame colonies) prepared so they are ready to receive the sealed cells (when the cells are eight or nine days old). If a colony is to be requeened, a sealed queen cell is cut out of the comb of the breeder queen with an inch or so of comb around it so that the cell will not be damaged. This cell is now inserted into the colony to be requeened, preferably by cutting, in a comb near the brood, a space large enough so that the cell and its attached comb may be inserted. In due course of time, the young queen will emerge, take her wedding flight and return to head the colony. The colony to be requeened, of course, will have been deprived of its queen the day before the new cell is given.

MILLER METHOD

Dr. C. C. Miller described a method of securing a number of good cells that may be used for requeening operations for home use with a minimum amount of effort, in many ways

being as good as the commercial methods used by the extensive queen breeders. We quote his method from the American Bee Journal, August 1912, as follows:

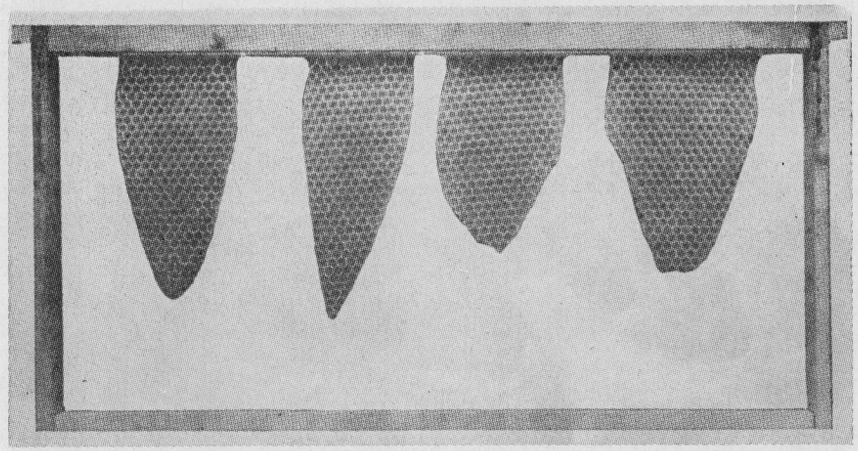
> Into an empty brood-frame, at a distance of 2 or 3 inches from each end, fasten a starter of foundation about 2 inches wide at the top, and coming down to a point within an inch or two of the bottom-bar. Put it in the hive containing your best queen. To avoid having it filled with dronecomb, take out of the hive, either for a few days or permanently, all but two frames of brood, and put your empty frame between these two. In a week or so you will find this frame half filled with beautiful virgin comb such as bees delight to use for queen-cells. It will contain young brood with an outer margin of eggs. Trim away with a sharp knife all the outer edge of the comb which contains eggs, except perhaps, a very few eggs next to the youngest brood. This, you will see, is very simple. Any bee-keeper can do it the first time trying, and it is all that is necessary to take the place of preparing artificial cells.
>
> Now put this "queen-cell stuff," if I may thus call the prepared frame, into the middle of a very strong colony from which the queen has been removed. The bees will do the rest, and you will have as good cells as you can possibly have with any kind of artificial cells. You may think the bees will start "wild cells" on their own comb. They won't; at least never any to amount to anything, and, of course, you needn't use those. The soft, new comb with abundant room at the edge, for cells, is so much more to their taste that it has a practical monopoly of all the cells started. In about 10 days the sealed cells are ready to be cut out and used wherever desired.

While it is possible to rear queens in northern climates, the season there is so short as to limit the volume of queens which can be produced, except in ideal seasons. Most of the breeders of both package bees and queens are, as a result, located in the southern states or in California.

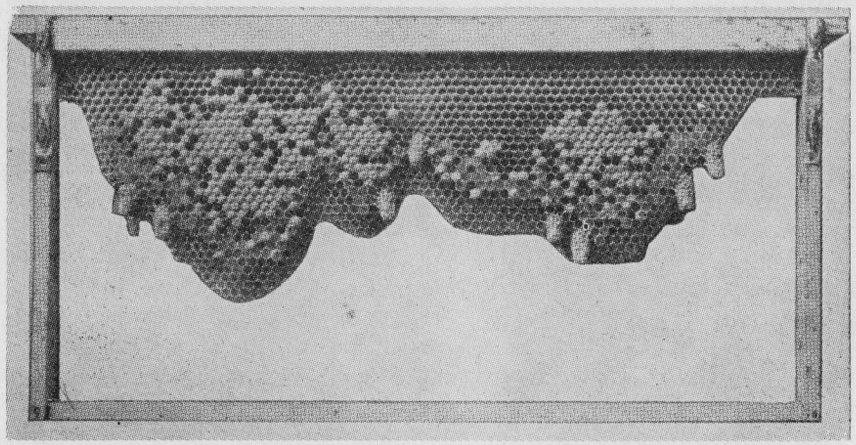
COMMERCIAL QUEEN REARING

The queen breeder furnishes his heavily fed queenless and broodless cell-starting colonies with numbers of embryo queen cells prepared by one of several methods. Most use the Doolittle plan. Rows of artificial wax cell cups are fastened, open end down on cell-bars on a frame which can be inserted in place of a frame in the cell-starters. Each of these cell cups is supplied with a small amount of royal jelly, and a very young larva (preferably less than one day old) is "grafted" or transferred into it from the chosen mother queen's brood. The starter colonies under ideal conditions accept and start building a large percentage of queen cells from these introductions. Twenty-four hours after introdutcion, the batch of started cells are removed and placed in strong cell finishing colonies.

The last step in the process is to remove these cells as soon as sealed, or before the young queens emerge, placing them in small queenless mating nuclei, where the young queens



The partly built comb containing eggs and young larvae. Note that the two combs on the right have been cut away along the edges leaving young larvae on the edge of the comb, Miller Method.



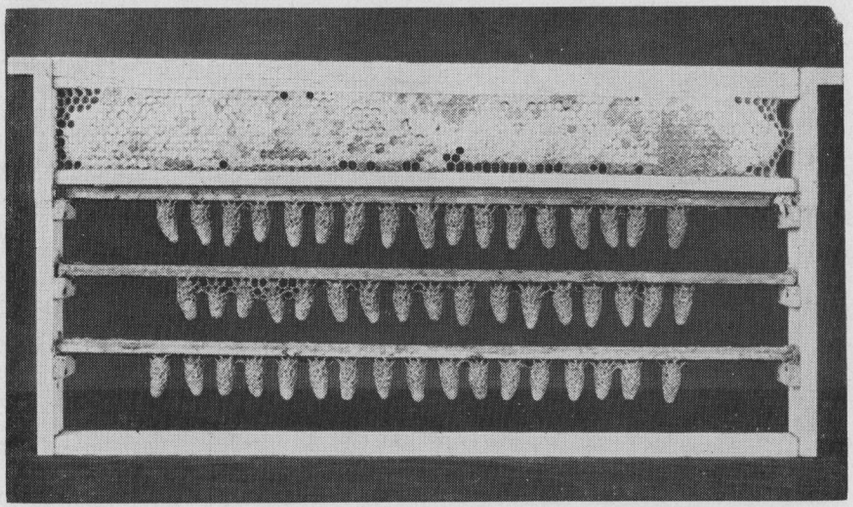
Queen cells constructed along the edge of the partly built comb.

eventually emerge and are mated. After she has proved her mating by the laying of eggs which develop into worker brood,

the queen is caught, placed in a queen cage provided with a few worker bee attendants and sugar candy provision sufficient for their maintenance until they reach the customer through the mails.

QUEEN INTRODUCTION

Benton cages in which most commercially reared queens are packed have accompanying them, directions for introduction of these queens. The cage is provided with a screen front and a small hole in the end where the sugar candy has been provided. A cardboard paper covers the outside of this hole. When the queen is to be introduced into the colony, this small



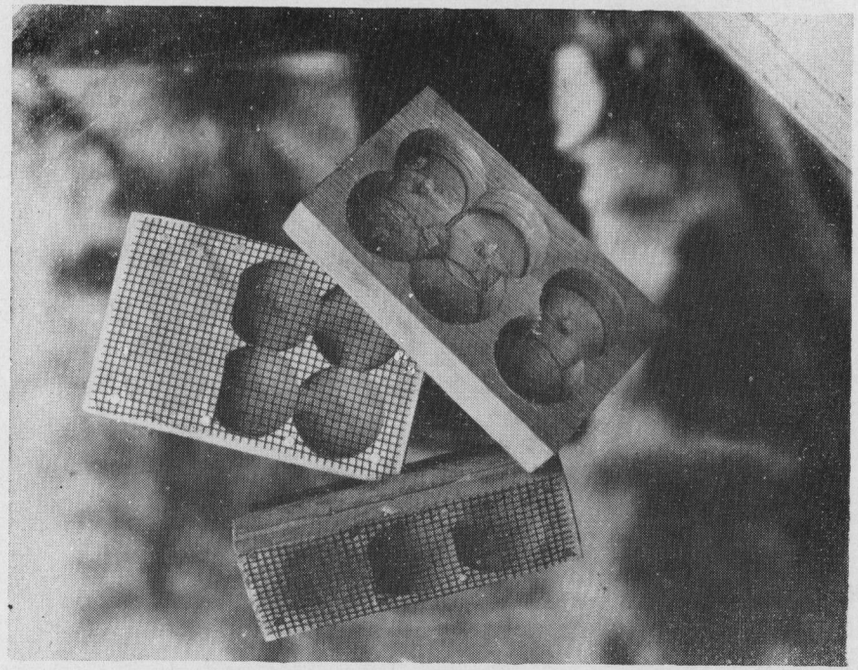
Frame containing three cell bars of finished queen cells removed from the center of the cell-finishing colony. (Photo courtesy John S. Shackelford)

cardboard is removed from the candy and the wire screen side of the cage is either inserted between the frames or just over them with the bees exposed through the screen to the bees of the hive. By the time the bees have eaten through the candy into the cage, they are acquainted with their new queen and she walks out onto the combs to proceed with her duties.

Some recommend that all attendant bees be removed from the cage before introduction is attempted. Others, during a

honeyflow may endeavor to "run the queen in" the entrance with little more than a few puffs of heavy smoke to accompany her. During periods of heavy honeyflow oftentimes they succeed, many times not.

A surer way is by a "push in" cage made of wire, by which the queen is imprisoned in a small cage on the sealed



Note the queen bee in the center of one of the holes of the queen cage. In this manner the queen is mailed to the beekeeper.

brood of a comb in which the queen is to be introduced. The emerging bees within the cage surround the queen. She gets the odor of the hive, the recognition of these young bees and in 24 to 36 hours may be released in the colony.

With a very valuable queen a similar method may be used. The new queen is given a hive or nucleus of her own, with no entrance. She is released on two or three frames of sealed brood—no bees. This must be in warm weather or both the brood and the queen might suffer. As the bees emerge from

the brood they proceed to feed the queen. After sufficient emergence for colony defense has taken place, a small entrance may be given to the colony, from whence it develops into a full colony.

CHAPTER XIII

Honey and Beeswax

HONEY and beeswax are the two principal products of the honey bee colony. The pollen gathered by the bees from the flowers is mixed with honey or sugar sirup within the hive to feed the bees. Some experiments have been made which suggest that pollen may have some possibilities as a human food.

The propolis gathered by the bees (similar to glue) and which the bees use to close up holes and cracks in the hive as well as to cover objects within the hive which the bees cannot remove, has been used at times as a furniture glue and polish. The acid of bee stings is being marketed as an inoculation for certain types of arthritis.

HONEY

Honey is actually made or "manufactured" by the honey bee. The worker bee visits the flowers which secrete a sweet liquid called nectar. This nectar, waterlike in consistency, is sipped from the blossoms by the bee and carried to the beehive in its honey stomach. In the manufacture of honey from nectar, two distinct processes are involved: One brings about a chemical change in the sugar which makes it more easily digested, and the other results in a physical change whereby surplus water is eliminated. The sugar in nectar is largely cane sugar but as soon as it is taken into the honey sack of the field bee there begins a process, known as inversion, which rapidly changes most of the cane sugar into two simple sugars, dextrose and levulose. After many handling processes, including water evaporation and enzyme addition, the house bees convert the raw nectar into honey.

Such honey contains from 15 to 20 per cent water (usually about 18 per cent), 40 per cent levulose of fruit sugar, 34 per cent of dextrose or grape sugar, and 2 per cent of sucrose or cane sugar. There is besides, in the honey, a small percentage of dextrine, ash, acids and minerals and a small quantity of undetermined materials. When honey contains 20 or more per cent water it is unripe and under some conditions may ferment. For that reason the beekeeper is urged to leave the

honey on the hive until the bees have thoroughly ripened it. Sealed honey, except under extreme conditions, is ripe. The bees often ripen the honey as it is gathered. It is only under circumstances of heavy honeyflow or high humidity that they have difficulty in keeping up with the field-gathering bees. At the end of the flow, all honey, sealed or unsealed, is safe to remove. Ripe liquid or extracted honey weighs 11½ to 12 pounds to the gallon.

Honey is classified according to the source from which it is collected. Thus, we have a wide variety of honeys depending on the major source from which they were gathered, whether it be black sage, orange, sourwood, clover, alfalfa, buckwheat, milkweed, etc. Similarly, in most localities where there is a variety of plants, we are apt to have a mixture of honey from several flowers, the honey taking its color and flavor from the combination of flowers represented. In our chapter on "Honey Plants" we give a chart with names of the principal honey plants in various sections of the country.

Honey also is classified according to its color and flavor. It may either be white, amber, dark amber, or straw colored, and may be either mild, or more pronounced in flavor. Usually the light-colored honeys are milder in flavor, while the strong-flavored ones generally are darker in color. The darker honeys have somewhat higher mineral content and are preferred by some for this reason. Usually the kind of honey we have been used to in our neighborhood, is the honey which appeals to us. The New Yorkers and Pennsylvanians like their buckwheat. The northern sections generally produce the clovers which are preferred there, while the Southerner prefers sourwood, or mesquite, or tupelo, or gallberry.

There are few honeys which are objectionable. The bitterweed of the South produces a bitter honey which should be left on the hives for winter food and spring build-up. But even the bitterweed loses much of its bitterness when off the hive and exposed to the air.

Most honeys granulate within a few months after harvesting, the ones with the least water content being the most rapid to granulate. Thus, the honeys of the arid regions are much more apt to granulate rapidly (candy or sugaring) than those where the humidity is greater. Granulation of honey is nearly always a sure proof of the purity of honey, though nowadays

the public is protected from adulterants by the pure food laws. Tupelo honey, to the contrary, seldom granulates because of its relatively high content of levulose sugar and a minimum of dextrose. It finds a ready special market.

A honey which has been heated as a preventive of granulation will be slow to granulate again. So, the bottlers and packers of liquid or extracted honey heat the honey as rapidly as possible to a maximum of 150 degrees, being careful not to injure the honey by overheating or scorching. This is usually done in steam or water jacketed tanks with a very careful control of the temperature. The honey is then drawn off quickly into retail receptacles and sealed at once while hot. This helps retard further granulation also. But care must be taken to allow the honey to cool as rapidly as possible after it is sealed, otherwise, if stacked in a close pile, the retardation might definitely darken the honey and impair its flavor.

Similarly when honey is kept over a long period, every effort should be made to keep it in a cool and as dry a place as possible. Temperatures of 80 or 90 degrees or more over a long period will cause the honey to get darker, and as honey is hygroscopic (capable of absorbing moisture), a damp storage place may cause it to become thinner and to ferment. So honey may show tendencies to ferment either from having been harvested from the hive when yet too high in moisture content, or it may ferment if stored where the air is exceedingly moist. When a honey has once soured, it will be hard to return it to its original flavor, though prompt heating of a slightly soured honey may remove most of the difficulty. Hopelessly sour honey can be fed back to the bees after heating, or preferably made into vinegar.

As already explained, honey is usually sold either in comb honey sections, as wrapped cut comb honey, as chunk comb honey which is a mixture of both comb and extracted honey, or as extracted honey. The bulk of American honeys moves as liquid or extracted honey. Granulated honey should have more of a market than it has. Lately there has been developed a process by which the honey may be aided in its granulation by the addition of very fine grains of candied honey. This process called the Dyce process makes a very fine smooth granulated honey called creamed honey, which is reaching a popular demand.

HONEY USES

We think of honey usually as a table spread, to use on bread, or pancakes, or biscuits. This is possibly its chief use. Its use in cooking, however, is very considerable, both in pastries, in canning, in milk drinks, in sirups and desserts and as an adjunct to frostings and dressings. The American Honey Institute located at Madison, Wisconsin, has a number of booklets on honey and its use which are free for the asking.

BEESWAX

Beeswax is the second most important product of the beehive. Produced by the honey bees themselves in the hive, it is extruded between the segments of the underside of the abdomen of the bee while she is gorged with honey. These small slabs of beeswax are formed either into comb for the bees' brood, their combs for surplus honey, or for sealing the combs when they have been filled with honey. The beekeeper obtains beeswax by melting up and pressing the wax from old discarded empty brood or super combs; or from cappings which have been removed from sealed combs of honey in extracted honey production.

Beeswax was one of the earliest of waxes, being used in the form of candles for lighting. This remains at least the second largest use of beeswax today. Several church faiths use beeswax to some extent. Earlier the Roman Catholic Church required that pure beeswax be used on the altar for the service of the Mass and the Benediction of the Blessed Sacrament. As the numbers in this faith grew, however, there was not enough beeswax to serve the purpose and the regulations were modified to require candles which were at least 51 per cent beeswax.

Probably the largest user of beeswax today is the cosmetic industry, since the emulsifying agent of nearly all of our modern cold creams is dainty, pure, white bleached beeswax, being used as well in ointments, lipsticks, pomades and rouges.

The beekeeper himself is the third largest user of beeswax in the form of comb foundation which he gives to his bees as the base for their combs. There are some 70 or more commercial uses of beeswax today. Some 200 million pounds of honey and four to six million pounds of beeswax are produced yearly in the United States.

CHAPTER XIV

Diseases and Enemies of Bees

ONE of the problems most frequently met by the uninformed person who attempts to keep bees, comes when the combs of those bees are attacked by the wax moth. "Why are my colonies full of worms? I am losing my bees. They are being cleaned out by these worms."

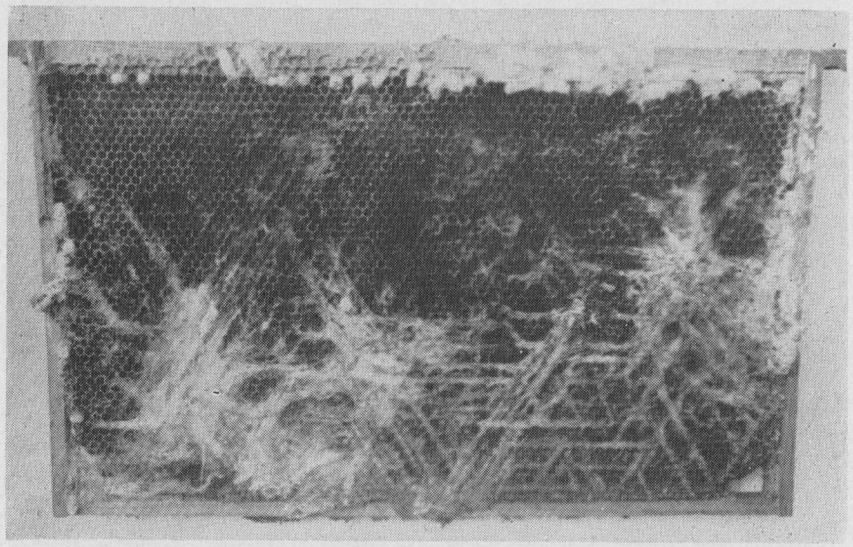
The greater wax moth (*Galleria mellonella*) is similar to the meal moth and the clothes moth. If it can gain access to the beehive it lays its eggs in the combs or around the corners of the hive. When these eggs hatch, the small worms attack the combs, making tunnels through them as they make their growth. Their food consists of the combs themselves and the cocoons left by generations of emerging bees. Their tunnels are generally through the midrib of the comb so that the earlier depredations of the growing worm are scarcely noticed. By the time the moth worm is ready to spin its cocoon, the damage is done and the combs are useless.

Naturally, these moth easily gain access to the weaker colonies but if they should attack the stronger colonies, house cleaners that they are, the bees soon drive them out. So, the solution for the prevention of damage by the wax moth or worms in the colonies, is to keep all colonies strong. Vigorous young queens which can keep the hives populated are the best deterrent to wax moth attacks. Control of the hive entrance by the beekeeper, allowing only as much entrance space as the colony needs and can protect is desirable.

Bare drawn combs, not protected by bees, such as combs from dead colonies or stored combs, are particularly susceptible to the ravages of the wax moth, since they do not have the protection of the bees. Such combs should be placed in tight hives, tightly sealed stacks of supers, or in a room as nearly impervious to moth entrance as possible. Since the moth and their eggs are rendered ineffective by freezing weather, storage in buildings where the temperature is allowed to follow the winter cold, is desirable. During the summer, combs which

are not protected by the bees should be fumigated at intervals. The commercial wax moth fumigator (paradichlorobenzine) may be placed in a small receptacle at the top of a stack of supers or over the combs. With all sealed, the fumes descend through the combs. A relatively new product, similarly used, called "Killmoth," is especially effective and used above the super stacks as is paradichlorobenzine. If burning sulphur is used, the container should be in an empty super at the bottom of the super stack. Extreme care should be used if carbon bisulphide or calcium cyanide are used. The former is highly inflammable; the latter gives off a deadly gas.

Wax moth are most destructive, naturally in the southern states since the moth can flourish during the entire year. In



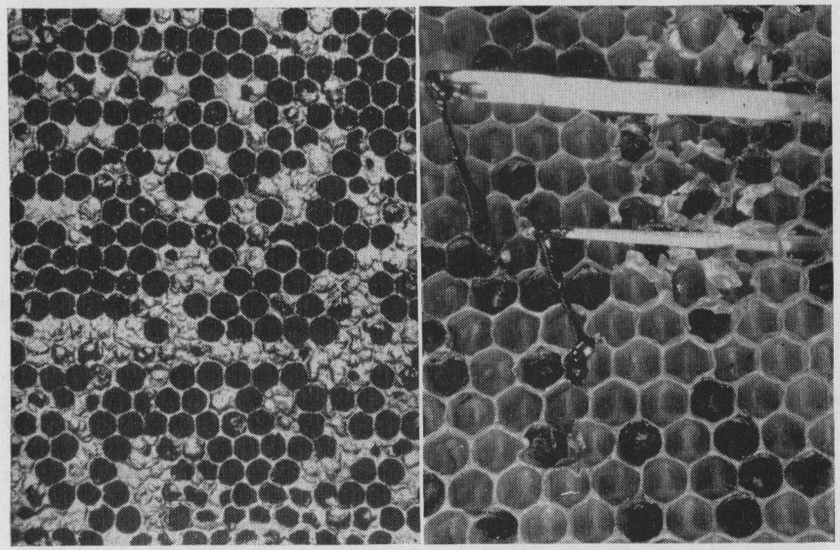
A comb ravaged by the work of the wax moth.

the North the few hibernating moth which carry through the winter must start a new cycle of brood in the spring, and do not become troublesome until midsummer when their numbers have multiplied.

OTHER ENEMIES

Ants often get into beehives but they are more of a nuisance than being harmful. Their nests should be destroyed and

often poison is distributed to keep a locality free of them. Argentine ants are found in the South and can destroy a colony. Sometimes the hives are placed on stilts in pans of oil to protect them from these pests.



Brood comb with an advanced case of American foulbrood. Notice the perforated and sunken cappings on the cells and the scattered appearance of the brood. Many of the open cells, from which cappings have been removed by the bees, contain scales When the larva has died with the foulbrood it dries down into this scale.

As decomposition of the larva progresses the dead larva sinks down in the cell and the color changes to dark brown. During this stage the larva has a ropiness to it. With a match or toothpick the remains may be drawn out like thick glue into fine threads. Typical dark brown foulbrood scales form on complete drying

DISEASES

There are two types of diseases harmful to bees, one which attacks the brood of bees and the other attacking the adult bee. Those attacking the adult bee have never been serious in America but the brood diseases have in the past caused considerable loss to the beekeepers.

If a beekeeper is in doubt as to the kind of disease he has in his apiary, he should consult his state apiary inspector or

the Bee Culture Laboratory at Washington, D. C. They will be glad to examine samples of disease and give advice.

AMERICAN FOULBROOD

Of the diseases attacking the brood of bees, American foulbrood (bacillus larvae) is the most prevalent and serious. The disease is transmitted through bacteria carried in with the food of the hive (honey). Fed to the very young larvae, it develops in them. It usually can be detected in the grown larvae in the sealed cells. Isolated sealed cells or most generally perforated cells with sunken cappings are a good indication to look for trouble. The larva will be found sunken in the bottom of the cell with perhaps a tongue attachment to the top of the cell. The mass will be a brown or coffee colored sticky gummy substance which will string out when drawn out by a toothpick. As the disease progresses, it gradually kills all brood and the colony is doomed.

The disease is rapidly transmitted from one colony to another by robbing. Colonies affected should have all combs destroyed, the hive and interior scorched before new equipment is installed. Usually the beekeeper does a good job and kills the bees as well.

American foulbrood, though a menace in some sections, is not as much feared as previously. Beekeepers themselves have become more alert to the disease; state bee inspectors in most states are doing a good job in controlling and eradicating.

Sodium sulfathiazole given in the feed prevents the organism from growing even though it may not destroy it, thus giving the bees more opportunity to "clean house." Disease resistant bees are also being bred which, while not immune to the disease, are highly resistant.

EUROPEAN FOULBROOD

European foulbrood (bacillus pluton) is more prevalent in mongrel or black bees than in the Italian and is found most generally in northern areas. This organism also attacks the larvae which lose their plumpness, become flat and white, gradually changing to a creamy color, then brown, then putrefying. Good strong colonies with vigorous young queens of good stock

are the best deterrents. Strengthening of the colonies by uniting or giving brood from stronger colonies helps, as does feeding. The usual procedure is to kill the queen of the colony, leave the colony queenless for a short period, then introduce a new queen. The honeyflow is a decided help. Unfortunately, by that time the colony may be weak and unable to take best advantage of it.

In recent years a number of drugs have been found effective as preventives against this disease. The best of these is Terramycin. Properly used, as a dust-mixture with powdered sugar, it will almost assure against the appearance of European foulbrood.

ADULT BEE DISEASES

Nosema disease is the only adult bee disease of consequence in America. The symptoms are restlessness of the bees, weakened, crawling bees around the entrance; shiny with abdomen distended. It most generally occurs during the damp weather of spring, and usually disappears as spring advances. But it may still weaken the colony materially.

It is generally assumed that the disease is more apt to spread where bees have access to contaminated sources of drinking water. The bees should be located in as dry and airy a location as possible, and supplying of a trough of water near the apiary, with a little salt in it will not only counteract the disease, but also may prevent neighbor trouble by keeping your bees away from neighbors' bird baths and watering troughs.

It has recently been discovered that fumagillin was effective in the control of this adult bee disease. Sold under the trade name of Fumidil B, the drug is fed to infected colonies in sugar sirup. Some success has been claimed when the drug is fed as a preventive to clean colonies, however experiments are not yet conclusive on this point.

Importations of bees into this country have been prohibited for some years to prevent the possibility of the entry of Acarine disease from the British Isles and the Continent.

INDEX

A

American foulbrood—110

B

Bee escape—20, 52
Bee feeder—31, 33
Bee larva—24
Bee pasture—77
Bee pupa—24
Bee space—7
Bee stings—4, 23, 103
Beeswax—75, 106
Beeswax, use of—4
Beginners' outfit—11
Box hives—6
Brood, drone—41, 44
Brood nest—41, 65, 68
Brood, worker—44
Bulk comb honey—48

C

Cage, queen—101
Cappings—74
Cells, drone—41
Cells, worker and queen—40
Chunk honey—49
Cluster, winter—58
Colonies, bolstering—66
Colonies, switching—67
Colonies, uniting weak—57
Colony—14, 28
Comb packages—31
Comb honey, management for—45
Combs—14
Communication among bees—3
Cut comb honey—50
Cutting box—46

D

Dextrose—103
Diagram for supering—48
Disease, examination for—54
Diseases of bees—109
Disease resistance—10
Division of colonies—72
Doolittle plan queen rearing—98
Drone—27
Drone cells—41, 44
Drone layer—43

E

Egg to mature bee—24
Enemies of bees—107
Escape board—20, 52
European foulbrood—110
Examination for disease—54
Extracted honey—51
Extractor—76

F

Fall honeyflow—55
Fall management of bees—55
Feeder—31, 33, 37
Feeding in spring—63
Feeding for winter—56
Feeding package bees—32
Feeding pollen substitute—64
Feeding sulfathiazole—54, 68
Field bees—67
Foundation, invention of—7
Foundation, medium brood—15, 51
Foundation, thin surplus—46
Foundation, wired medium brood—14, 51
Fumigator for moths—108

G

Granulation of honey—104
Guards, worker bees—54

H

Hive parts—13
Hive, removable frame—7
Hive tool—16, 18
Hives compared—6
Honey, bulk comb—48
Honey, chunk—49
Honey, composition of—103
Honey crop, removing—52
Honey, cut comb—50
Honey, extracted—51
Honey extractor—7, 76
Honey, kinds to produce—45
Honey plants—79
Honey, section comb—45
Honeyflow—45
Hruschka, Franz, inventor of honey extractor—7
Hybrid crosses of bees—10

I

Increase, how to make—72
Introduction of queens—100

K

Killmoth—108
Knife, uncapping—52, 75

L

Langstroth's discovery of bee space—7
Larva, growth of—24
Levulose—103

M

Medium brood foundation—15, 51
Mehring, Johannes, inventor of foundation—7
Miller method of queen rearing—97
Moth—107
Moving bees—92

N

Nectar—103
Nucleus—66

P

Package bees—31
Package bees, how to install—34
Packing hives for winter—58
Paradichlorobenzine—108
Pollen—5, 64, 103
Pollen plants—78
Pollen substitute—64
Pollination by bees—4, 85

INDEX

Propolis—103
Pupa, developmental stages—24

Q

Queen—25
Queen cells—40
Queen introduction—100
Queen nucleus—66
Queen rearing—95
Queen sting—26

R

Relocation—72
Removing honey crop—52
Requeening—55
Robber cloths—63
Robbing—53

S

Section comb honey—45
Smoker—17
Spring management—63
Sting of queen—26
Stings, bee—4, 23
Straw skeps—6
Sucrose—103
Sugar sirup for package bees—32
Sugar sirup for spring feed—63
Sugar sirup for winter stores—56
Sulfathiazole—54, 68
Supering—48
Supersedure of queen—43, 95
Swarm control methods—70
Swarming—42, 68
Switching colonies—67, 72

T

Thin surplus foundation—46
Transferring—89

U

Uncapping knives—75
Uniting weak colonies—57
Uses of beeswax—4

V

Von Frisch's discoveries about bees—3

W

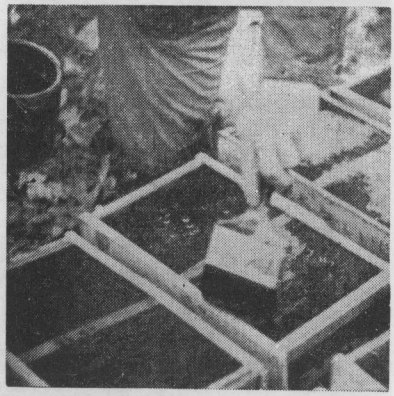
Wax moth—107
Wax scales—38
Wintering of bees—55
Wired foundation—14, 51
Worker bee—21
Worker cells—41

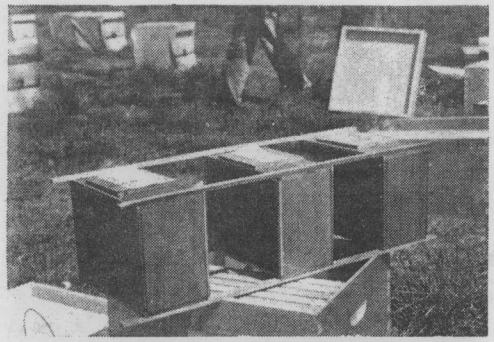
How To Handle Your Package Bee Colony

Packages of bees are shipped by railway express and upon their arrival should be examined carefully in the presence of the railway express agent. They usually arrive in good condition but occasionally will arrive with part or all of the bees dead, or with the queen dead. When such a situation occurs, accept the shipment but always remember to call the loss to the attention of the railway express agent and insist that he make a bad-order notation as to the extent of loss on the railway express receipt that he signs and gives to you. This receipt should immediately be sent to the shipper of the packages so that you may receive an adjustment. Package bee shippers guarantee safe arrival and invariably make replacements and adjust claims with the express company if bad order receipts are sent them. A claim filed with this bad-order receipt—and only if accompanied by this receipt—will be properly acknowledged and an adjustment made by the express company.

Parcel Post is becoming a popular method of delivering small numbers of packages, in view of rising express rates. Usually postage charges assessed by the shipper will include insurance, and any damage on arrival should be noted by the postal clerk, then sent to the shipper for adjustment.

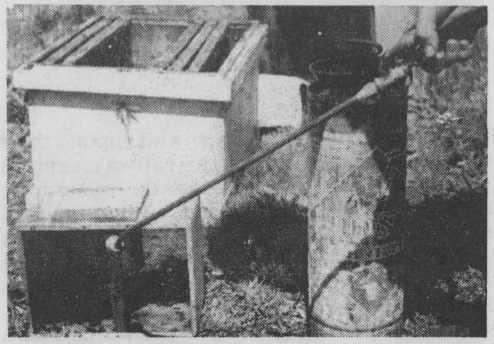
There is no particular rush about installing a package of bees after they are received. It is best to place the package in a cool, dry—and preferably dark — room, a basement answering well for this purpose, where they are fed sugar sirup. The sirup is made by mixing together one part of granulated sugar to one part of hot water. This sirup is fed to the bees by dipping a clean paint brush in the sirup and rubbing the brush on the wire cage. Caution should be taken not to apply too much sirup while the bees are confined in the package. When the bees do not remove the sirup quickly from the wire they have had enough.



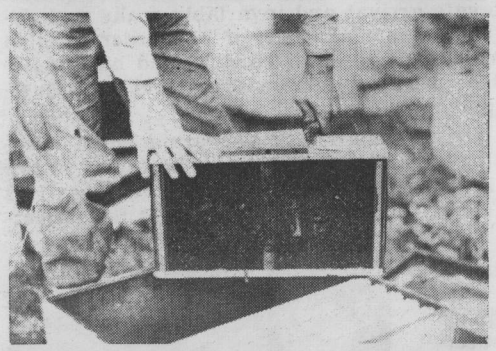


EVERY STEP IN

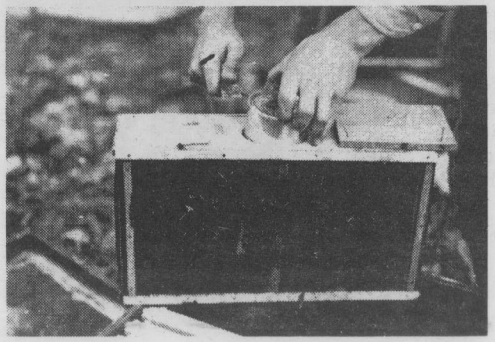
The best time to install a package is in the late afternoon or early evening. Take your packages of bees to where you have placed the hives and remove the wooden strips which fasten the packages together.



Wet the bees thoroughly with warm water. This can be done with a chemical or hand sprayer, or you may dip a large paint brush in a bucket of warm water and sprinkle the water on the bees. This wetting prevents the bees from flying.



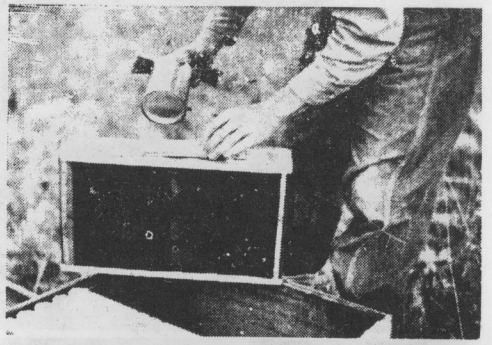
Using the angle end of the hive tool, the next step is to pry up and remove the wooden cover from the top of the package. Be sure to keep the cover near you because there is need for it when the feeder is removed.



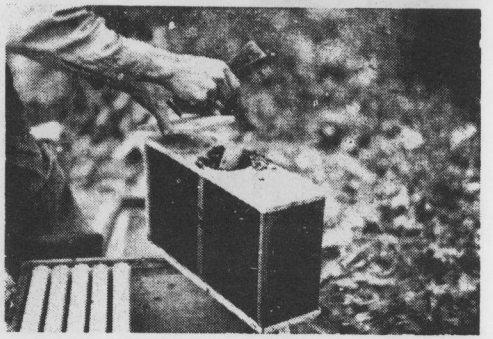
After removing the wooden cover, take the sharp end of your hive tool to lift up and remove the small feed can that was shipped with the package of bees. The remaining sirup in this can may be added to that which you have prepared for the bees.

HIVING PACKAGES

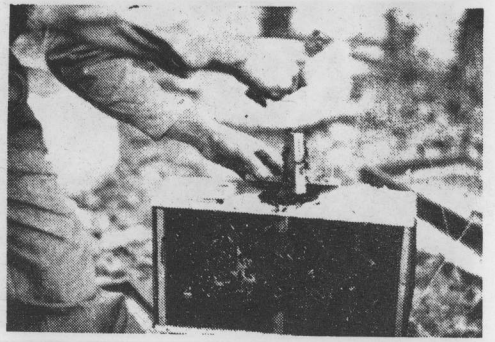
When the feed can is removed, place the wooden cover over the opening in the top of the package. This prevents the bees from getting out of the package while you are disposing of the can.



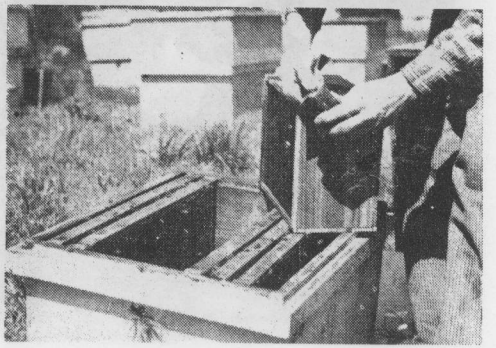
The next step is to take out the queen cage. which is sometimes suspended from a small wire or hung through a slot by a metal strip. Whatever method is used in preparing the package for shipment, the queen cage comes out easily.

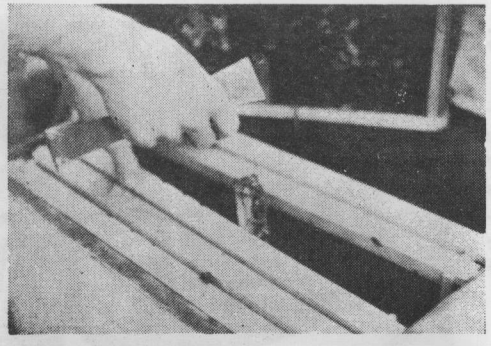


When the queen cage is removed, the bees clinging to it may be shaken back into the package. This will prevent you from getting stung while you are working with the queen cage. Replace the wooden cover before you prepare the queen cage for the hive.

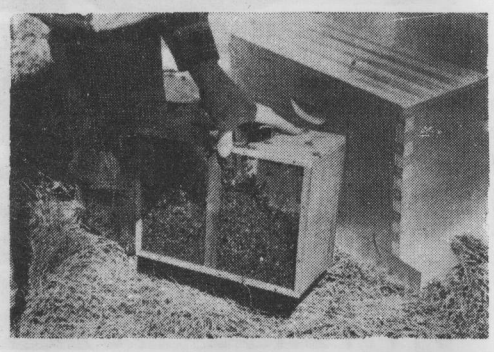


You will notice that one end of the queen cage has some white candy in it. The cardboard covering the hole which leads to this candy should be removed and a small hole, about the size of a match, punched through the candy.

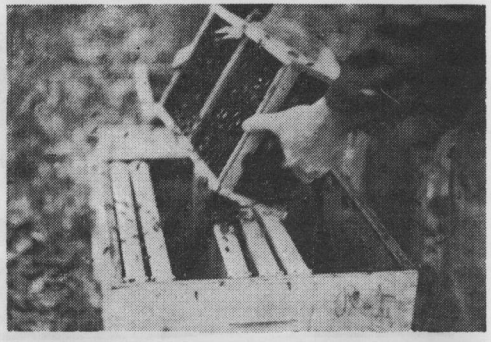




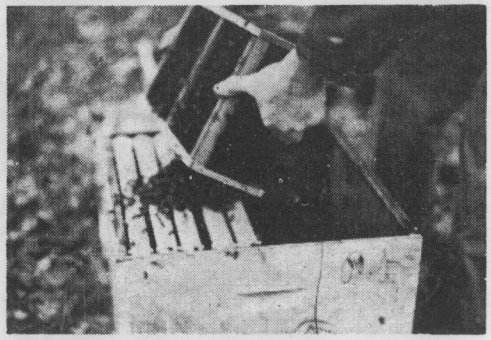
Now suspend the queen cage in the hive. The proper place for the cage is between frames numbered two and three, or between frames numbered three and four. Be sure that the end containing the candy is toward the bottom of the hive.



Leave the frames widely separated at the point where you suspended the queen cage. Then take the package cage containing the bees and bounce it on the ground. This will jar the bees to the bottom of the package cage.

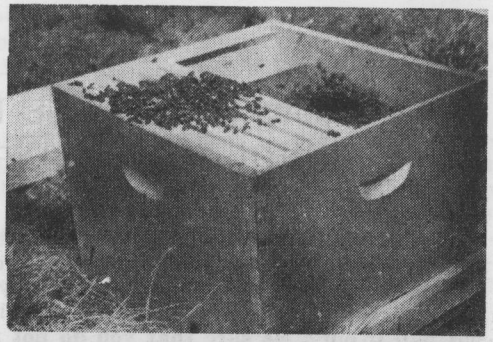


After jarring the bees to the bottom of the package, pour about half of the bees in the package between the frames where the queen is suspended. Then push the frames together, being careful not to crush and kill too many bees.



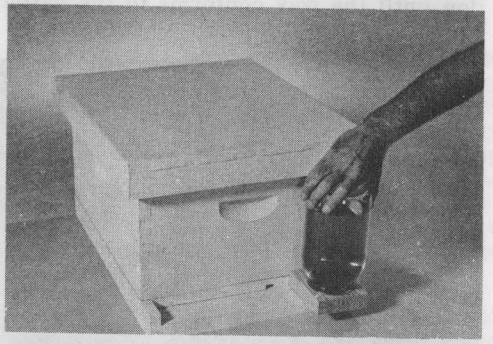
The next step is to jar the bees into the bottom of the package again and pour most of the remaining bees over the frames. The bees on the top of the frames will find the queen almost immediately and begin to eat the candy and release her.

There will still be some bees left in the package which you will be unable to shake or pour out. Place the package with the remaining bees inside of the hive with the open top up. The few bees left in the package will crawl out.

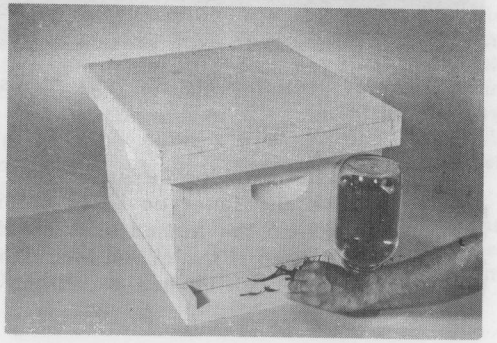


Next, place the inner cover on the hive. The outer, telescoping cover is then placed on top - and your bees are safely housed in their new home.

Your colony has a lot of work to do. To help them secrete wax and build comb, be sure to use your entrance feeder and to keep it full of sugar sirup for at least the first six weeks.



The last step in hiving your package is to lightly stuff the small entrance with a little green grass. This confines the bees to the hive and allows them to become accustomed to their new home.



HOW TO MANAGE THE PACKAGE UNTIL THE HONEYFLOW BEGINS

The day after the bees are placed in the hive you should examine the entrance of the hive to make sure that the bees have been able to work their way through the green grass that you put there. If the bees have not yet been able to get out of the hive loosen the grass slightly, but do not pull it out. **Be sure that you do not remove the cover of the hive or disturb the bees in any way.** It will take the bees some time to settle down in their new home. They have to eat through the candy in the queen cage and release the queen, and they have to build comb on the foundation you have given them. All of these operations will take time. During this first week your colony must have ample feed. Make sure the feeder jar has sirup at all times.

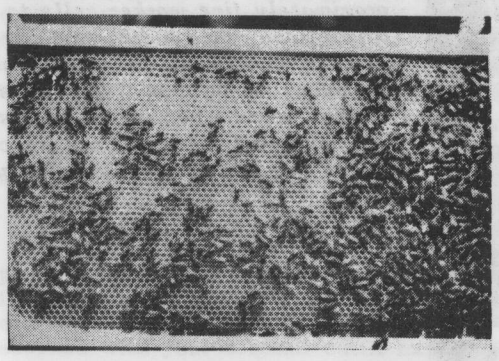
Two weeks from the day that you installed the package it is safe to open the colony and examine it. By this time the queen bee should have been released by the workers and will probably be laying eggs in the newly built comb and the bees should have made some progress toward building comb on the foundation which you furnished them. In building this comb the worker bees take the wax scales which are secreted on the under surface of their abdomen and shape and form them on the foundation until the wax conforms to the pattern of the cells.

Worker bees showing the wax scales secreted on the lower surfaces of the abdomen.

In making the two-week examination, remove the cover and, smoking gently, remove the inner cover in order to find the suspended queen cage. Then spread the frames at this point and remove the queen cage, examining it to see if the queen has been released. Then lift out one of the center frames which has faced the suspended queen cage. If you

see eggs or larvae you can be sure the queen is present and laying. Do not bother to look for the queen. Remove the empty package, place the remaining five frames in the hive (three on one side of the original five and two on the other side) and close the hive, replacing the inner cover and the cover as quickly as possible - but with easy motions.

To help you in colony manipulation it is advised that the original five frames be numbered one through five consecutively. When the bees start to build comb on frames numbered one and five it is advisable to turn them around so that the sides which were not facing the bees previously now face toward the cluster of bees. Place a frame with foundation between the frames numbered one and two and between the frames numbered four and five. In this way the bees are partially forced to expand their comb-building efforts.

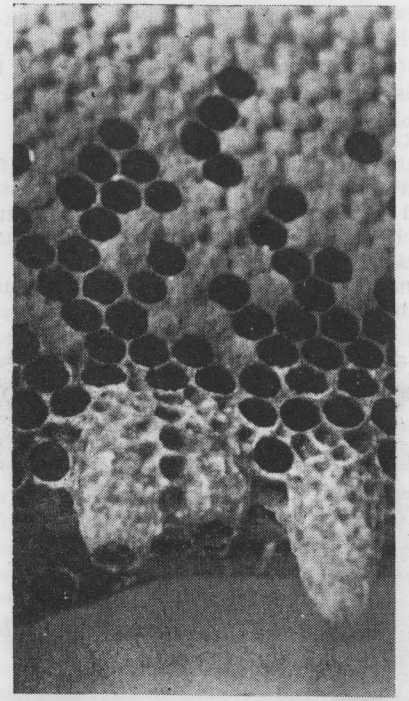


Worker bees in the process of drawing foundation. Usually worker bees will start their comb building efforts in the approximate center of the frame from end to end and closer to the top bar than to the bottom bar.

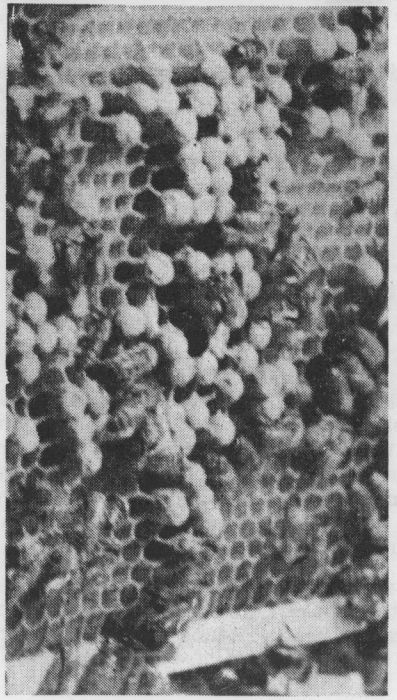
Three weeks from the day you hived the package you may again make an examination of the colony. Be sure to refill the feed pail during every examination. The bees need lots of food when they are in the process of wax secreting and building. When there is enough bloom so that they may secure nectar from flowers they will no longer need the sugar sirup and, in fact, will no longer take the sirup from the feeder pail. Let the bees be the judge of whether or not they need sirup. Do not take the feed away from them simply because you have seen numerous flowers. There are many factors which influence nectar secretion and an abundant bloom does not necessarily mean an abundance of nectar.

During this three-week examination check again to make sure that the queen is laying well. By this time there should be considerable sealed brood in the combs. Do not attempt to change the position of any of the frames in the hive at this time. Three weeks after the package has been hived is the period of lowest ebb in colony strength. Some of the bees which were shipped in the package have died and none have yet emerged from the cells to take their place. Toward the end of the fourth week young worker bees will start to emerge from the cells, and during the fifth week they will emerge in great numbers. From the fifth week on the number of worker bees will increase fairly rapidly.

From previous information you now know the difference between the three types of bees in the colony — the worker, the queen, and the drone. Nothing has been said, however, about the difference in the cells from



Worker and queen cells, approximately natural size. Notice how much larger the queen cells are than those of the worker. Queen cells are found in the hive only under certain conditions (discussed in the following pages) while worker cells are always present. There are approximately five worker cells to the linear inch. With a full-depth brood comb with foundation it is possible to have as high as 7000 cells of worker brood. Ten such frames in one hive will more than take care of the egg-laying capacity of a good queen.



Drone brood — smaller than natural size. With a good queen very few drone cells will be present in your colony. Notice the characteristic bullet-shaped appearance of the sealed drone brood in this picture. They may easily be distinguished from worker cells by the way in which they protrude beyond the rest of the cells in the comb. The overproduction of drones is one thing that should always be discouraged. Usually the bees will build drone cells in any section of the comb that has been damaged. Because of this the beekeeper should be careful when working his colony not to damage the comb.

which these bees emerge. A careful examination of the pictures or the opposite page should reveal this information to you.

During the fifth week you should conduct another examination of the colony. Check again for the queen and make sure that the brood nest is expanding and that the bees are drawing their foundation well. It will help if you will move sheets of foundation that have not been drawn, up next to the brood nest. A word of caution here — always put frames with empty comb or foundation **up to** and **not into** the brood nest. If the frames of the brood nest are separated there is danger of some of the larvae being chilled if the weather is cold.

By the end of the sixth week the fruit bloom is over and clover bloom is close at hand. It would be well to talk with neighbor beekeepers and find out from their experience just when you may expect the main honeyflow to start. Usually by the end of the sixth week you may stop feeding sirup. There should be plenty of bloom present by that time to supply natural sources of food for the bees.

Swarming reduces the worker population, and therefore, reduces the amount of honey crop, and if at all possible should always be prevented.

There are many ways to prevent swarming of bees. Giving them plenty of room for normal expansion is just one of them. Another aid is proper ventilation of the hive. As your colony of bees grows and increases in size, give it a larger entrance opening. The entrance closer supplied with your original outfit has two separate openings. When the package is first hived it is best to use the small opening, but by the end of the fourth week the larger opening should be used. As the honeyflow approaches you should remove the entrance block entirely and let the bees use the full entrance to the hive. This should provide adequate ventilation, but if the weather is extremely warm it would be well to place two small blocks of wood between the hive body and the bottom board. This will raise the hive and tilt it backwards and allow ventilation along the sides as well as increased ventilation in front.

Just before the main honeyflow begins there is usually a lull in activity within the colony. By this time the colony has reached its numerical peak and without abundant flowers in bloom there are thousands of bees with little or nothing to do. This is a good time to put on your first super. It gives the bees plenty to do for they must draw the foundation out into comb before they can store honey. Putting on the first super is a swarm control measure that is effective if properly timed and executed. **Be sure your bees have sugar sirup at this time if natural sources of nectar are not yielding.**

Supersedure of the queen is Nature's way of replacing a failing queen. The worker bees take matters in their own hands and construct queen cells in an attempt to replace their failing mother.

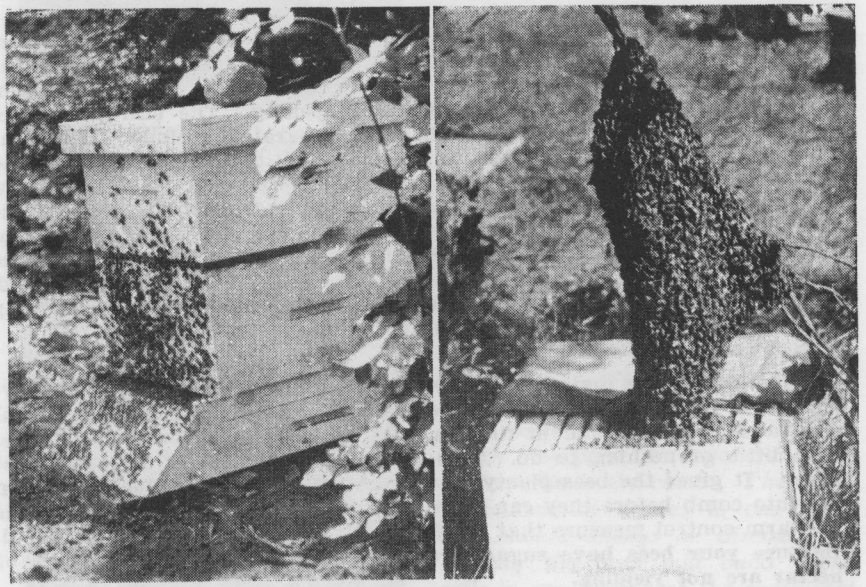
Supersedure in package bees occasionally presents a problem. Some times it is caused by too frequent handling of the colony. Such super-

sedure in package bees usually occurs about three weeks after the package has been installed. Certain queens also are inferior to others in the quality and quantity of their brood, a factor which contributes to queen supersedure.

The beginner is apt to be confused as to the difference between queen cells constructed for the purpose of supersedure and those constructed for the purpose of swarming. Actually, there are many old-time beekeepers who are unable to distinguish the difference.

Simply stated, supersedure cells are few in number — usually only three or four are constructed — are of the same age, and therefore, in the same state of development, and usually are larger and more copiously supplied with royal jelly than are the swarm cells. They commonly are constructed outward from the surface of the comb or in some depression along the side of the comb. Swarm cells are numerous, usually ten or more being constructed. They are of varying size and age, one or two being started each day over a period of a week or more, and are primarily constructed along the bottom edge of the combs.

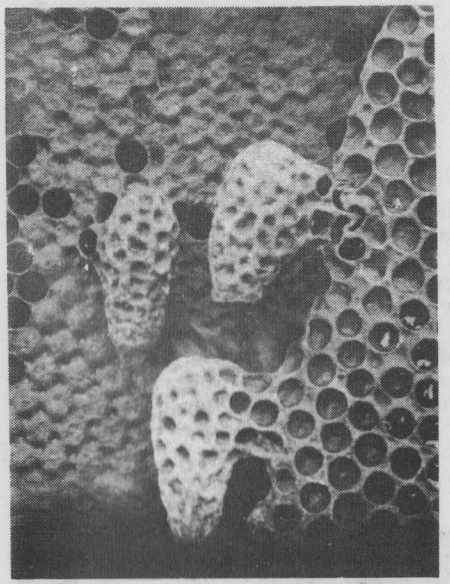
Since supersedure may occur at the height of the prosperous period before the honeyflow, the colony may dovetail their swarming with their efforts to secure a new queen by supersedure.



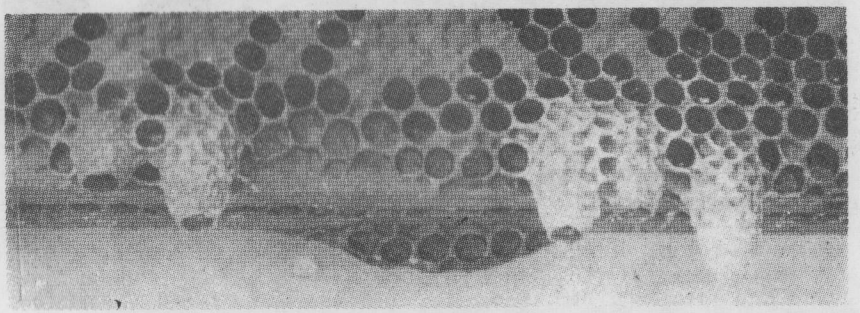
Here is a case where swarm prevention measures were not applied in time. This swarm is just leaving the colony. Weakened by the loss of the swarm, this colony will not make a profitable crop of honey without a considerable amount of help from the beekeeper.

Fortunately, this swarm lit among the low-hanging branches of a nearby tree. It may now be captured and hived. After the honeyflow has started it may be placed back in the colony from which it emerged —thus increasing the population of the original colony.

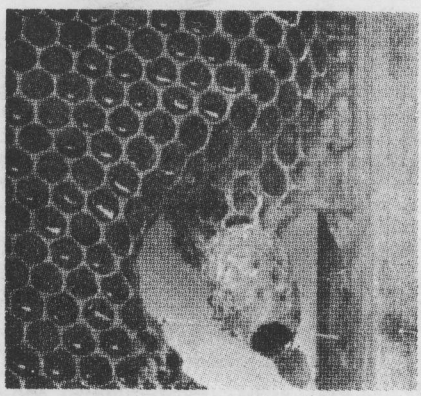
If there is evidence of swarming, all of the queen cells should be destroyed. However, if there are only a few cells and evidence of an attempted supersedure it would be best to leave two sealed cells in widely separated parts of the hive. When the bees are trying to supersede the queen and all cells are destroyed there is the possibility that the colony will become queenless in a short time. Usually the worker bees do not attempt to supersede the queen unless there is evidence that she is failing in her allotted role of egg-laying.



Supersedure queen cells. Notice that these cells are all of the same approximate age. Supersedure cells tend to be large and lavishly supplied with royal jelly. Notice how these cells were built next to the damaged area on the face of the comb. Some authorities tend to the belief that a queen raised under the supersedure impulse cannot be surpassed for quality. As a result of supersedure it occasionally happens that two queens, mother and daughter, inhabit the same hive.

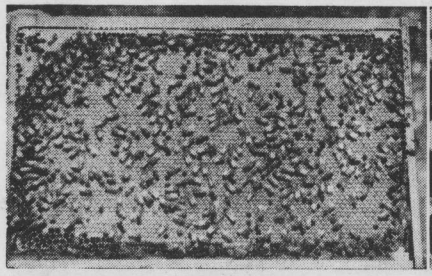


Queen cells built under the swarming impulse. Notice that in this case there are many cells of varying ages. From left to right—cells one and four are just being started, cells two and three are over half way constructed, and cell five is sealed.

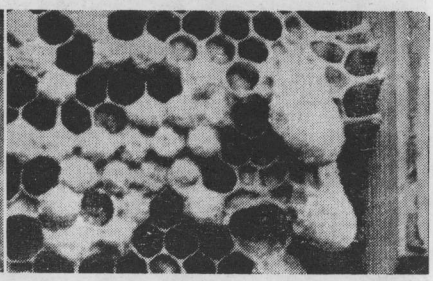


A queen cell along the side bar of a frame from which a queen has recently emerged. Notice how the cell was constructed in a damaged area in the comb. The worker bees remove the wax cap of the cell when they hear the queen trying to get out. The queen then has to gnaw her way out through the pupal case.

A queen's quality may readily be recognized by the way in which she deposits her eggs in the cells. A good queen will lay in a compact area so that the sealed brood presents a solid mass of wax cappings. A poor queen usually lays spottily with eggs scattered throughout the comb leaving many cells empty. Occasionally a queen will become a drone-layer — i.e., she will lay unfertilized eggs which will develop into nothing but drones. Such a queen should be replaced as quickly as possible. Order a new queen, and when she arrives kill the old one and place the new queen in the colony. (Instructions for introduction of a queen are included in shipment of the queen cage.)



Good brood — the result of an excellent queen.



Poor brood — the result of a drone-laying queen.

Your package of bees is now a full-grown colony, humming with activity and ready for the honeyflow. Here's luck to you! Put on those supers and breathe a little prayer to the whims and fancies of Mother Nature. May she yield you an abundant supply of rich nectar.

Your supplemental supering kit is available at the same store where you purchased your beginner kit. Supering kit includes two honey supers, twenty frames, queen excluder, and twenty sheets of comb foundation.