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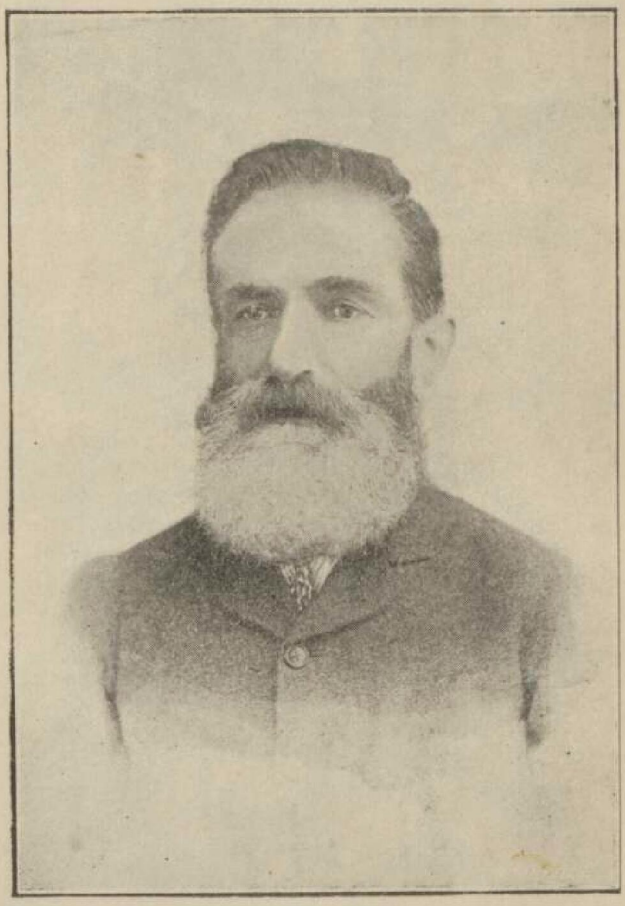
Australasian Bee Manual

I. Hopkins



THE AUTHOR.

THE ILLUSTRATED

AUSTRALASIAN BEE MANUAL

AND COMPLETE

GUIDE TO MODERN BEE CULTURE

IN THE

SOUTHERN HEMISPHERE.

BY ISAAC HOPKINS, AUCKLAND, NEW ZEALAND.

WITH WHICH IS INCORPORATED THE

"NEW ZEALAND BEE MANUAL"

REVISED AND MOSTLY RE-WRITTEN
BY THE AUTHOR.

FOURTH EDITION.

78 ILLUSTRATIONS.

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AUCKLAND, N.Z.

[1904]

PREFACE.

It has been especially gratifying to me all through my bee-keeping career to learn from the large number of kindly letters sent me from time to time by bee-keepers in all parts of Australasia, that my efforts to spread a knowledge of advanced bee-culture over this part of the world have borne some fruit. Since the first edition of this work was published in 1881, the bee-keeping industry has become firmly established in nearly every district in the Australasian Colonies, giving healthful and profitable employment to a large number of people, as well as affording a useful, interesting, and an intellectual hobby to a still greater number. Notwithstanding the fact that there are several most excellent works on the culture of bees published, the "Australasian Bee Manual" is in a larger demand in this part of the Southern Hemisphere than any work of the kind, owing to its dealing with the seasons, flora, and other local peculiarities of the Australasian Colonies. That I was justified in bringing out this—the fourth—edition has been proved by the number of urgent requests received, since the last went out of print, to publish another. With such encouragement I decided to do so, and trust it may merit the same cordial approval bestowed upon its predecessors.

During the currency of the previous edition of the "Manual"—which had been enlarged to much over double its former size—it became clearly evident to me that the correspondingly increased cost of the book debarred many from availing themselves of its assistance. Taking into consideration that the additional text consisted chiefly of theoretical matter, and that this, while of great service to students, would not appeal with the same force to practical bee-keepers, who constitute by far the greater number of those who require such a work, and whose needs in the first place I felt bound to consider, I decided to cut down so much of the theoretical part as could be dispensed with without marring the usefulness of the work, and thus enable me to issue it at a lower price.

In the revising of the "Manual" I have brought the practical working method of each operation fully up-to-date, and in doing so I have adhered to my former practice of describing only such methods as I have proved after long experience to be the least complicated and best for the novice, as well as for those more advanced. A number of the older appliances have been much improved upon of late years, and new ones introduced. These will be found illustrated and fully described in their proper places, and I can only hope the present volumes will prove as useful as the others appear to have been.

I feel that I cannot let this opportunity pass without again paying tribute to my old and dear friend, the late Mr. T. J. Mulvany, who was so intimately connected with me in the revision of the Second Edition. I shall ever remember with gratitude his kindly and scholarly assistance in the theoretical part of the work, which called forth the highest praise from competent authorities. His frequent and able contributions to bee-keeping literature made his death a severe loss to the bee-keeping world.

I. HOPKINS.

Auckland, New Zealand.

ERRATA.

Page 41, last line—For Fig. 30, read 13.

,, 57—The words "Bottom Board" under Fig. 20 should have headed the next paragraph.

,, 60, line 1—For "made in" read "made of."

,, 63—The words "Timber for Hive Making and Painting Hives" under Fig 29, should have headed previous paragraph.

CONTENTS.

LIST OF ILLUSTRATIONS.

FRONTISPIECE: The Author.

CHAPTER I.

INTRODUCTORY AND HISTORICAL.

In the whole range of created objects presented to our contemplation in the study of what we familiarly call Nature, from the inconceivably great systems of inanimate matter rolling in infinite space to the inconceivably small but animated forms revealed by the microscope, there is probably no class more calculated to excite our wonder and admiration than that of *Insects;* and of all the different kinds of insects there is none more interesting as an object of study, and none that can be made more useful and profitable to man, than the Honey-Bee. Its history is as old as that of the human race; its product, honey, was recognised in the earliest ages as a most desirable, almost an indispensable, addition to the food of man: and yet it is only now, some 3,600 years after its first authentic historical mention, that we are beginning to realise the full economic importance of that product and to avail ourselves fully of the bounty of Providence, evidenced not only in its production, but also in the endowment of the bee with those wonderful instincts which render its collection so easy.

ANTIQUITY OF THE USE OF HONEY.

A certain proportion of saccharine matter in the food of man appears to be essential for his sustenance in a healthy condition, and previous to the comparatively modern invention of preparing sugar from vegetable juices, the only form in which such saccharine matter was attainable in a concentrated state was that of honey. The temperate or semi-tropical climate of that part of the globe which is frequently termed "the cradle of the

human race" was most favourable to the spontaneous spreading of the honey-bee and the collection of surplus honey in its natural hives or nests. These would be built in the hollows of trees, in the clefts and under the ledges of rocks, as they are at the present day in such climates, and their stores would soon be discovered by men engaged in the grazing of flocks and herds in a very thinly populated land. It is not, therefore, surprising that in the Scriptures of the Old Testament, the earliest records of the human race, we find frequent reference made to honey as a thing universally known and intimately connected with the comforts of man. The name is said to be *ghoneg* in the original Hebrew, signifying "delight," evidently the root of the German word "honig," which easily becomes "honey" in English. The name is used generally in the ancient Scriptures in combination with that of milk, the most universal of all foods, to form the Oriental metaphor denoting abundance—"a land flowing with milk and honey" being the words used in nearly twenty passages of those writers, from Moses down to the prophet Ezekiel, to describe the country promised to the descendants of Jacob. In the non-historical parts of Scripture, the Prophecies, the Psalms of David, the Song of Solomon, Proverbs, and the book of Sirach, the words "honey" and "honey-comb" are always used as the types of everything good and wholesome as well as sweet; in the last mentioned book (which, though its canonical value is a matter of dispute, may be safely quoted in this respect) it is distinctly mentioned as one of the necessaries of life.

ORIGIN OF THE ART OF BEEKEEPING.

Though we may never learn when bees were first domesticated in Eastern countries, we do know that amongst the Western nations the civilised Greeks had unquestionably practised the art of bee-keeping at a very early period. The laws of Solon, 600 years B.C., contain regulations as to the distances apart at which bee-hives

may be kept; and both Greeks and Romans wrote and sang about bees and bee-keeping from the times of Homer down to those of Aristotle, Virgil, Palladius, Pliny, and Columella. It is very probable that the Romans first introduced the practice into Palestine. The term "wild" honey is never met with in the ancient Scriptures, simply because *all* honey deserved that name in those times; but the Evangelists Matthew and Mark, who wrote when Palestine had been for nearly a century virtually a Roman Province, both use the term "locusts and wild honey." We may conclude that at that time the people were accustomed to keep bees in artificial hives, and they would naturally make a distinction between honey so obtained and that gathered by "wild" bees in the "wildernesses" or unfrequented places.

The true history of the rise and progress of the art of bee-keeping amongst the Greeks and Romans, and its extension over Europe during the middle ages, is as yet unwritten, but there can be no doubt that amongst the Northern nations the use of honey became with time more and more a matter of necessity, much of their fermented liquors being prepared from it, and the more northern the positions, and the more severe the winter seasons, the more essential it became to domesticate the bees, or use artificial means for preserving them during the winter months. Since the middle of the seventeenth century much attention had been paid to the natural history of the bee and other insects by Von Swammerdam, Maraldi, Réaumur, Lepeletier and Latrielle, Bonnet, Linnæus, Dr. John Hunter and Dr. Bevan; but it is to the researches and discoveries of Huber and Dzierzon that we are indebted for that knowledge of the physiology of the honey-bee which has led to those great practical improvements which may be said to constitute the

MODERN ART OF BEEKEEPING.

This may be dated from early in the second half of the nineteenth century, when the movable frame hive in

a practicable form was introduced by the Rev. L. L. Langstroth, though it was nearly twenty years after before the industry was thoroughly established on commercial lines. Subsequent to the introduction of the modern hive, the invention of the honey extractor, of comb-foundation, and a number of ingenious implements and appliances, have led to a complete revolution in the practice of bee-keeping, and helped to raise it to the rank of an important national industry which can no longer be neglected in any country possessing the natural capabilities for its establishment.

BEE-KEEPING IN NEW ZEALAND AND AUSTRALIA.

None of the countries of the New World, of North or South America, or of Australasia, were found, when first discovered, to possess any variety of the true honey-bee (*Apis mellifica*); a necessary preliminary, therefore, to the practice of bee-culture in any of those regions was the introduction of bees from the Old World, an operation which was attended with far greater difficulties fifty or sixty years ago than in these days of rapid steam navigation.

INTRODUCTION OF BEES INTO NEW ZEALAND.

The difficulty of tracing the particulars of most circumstances where public records have not been kept has been exemplified in the matter of the first introduction of bees into New Zealand. I did my utmost when getting the three previous editions of my book ready for the press to obtain the true facts of the case, and each time was led into error. I have, however, at last managed to get what I feel certain is the correct information, and which I am very pleased to be able to place on record.

It is undoubtedly correct that Lady Hobson and the Rev. William Charles Cotton brought bees with them to this colony, the former from New South Wales, in 1840, and the latter from England, in 1842. But the

first bees to land in New Zealand came in the good ship "James," and were embarked at Mangunga, Hokianga, on or about March 13th, 1839. I am indebted for this information to Mrs. Gittos, wife of the Rev. W. Gittos, and daughter of the late Rev. John Hobbs, who very kindly wrote me a long letter detailing full particulars of the introduction of the bees, and confirming her recollections by the testimony of others who were conversant with the facts. The following extract from her letter will be sufficient for the purpose of this record. Mrs. Gittos, I may mention, was an enthusiastic and successful bee-keeper herself in after years.

"It was on the 13th of March, 1839, that the good ship 'James' (Captain Mark Todd) anchored off the Mission Station of Mangunga, Hokianga, New Zealand. This ship brought a party of missionaries, among others the Rev. J. H. Bumby and his sister—Miss Bumby, who accompanied her brother as housekeeper. This lady brought with her the first bees I ever saw. There were two straw hives, and they were placed in the Mission Churchyard as being a safe place, and free from the curiosity of the Maoris, who, of course, had never even heard of the 'little busy bee.' Some years later on I was writing to a gentleman friend in Tasmania who had been one of the party I have spoken of. I was anxious to know if he remembered their first Sunday in New Zealand his taking us little children (I was nearly nine years old) to see the bees from England. He replied that he distinctly remembered bees having come in their ship, but what became of them he could not tell, as he removed from that station to another field of labour, and the same thing having happened to our parents, we lost sight of our little new friends, not, however, before we tasted for the first time in our lives real honey in the comb, which Miss Bumby kindly sent to us, knowing our interest in her bees."

The case I now consider settled so far as the first bees in the North Island are concerned; but the credit for sending the first bees from England to the South Island successfully lies with Mrs. Allom, the mother of our respected citizen, A. J. Allom, Esq., of Parnell. They arrived in the barque "Clifford" in May, 1842, and were consigned to Captain Wakefield, the then head of the Nelson settlement. For her successful introduction

of bees into New Zealand, the Society for the Encouragement of Arts, Adelphi, London, awarded Mrs. Allom the silver Isis medal in 1845.

ITALIAN BEES IN NEW ZEALAND.

The first Italian bees to arrive alive in this colony came from Los Angelos County, California, consigned to Mr. J. H. Harrison, Coromandel, and to the Acclimatisation Society, Christchurch—one hive to each—in September, 1880. Within a few months after another consignment came from Ventura County, California, to the order of the author. Subsequently I obtained two other consignments from America, and a number direct from Italy; also Italian, Cyprian, Syrian, and Holy Land queens, by way of England.

INTRODUCTION OF BEES INTO AUSTRALIA AND TASMANIA.

The common, or black bee, was first introduced into New South Wales in April, 1822, by Captain Wallis, in the ship "Isabella," and as there appear to be no records of their having been introduced from abroad into any of the sister colonies, no doubt they were sent to or taken by early settlers to various parts of the continent from the mother colony, New South Wales. They were introduced into Tasmania by Dr. Wilson, R.N., from New South Wales in 1831.

Although it is said that Italian bees were introduced into Australia as early as 1862, it is pretty certain there were none there in 1880, until Mr. C. Fullwood, then of Brisbane, brought some queens with him from the Old Country in that year. He subsequently imported a number of others direct from Italy. Later on—in 1883—Mr. Abram brought some colonies from Italy to Sydney, and settled in Parramatta. In the same year Mr. C. Fullwood sent a colony of Italians to Adelaide, from whence they were sent to Kangaroo Island. In October, 1884, Mr. T. L. Hood, of Hobart, introduced the first Italian bees into Tasmania from New South Wales.

BEE-KEEPING IN AUSTRALASIA.

Little need be said with regard to the suitability of the climate and flora of the Australasian colonies for bee culture; that has already been proved satisfactorily. With the exception of the occasional prolonged droughts in Australia, there are no serious drawbacks. The rainfall in most of the colonies is amply sufficient for a luxuriant vegetation, and the mean winter temperature is over 50 degrees, the same as in the most favoured honey-producing countries of the Northern Hemisphere. The native flora in all the colonies make excellent bee forage, and more or less nectar can be gathered all the year round.

PROFITS OF BEE-KEEPING.

The question as to the average annual profit that may be expected from each hive is very frequently asked by those who contemplate going into bee-keeping largely. It is easy to show what results are attained in some cases, but it would be dangerous to apply such results as a measure of success or failure to every case. So much depends upon the skill and perseverance of the apiarist, the location of the apiary, and the commercial ability brought to bear in the management, that it is necessary to be very guarded in one's reply. Under favourable conditions with regard to locality and bee forage, a reasonable sized apiary, and a skilful and persevering man in charge, an annual average of from 75lbs. to 100lbs. of extracted honey, or from 50lbs. to 60lbs. of comb honey, might reasonably be expected, and I consider the above quantities well within the mark. A "reasonable" sized apiary in a good locality I put down at from 75 to 100 hives, but it would not be wise to run so many as that for comb honey alone.

ADVICE TO BEGINNERS.

Whatever may be your ideas, whether eventually to make bee-keeping your principal occupation or only to

establish a small apiary, go cautiously to work at first, and don't lay out too much money. Three or four colonies your first season would be ample to work with, and to gain experience by. Some little increase the second season would be advisable, by the end of which sufficient knowledge of the work and your adaptation to it should have been gained to enable you to intelligently decide whether to increase your apiary or not. If you decide to go in on a large scale, then it is absolutely necessary for your own benefit that you choose a good district—a district where, in the first place, there is plenty of white clover, and not too difficult of access to a shipping port. Start with black or common bees, which probably may be obtained near at hand, but directly you decide to enlarge your apiary Italianise your colonies at once (see chapter on "Queen Rearing").

Axiom.

"BEES GORGED WITH HONEY NEVER VOLUNTEER AN ATTACK." *Langstroth.*

CHAPTER II.

THE HONEY-BEE AND ITS VARIETIES.

THERE are many species of the genus Apis, or Bee, but only one which stores honey in such a manner as to be practically useful to man, and which Linnæus distinguished by the name *Apis mellifica*. The particular variety of this species known to Linnæus was the Black, or German bee. Since the beginning of the nineteenth century, other varieties were observed and described by Spinola and others, and were classed at first as distinct species. In the year 1862, Dr. A. Gerstaecker, of Berlin, first published the results of his investigations upon the

"GEOGRAPHICAL DISTRIBUTION OF THE HONEY-BEE AND ITS VARIETIES,"

from which I take the following condensed extracts. He says that up to within some ten years of the time when he was writing, bee-keepers knew only one sort of honey-bee—that which had been reared for ages—the *Apis mellifica* of Linnæus; but they then (in 1862) distinguished the German from the Italian bee. The latter had, in fact, been noticed in the beginning of this century, by Spinola and by Latreille, as a separate species of the genus Apis, and was named by the former zoologist, *Apis ligustica;* nevertheless it proved to be only a coloured variety of the same species; the size, as well as the structural peculiarities of the insect, being the same in every respect, and the two sorts admitting of cross-breeding to any extent, whereas, if they belonged to different species, the offspring would, in all probability, consist of unprolific hybrids. The knowledge of the practical apiarist was, at all events, then

confined to these two varieties of the honey-bee, and they were supposed to be indigenous almost exclusively to Europe, the northern coast of Africa being their supposed boundary on the south, and the coast of Asia Minor on the east. When Dr. Gerstaecker, however, undertook his investigations, he obtained samples of a large number of varieties mentioned in the works of Fabricius, Latreille, Lepeletier, and others, as being found in various parts of Africa and of Asia, north of the Himalayas, and subjected them to a minute examination, comparatively, with each other, and with the two varieties already known in Europe. He soon satisfied himself beyond all doubt that they were all merely varieties of the one species, the *Apis mellifica*, differing only in colour and size—all capable of being cross-bred, and of being utilised by the apiarist. He also found that this one species, represented by many different varieties, was spread over a vastly larger area than had been supposed, comprising nearly the whole of Europe (up to 60° or even 64° north latitude in some places), the whole continent of Africa, and the whole of Asia Minor, Syria, Persia, and other portions of Asia north of the Himalayan range, up to eastern Siberia and China.

Out of the numerous varieties particularised by Dr. Gerstaecker, six of which were given in the last edition of this work, it is only necessary for the guidance of the beginner to consider those that have been sufficiently long under cultivation to have proved their value to bee-keepers.

GERMAN, OR BLACK BEE.

Neither of the names, German or Black, is a correct designation of this variety; for, as Dr. Gerstaecker has shown, it was by no means confined originally to Germany, and its prevailing colour is more brown than black; but these are the names by which it is now universally known.

This variety has held undisputed sway in the north and west of Europe for a couple of thousand years at

least, and has been the pioneer in culling the sweets of all the countries of the New World. Wherever Europeans have colonised, there may be found this little insect. It is now being rapidly superseded by the Italian race, but it has still some faithful admirers, and in more than one respect it is admitted by all to hold the advantage over its Italian rival. I shall compare its qualities with those of the Italian further on. However we may admit the superior beauty, as well as the more useful qualities, of the new races, we cannot avoid feeling a sort of regret for the extinction of our old favourites.

CARNIOLAN BEES.

These bees take their name from the Austrian province of Carniola, a part of the ancient Illyria, to the east of the Carnic Alps, and on the upper part of the river Save, the great tributary of the Danube. There has been great diversity of opinion with regard to these bees, some claiming their superiority to other varieties, while the majority have condemned them in comparison both with blacks and Italians. The fact that so few cultivate them seems convincing proof that they do not compare favourably with others. The difficulty of distinguishing a hybrid of the black and Carniolan on account of the close resemblance of the two varieties, is a great drawback when one wishes to keep them pure, and their propensity to excessive swarming has largely influenced the feeling most bee-keepers of experience have against them.

The description of this bee, given in the *British Bee Journal*, is as follows:—

"In outward appearance the Carniolan bee is slightly larger than the Italian, and not so slender in shape. It is, in fact, a larger bee—probably the largest domesticated bee. The entire body is of a rich dark brown, almost approaching to black. The golden rings of the Italian are wanting, but each rim of the abdomen is clearly marked by whitish-grey hairs, which render it distinct from any other known race; and these hairs being longer and brighter than those of the

Italian, give the bee a silvery-bright appearance which is very pleasing to the eye. . . . The Carniolan queen is a larger bee, broader in the thorax, and especially in the upper part of the abdomen, than the Italian or black queen."

CYPRIAN, SYRIAN, AND PALESTINE BEES.

The first of these varieties is a native of the Island of Cyprus. The name "Syrian" is now confined to a race of bees coming from the part of Syria north of the mountain range which extends from the Mediterranean at Mount Carmel eastward to the Jordan, while those coming from the south of that range, although still in Syria, are called "Palestine" or "Holy Land" bees. The first two differ very little from each other; they have the yellow bands of the Italian, with which race they are probably nearly related, but have also more or less yellow on the thorax. They are evidently those comprised by Dr. Gerstaecker under one head, which he mentions as being found on the coast of Asia Minor and the adjacent islands, as well as in other places. The third sort, or "Palestine bee," is as evidently the Egyptian bee of Gerstaecker, which he says inhabits Egypt, Arabia, and Syria.

Each of the above has been well tried in the principal bee-keeping countries of the world, and has been almost entirely discarded owing to some serious faults. Speaking from experience of all three varieties, I can only say that I would not again cultivate either while I could get blacks or Italians. Cyprians especially are outrageously vicious, so much so that after two years' trial I was compelled to smother a number of colonies, as it was simply impossible to handle them without being tortured by their stings. Smoke seemed to make them worse; therefore those who have any regard for their feelings had better not venture to keep Cyprian bees. We now come to the Italians, than which there are no better bees known.

ITALIAN, OR LIGURIAN BEE.

The Italian bee was evidently known to Aristotle and Virgil. The latter writer refers to it in the following lines:—

> "These gaily bright their radiant scales unfold,
> Spangled with equal spots, and dropped with gold."

Although known so well to these ancient writers, very little notice appears to have been taken of this variety till quite modern times, when, in the beginning of the nineteenth century, the Marquis de Spinola described it as being distinct from the common bee, and gave it the name of "Ligurian," after a province in Northern Italy, where it was first discovered. This district being very mountainous, and the Alps intervening between it and Northern Europe, it is in a manner isolated, which will no doubt account in some measure for so little having been known of this bee, and, as some think, has helped to develop a distinct variety.

It was introduced into England and America in 1859, and to this part of the world, as before stated, in 1880, with the result that among advanced apiarists it has almost entirely superseded all other varieties. It is very peculiar that for several years after Italians were introduced into England they were condemned, and the same may be said of these colonies. It was generally believed that they were inferior to the blacks as honey gatherers, they were great robbers, they were killing off the black bees, and they were more vicious. The Government of New Zealand was even censured for allowing them to come into the country. At present they are welcomed everywhere as being the most profitable bees under cultivation. I am quite prepared to say, after an extended experience with them, that Italians gather fifty per cent. more honey than blacks, but I have heard it said by one who has had even a longer experience, that they gather twice as much. Be this as it may, there can be no doubt as to which is the most profitable bee to keep,

and though our old familiar black bee has some good qualities, the Italian is better in nearly every respect.

MARKINGS OF PURE ITALIAN BEES.

How to distinguish pure Italian bees from hybrids is a point of much importance to those purchasing queens or colonies for the first time. A knowledge of this will often save a misunderstanding between the breeder and customer. I may first state that there appear to be two distinct sub-varieties—the golden or light-banded, and the leather-coloured or dark-banded bees. The light-banded bees, on account of their handsome appearance, were originally in greater demand, and no doubt this fact induced breeders to select them, but experience proved the darker, or leather-coloured, bees to be hardier and better honey-gatherers; consequently the latter have become the more popular in recent years.

MARKINGS OF PURE ITALIAN BEES.

In describing the markings of pure Italian bees, all

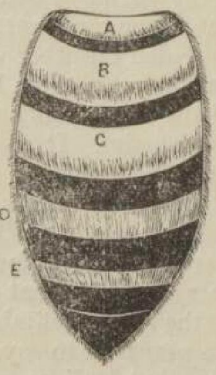


Fig. 1.—ABDOMEN OF ITALIAN WORKER BEE.

writers agree that the workers should have three yellow bands on the abdomen.

This is undoubtedly their distinguishing characteristic, but for many years past some breeders in America have raised four and even five-banded bees. These, however, need not be considered, as they have evidently been bred for colour rather than for working qualities. A B C, Fig. 3, represent the three yellow semi-transparent bands; D E, and the shaded parts of A B C, are rows of greyish hairs. The three yellow bands should be plainly visible, though the band A, next the thorax, is sometimes very narrow, and may be overlooked at the first glance. The surest test of a pure colony is that all the bees carry the three yellow bands.

HYBRIDS—GERMAN-ITALIAN.

Much has been said for and against hybrids, but from experience I feel satisfied that bees of the first cross between the blacks and Italians are superior to either variety pure. With regard to docility in handling, it is generally understood that hybrids are exceedingly vicious. While this may be true in some cases, I must say, after handling many hundreds of colonies, that I have found very few indeed worse than some of the pure races I have had to do with. The worst bees I have noticed in this respect were nearly pure blacks with a small dash of Italian blood in them.

A hybrid colony may be distinguished by the great variety in the markings of the bees, from three-banded Italians through the different grades to pure blacks.

In briefly stating what I consider to be the superior qualities of each variety, Germans, Italians, and hybrids, as compared with each other, I shall first take the German, or black bees. Without a doubt, for raising comb-honey, they beat both Italians and hybrids. First, they will take to the section boxes sooner than the others; second, they leave a slight air space between the honey and the capping of the cells, which preserves the brightness of the cappings and gives to comb-honey that nice white appearance which is so much admired. On the

contrary, the Italians, and in a less degree the hybrids, allow little or no air space, consequently the comb has a dark, damp look, on account of the proximity of the honey to the cappings. Italians are superior to the Germans—first, in being better honey-gatherers; second, in possessing longer tongues; third, in being more prolific; and fourth, in being more gentle, though, if once aroused, I believe them to be as vicious as hybrids. Hybrids I have found best of all for honey-gathering and for hardiness. As to prolificness, I think they are about equal to Italians. To sum up, I would place the three sorts in the following order for the different qualities required:—As honey-gatherers—Hybrids, Italians, Germans; for gentleness, Italians, Germans, Hybrids; for prolificness, Italians, Hybrids, Germans; for hardiness, I have seen little difference between Hybrids and Italians—Germans; for protecting their hives against robbers, Italians, Hybrids, Germans; for comb-honey raising, Germans, Hybrids, Italians.

Axiom.

"BEES, WHEN FRIGHTENED BY SMOKE, OR BY DRUMMING ON THEIR HIVES, FILL THEMSELVES WITH HONEY, AND LOSE ALL DISPOSITION TO STING, UNLESS THEY ARE HURT."

Langstroth.

CHAPTER III.

INMATES OF THE HIVE—THEIR NATURAL HISTORY.

Every colony in a normal working condition, during the swarming season, will be found to contain bees of the three different kinds, the characteristics and relative sizes of which are shown in the illustrations which follow. First, one bee only of the peculiar form which denotes the queen or mother bee; secondly, a few hundreds (sometimes more than a thousand) of large bees, called drones; and thirdly, many thousands of the smaller kind, called workers, which are the common bees to be seen on blossoms, as neither the queen bee nor the drones gather honey or work outside the hive.

The queen is indispensable to the prosperity of the colony. She is the only perfectly developed female, and lays all the eggs, of which she can, on occasions, produce two to three thousand in twenty-four hours. Without her the colony would soon dwindle down and die out, or be attacked and killed for the sake of its stores, as, after being deprived of their queen, the workers generally (unless they are in a position to rear a new one, as will be seen further on) lose the disposition to defend themselves and their home. The queen is not provided with the special organisation which enables the workers to gather honey and pollen and to secrete wax. She is furnished with a sting, which, however, she very rarely uses, except in a struggle with a rival queen. When she has been once impregnated, and has taken her place in a hive, she never leaves it except to accompany a swarm. Her term of life may extend to four years at least, and during that time she may lay many hundreds of thousands of eggs; but she is considered to be in her prime in the second year, and is seldom very prolific after the

third. She can be easily distinguished from the other bees, and be recognised even by the most inexperienced from the following description:—Her body is not so

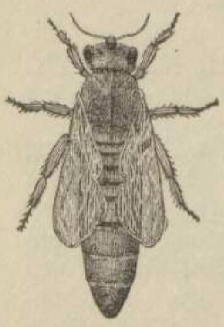


Fig. 2.
THE QUEEN.

Fig. 3.
THE DRONE.

Fig. 4.
THE WORKER.

(Relative sizes, enlarged.)

bulky as that of a drone, though longer; it is considerably more tapering than that of either drone or worker; her wings are much shorter in proportion than those of the other bees; the under part of her body is of a lighter and the upper of a darker colour than the worker's; her movements are generally slow and matronly, and indeed she looks every inch a queen.

The drones, or male bees, are much stouter than either the queen or workers, although their bodies are not so long as that of the queen. They are neither furnished with a sting nor a suitable proboscis for gathering honey, no baskets on their legs for carrying pollen, and no pouches on their abdomens for secreting wax, so that they are physically incapable of doing the ordinary work of the hive. Their office is to impregnate the young queens, but very few have the chance of doing so; those that have, die immediately afterwards, and the rest are usually destroyed by the workers at the end of the swarming season, having by this time become an incumbrance only.

The worker bees, the smallest in size, constitute the bulk of the population of the hive. A good-sized swarm should contain at least twenty thousand,*, and a well-stocked hive, during the full working season, will have twice, and sometimes three times, that number of workers. They are all females, but not fully developed as regards their sexual organization—they are incapable of being impregnated by the drones; but in some rare cases their ovaries are sufficiently developed to admit of their laying eggs, which, however, as will be shown later, are unfertilised, and produce only drones. On the other hand, these workers are specially provided with the means of successfully prosecuting their useful labours. They have a wonderfully constructed tongue, or proboscis, which enables them to suck or lap up the liquid sweet from the nectaries of blossoms, and to store it in a "honey sac," which is, in fact, a first or extra stomach, from which they can again disgorge it at will into the cells of their combs. Their hinder legs are provided with a hollow, or "basket," for carrying pollen, which they are enabled, by the use of their front legs and their proboscis, to work up into little pellets, and pack in these receptacles. They have the power of secreting wax in small scales under the folds of the abdominal rings of their body, and they are furnished with a sting to protect themselves and their stores, and of which they make effective use when provoked. They perform all the work both inside and outside the hive; collect the materials for honey, bee-bread, and propolis; carry water, secrete the wax, build the combs, nurse and feed the young brood, ventilate the hive, and stand guard at the entrance when it is necessary to keep out intruders. Although division of labour is beautifully exemplified in the economy of the hive, still there are not separate classes of worker bees (as was at one time supposed) to perform the different sorts of work; on

* About 4000 ordinary bees weigh one pound, so that a 5 lb. swarm contains about 20,000. Extra large swarms, however, sometimes weigh 7 lb. to 8 lb.

the contrary, every worker bee is capable of doing all these things, and they take their turns accordingly. "One bee in her time plays many parts." The young bees are employed on "home duty" for the first week or two; they then take their turn of outdoor work, and are gradually worn out in the service. Their term of life is short, varying from only six or seven weeks in the busiest working season to nearly as many months after that busy time is past.

STRUCTURAL ORGANISATION.

Under this heading it is my intention briefly to touch upon two or three of the chief organs of the queen and worker bees, but for a fuller treatise on the anatomy and physiology of the honey-bee I must refer my readers to the last edition of this work.

HEAD OF WORKER BEE.

Within the small limits of a bee's head there are contained several important organs, some of them of a very complex nature. These are—the compound eyes; the simple eyes, or stemmata; the mouth and its appendages; and the antennæ. The engraving on next page shows a front view (on a greatly magnified scale) of a worker bee's head.

The Compound Eyes are shown at b b, at right and left on top, and the simple eyes between them. Each compound eye is composed of something like 3,500 hexagonal convexities, or facets, which according to Cheshire are about one-thousandth of an inch in diameter, and are independent instruments of vision. The compound eyes are believed to be used chiefly for distant vision, and the simple eyes for objects near at hand.

The Antennæ (a) are wonderful structures under the microscope. That they are organs of touch—"feelers"—there can be no doubt, and that they also perform the functions of hearing and smelling, although an open question at present, is generally believed by naturalists.

The Mouth Parts consist of several organs, as shown in the figure, the chief of which is the tongue. The end

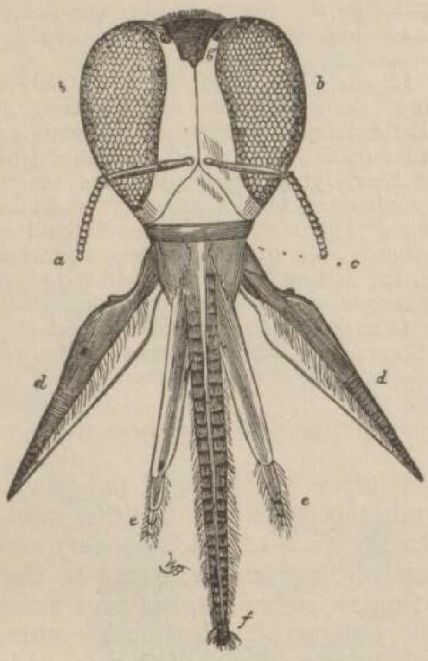


Fig. 5.—HEAD OF WORKER BEE.

a, Antennae; b, Compound eyes; c, Jaws; d, Maxillae; e, Lateral palpi; f, Ligula, or tongue; g, Stemmata.

of this is covered with whorls of hair, and is furnished with a spoon-shaped hollow on the under side, opening into a capillary tube on the upper side, into which the liquid passes when the bee is sipping. Herman Muller, in his work on "The Fertilisation of Flowers," beautifully describes the process of gathering nectar. He says:—

"When the bee is sucking honey which is only just within her reach, all the movable joints of its suction apparatus, car-

dines, the chitinous retractors at the base of the mentum, laminæ (maxillæ), labial palpi, and tongue, are fully extended, except that the two proximal joints of the labial palpi are closely applied to the tongue below, and the laminæ to the mentum and hinder part of the tongue above. But as soon as the whorls of hair at the point of the tongue are wet with honey, the bees, by rotating the retractors, draw back the mentum, and with it the tongue, so far that the laminæ now reach as far forward as the labial palpi; and now labial palpi and laminæ together, lying close upon the tongue, and overlapping at their sides, form a tube, out of which only a part of the tongue protrudes. But almost simultaneously with these movements, the bee draws back the basal part of its tongue into the hollow end of the mentum, and so draws the tip of the tongue, moist with honey, into the tube, where the honey is sucked in by an enlargement of the foregut, known as the sucking stomach, whose action is signified externally by a swelling of the abdomen."

REPRODUCTIVE ORGANS OF THE QUEEN.

The most important organs of the queen bee—themselves forming perhaps one of the most wonderful objects of nature, and of which the very accurate knowledge which we now possess, owing to the patient researches of many naturalists, has done more than aught else for the progress of scientific bee-culture—are her ovaries and the parts attached thereto, which are illustrated in the following engraving.

The two fig-shaped bodies are the ovaries, which are multi-tubular, there being more than a hundred tubes (called the ovigian tubes) in the two ovaries of a queen bee. In these tubes the eggs grow and develop themselves until they are fit to be deposited. Each ovary has a separate oviduct at bottom, through which the eggs pass for some distance, until the two join in one common oviduct leading to the vulva, or vent, through which the eggs are ultimately deposited. A little below the junction of the passages from the two ovaries, and on the outside of the common oviduct, is a small globular body, shown on the right hand side in the engraving.

This is a hollow vessel, called the spermatheca, of which much has to be said. More than two hundred years ago Swammerdam published an excellent illustration of the ovaries of a queen bee, showing the spermatheca, but he conjectured that it secreted a fluid for sticking the eggs to the bottom of the cells in the comb. In his time

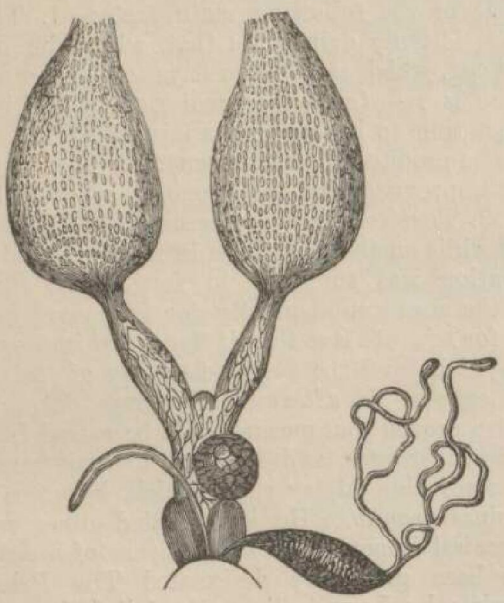


Fig. 6.—OVARIES OF QUEEN.

but little was known of what went on within the hive. It was no doubt assumed by many that every single egg laid by the queen required to be fertilised by a separate act of the drone, while Swammerdam himself conceived the idea that no copulation was necessary, but that some gaseous emanations from the body of the drone produced fecundation by penetrating the body of the queen. About a hundred years later great ad-

vances were made in the knowledge of the physiology of the bee. It is said that Jansha, apiarist to the Empress Maria Theresa of Austria, discovered the fact that young queens have to leave the hive to meet the drones; but it is to the labours of Huber, in 1787 and following years, and communicated in his letters addressed to Bonnet in the years 1789 to 1791, that we owe the first knowledge of the following main facts:—1. That the queen bee is truly oviparous; that what she deposits is a true egg, which takes three days to produce a living maggot or larva—(even the great Bonnet was inclined up to that time to believe that a minute worm, and not an egg, was produced by the queen). 2. That the queen must be impregnated by the drone in order to become fertile. 3. That copulation is accomplished outside the hive and while on the wing high in the air. 4. That one impregnation was sufficient to fertilise all the eggs laid by the queen subsequently for two years at least, perhaps for life. 5. But that if the act of impregnation was delayed beyond the twenty-first day of the queen's life, her eggs would afterwards produce only drones. Huber also proved that queens could be reared from the larvæ of worker eggs, and also that in some rare cases workers were able to lay eggs, which, however, could only produce drones. He investigated other matters of the greatest importance to the science of bee-culture, and has been gratefully designated The Prince of Apiculturists by Langstroth. He failed, however, to discover the secrets of the spermatheca, and remained under the false impression that the fertilisation of the eggs took place in the ovaries and that there were two sorts of eggs, one sort to produce workers and queens, the other to produce drones, and that they occupied separate portions of the ovaries. His contemporary, Schirach, who also contributed much to apiarian science, supposed that one branch of the ovaries contained the one sort and the second branch the other sort of fertilised eggs. In this state the science remained for some sixty years. Langstroth says it is now

ascertained that Posel, in a work published at Munich in 1784—therefore previous to the experiments of Huber—"describes the spermatheca and its contents and the use of the latter in impregnating the passing egg;" and also that "years ago the celebrated Dr. John Hunter and others supposed that there must be a permanent receptacle for the male sperm opening into the oviduct." Nothing certain was known, however, until 1845, when the brilliant discoveries of Dzierzon led to the promulgation of the theory which bears his name, and especially to the doctrine of

PARTHENOGENESIS.

On this point Professor Cook says:—

"This strange anomaly—development of the eggs without impregnation—was discovered and proved by Dzierzon in 1845. Dr. Dzierzon, who as a student of practical and scientific apiculture must rank with the great Huber, is a Roman Catholic priest of Carlsmarkt, Germany. This doctrine—called Parthenogenesis, which means produced from a virgin—is still doubted by some quite able bee-keepers, though the proofs are irrefragable."

Space will not admit of going into the details of observations and experiments by which the case has been proved, but they are fully discussed in an excellent little work on the Dzierzon Theory by the Baron Von Berlepsch.

DEVELOPMENT FROM THE EGG TO THE BEE.

Having now come to understand the manner in which the egg, whether male or female, is laid, we may examine the egg itself, and the way in which the germ it contains becomes developed into the full-grown insect.

The egg, when laid in the cell, requires a tolerably sharp sight to distinguish it as it lies at the bottom, attached by one end to the comb by means of some glutinous fluid with which it is coated. It is very small and not round or oval like a bird's egg, but long, like a small worm or maggot. It is, however, a true egg.

It appears covered with a sort of delicate network, which is, in fact, its shell, and it has a yolk and surrounding white, or albumen, like all eggs of birds or reptiles. When deposited in a worker cell, it remains unchanged in outward appearance for three days, when the larva first appears as a minute worm, and goes through the stages of development shown in the following figure; the numbers underneath denoting the age, in days, from the laying of the egg.

Fig 7.—FROM THE EGG TO THE BEE.

The larva, when it emerges from the egg, is fed by the workers, which act as nurses, with a mixture of bee-bread, honey and water, the two first-mentioned materials having undergone a partial digestion in the stomach of the bees, and been converted into a species of chyle. Whether the water is mixed with the food so prepared, or is required for the process of digestion to prepare it, certain it is that during the breeding time great numbers of bees are to be seen imbibing water, and bringing it to the hive. This process of feeding the larvæ continues five days for the workers and six and a half days for the drones, and the cells are then capped with a mixture of wax and pollen, which forms a safe covering for the cells, but is sufficiently porous to admit the air necessary for the life of the larva and pupa, or nymph, during its period of metamorphosis. As soon as the cell is closed, the grub begins to spin a web or cocoon round itself; this spinning goes on for thirty-six hours, when the cocoon is complete, and then

ensues a period of rest, or apparent rest, and subsequent metamorphosis, during which time a wonderful transformation is going on from hour to hour. This includes the pupa or nymph period, and lasts altogether thirteen days for workers and fourteen and a half for drones; and at length, on the twenty-second day from the laying of the egg in the former, or on the twenty-fifth day in the latter case, the fully formed bee cuts through the capping of the cell with its mandibles, and emerges complete in every respect, and ready, *without any previous training, education or experience,* to fulfil its functions, to execute all the delicate operations, and to observe those rules of conduct which appear to us (and justly) to be such marvels of intelligence, ingenuity, dexterity and even foresight.

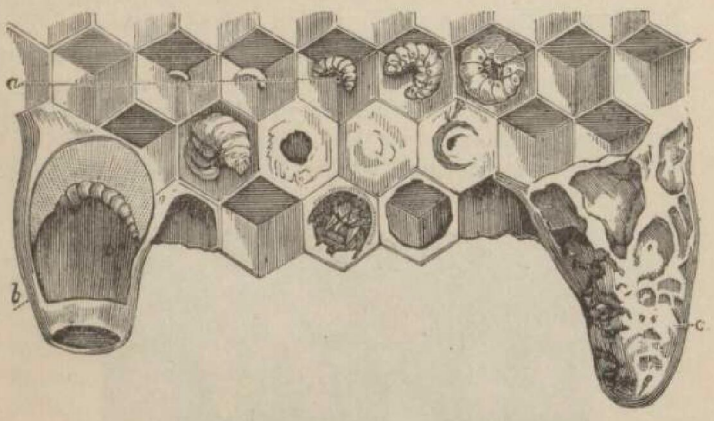


Fig. 8.—WORKER LARVAE AND QUEEN CELLS.

The cells in which queen, or perfect female eggs are laid and developed differ widely from those of the workers and drones; in the natural state, they are only built in the swarming season, or in cases where the colony has become queenless; in the former case the cells are laid out for the purpose on the under side or on

the edges of the comb, as shown in the preceding engraving, which exhibits, on an enlarged scale, the top view of a number of worker cells, with the egg and larva in the different stages of development up to the time of capping the cells (in the line marked a); a section of a queen cell (b) showing the larva and a supply of the royal jelly, and a similar one completed and closed (at c).

Langstroth, in describing the queen cells, says:—

"These cells somewhat resemble a small pea-nut, and are about an inch deep and one-third of an inch in diameter. Being very thick, they require much wax for their construction. They are seldom seen in a perfect state after the swarming season, as the bees, after the queen has hatched, cut them down to the shape of a small acorn cup."

The material of which these cells are composed is not pure wax; there is much pollen mixed with it. The outside surface is uneven and indented like the sides of a thimble. The number built at one time varies much, according to circumstances—sometimes only two or three, but ordinarily not less than five.

The transformations of the queen larva are com-

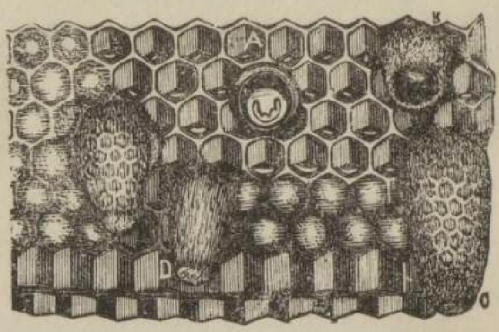


Fig 9.—QUEEN CELLS BUILT OVER WORKER CELLS.

pleted in seven days from the closing of the cell, so that on the sixteenth day from the laying of the egg (six

days shorter than the period for the worker, and nine days shorter than that for the drone) the fully developed queen emerges from the cell.

In the case of a colony becoming queenless in an abnormal manner, queen cells may be built over worker eggs or larvæ in convenient places on the flat surface of a comb as shown in the engraving on page 28. The ordinary worker cells, with eggs in them, are shown at A; B is a queen cell partly built; and C one completed and closed. D shows a case, which sometimes occurs, of a queen cell built over drone brood. Such cells—which may be known by the absence of indentations on their outer surfaces—are of course useless, as the nature of the drone egg is not altered by the form of the cell or the quality of the food given to the larva.

THE STING.

The sting of the worker bee is a very complicated organ, as will be seen by a study of the following engraving, taken from Root's "A B C of Bee Culture."

In the general view of the sting, I is the double gland which secretes the poison; A, the cylindrical reservoir in which the poison is collected from the glands, and from which it is transmitted through hollows in the spears or lancets to the wound; B, the two barbed lancets; and D, the third spear or awl, usually styled the sheath, in which the other two partly slide when at work. In the cross section (greatly enlarged) of the lancets, at the point D, it will be seen how the two hollow lancets, A and B, slide on ribs or guides in the concave side of the so-called sheath, D. They have tubes, F and G, through which, as well as through the tube E, formed between the three parts of the sting, the poisonous fluid is transmitted. There is a hollow, C, in the awl or sheath, D, but it is only for strength and lightness, and is not open either above or below. In the barbed lancets, the end of one of which is shown, greatly magnified, there are grooves, G, to fit on the

ribs of the sheath, and the poison, which is conveyed down the hollow tube inside of each, finds vent by small side openings to the barbs at H H. It appears that

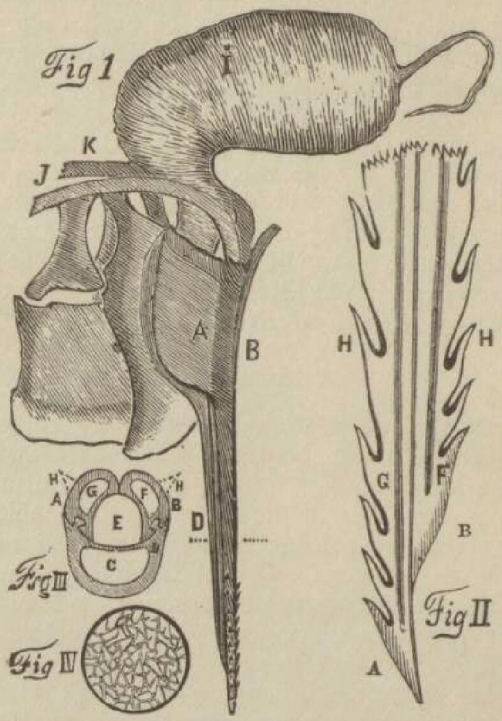


Fig. 10.—THE BEE STING.

I. Bee sting, magnified.
II. One of the barbed lancets.
III. Cross section of lancets at D.
IV. Drop of the poison, crystallised.

when the wound is first pierced by the smooth and highly polished point of the awl, D, a sliding motion is communicated to the barbed lancets by the muscles shown at J and K, and the poison is *pumped* into the

wound through the centre cavity, E; the barbed lancets are then driven in by alternate motions, and at the same time the centre cavity is closed by valves at the root of the sting, and the poison is forced through the tubes in the hollow lancets, and through the side openings near the barbs. The barbs having once penetrated any tough material, such as the human skin, cannot be withdrawn by a direct pull. The bee, if left to itself, will gradually work round and round until it screws out the sting, but if it be abruptly shaken or brushed off, the whole sting is torn out of its body and left behind. In that case the muscles will continue to work and to force poison into the wound for some time, if the sting be not carefully extracted, which should be done without squeezing the poison reservoirs at its base. The body of a bee that had been dead for hours has been known to sting in that way. The injury occasioned to a bee by the tearing out of its sting must be very severe, and it has been generally supposed that they must die immediately afterwards. Sir John Lubbock, however, in his work on "Ants, Bees, and Wasps," says: "Though bees that have stung and lost their sting always perish, they do not die immediately, and in the meantime they show little sign of suffering from the terrible injury." He mentions having seen a bee after losing its sting, remain twenty minutes on the floor-board, enter the hive, return in an hour, feed quietly on some honey, and again return to the hive.

It is said:—"1. The poison of the hymenoptera is always acid. 2. It is composed of a mixture of two liquids, one strongly acid, the other feebly alkaline, and acts only when both liquids are present. 3. These are produced by two special glands that may be called the acid gland and the alkaline gland. 4. These two glands both expel their contents at the base of the throat from which the sting darts out."

LAYING OR "FERTILE" WORKERS.

The existence of egg-laying workers in a hive upon certain rare occasions was noted by M. Riem even before

Huber's time, and fully confirmed by the latter. They are, of course, quite useless for keeping up the stock of a hive, as their eggs can only produce drones. Prof. Cook sums up in a few words all that is as yet known about their origin. He says:—

"Huber supposed that these were reared in cells contiguous to royal cells, and thus received royal food by accident. The fact as stated by Mr. Quinby, that these occur in colonies where queen larvæ were never reared, is fatal to the above theory. Langstroth and Berlepsch thought that these bees were fed, though too sparingly, with the royal aliment by bees in need of a queen, and hence the accelerated development. Such may be the true explanation. Yet if, as some apiarists aver, these appear where no (royal?) brood has been feed, and so must be common workers, changed after leaving the cell, as the result of a felt need, then we must conclude that development and growth, as with the high-holder, spring from desire."

This is evidently one of the matters relating to apiculture about which we have still much to learn.

The presence of a fertile worker may be known by its eggs being scattered about promiscuously, sometimes on the sides and edges of the cells, and generally more than one in each. I have seen as many as a dozen in one cell. To get rid of them is sometimes a difficult matter, for unless you saw them in the act of laying you would not know them from the other workers; and usually the colony will not accept a queen or queen cell when in this condition. If the hive has become weak it will be best to unite it with another; and I believe in any case this is best, for I have tried other means to get rid of them, but without success. A sharp look-out should be kept to prevent a colony getting into this state, but it will happen sometimes in spite of all your carefulness, as I have found.

Axiom.

"BEES MAY ALWAYS BE MADE PEACEABLE BY INDUCING THEM TO ACCEPT OF LIQUID SWEETS." *Langstroth.*

CHAPTER IV.

WHAT BEES COLLECT, AND WHAT THEY PRODUCE.

Bees *collect* three different sorts of raw materials, all of vegetable origin: (1) the sweet liquids secreted by plants in the nectaries of their blossoms, or exuded on any parts of their leafy structure; (2) the pollen, or fecundating dust of plants; (3) resinous matter exuded on various parts of some trees and other plants. They *produce*, on the other hand, honey, wax, bee-bread, and propolis. This distinction must be borne in mind if we wish to be precise both in our ideas and our mode of expression.

HONEY.

The raw material of the honey is entirely a vegetable production; it is excreted or thrown off by the plant, from the superfluity of its saccharine juices, which, when subjected to chemical analysis, are found to consist of nearly the same constituents as all sugars, starch, gum, and other non-nitrogenous vegetable secretions, namely, of carbon, oxygen, and hydrogen, the two latter in the proportions required to form water. This nectar, therefore, does not contain any of the nitrogenous or of the mineral substances furnished by the soil, and which require to be returned to it, in some degree at least, by the use of manures. Liebig and other chemists have proved that all the elements of the non-nitrogenous vegetable substances are derived from the atmosphere and from rain-water; it is clear, therefore, that no quantity of honey produced in any district can tend to impoverish the soil from which the nectar is collected. While lying in the nectaries of blossoms, and being collected by the bee, or afterwards when being stored in

the honey-comb, it may by accident take up some particles of pollen, which will account for the fact that minute grains of that substance are generally discoverable in honey when examined with the microscope. In its passage through the honey-sac of the bee, and in the act of being stored in the cells of the comb, the raw juice goes through a process of ripening, which deprives it of all superfluous watery particles, and while in the honey-sac it is also probably in some way chemically affected by the juices from the salivary glands of the bee. When quite "ripe," it is hermetically sealed in the cells by the worker bees, just as the preserves of a careful housekeeper are closed up so as to save them from the action of the oxygen in the atmosphere. The honey in this ripened state is nearly the same, in point of chemical composition, as ordinary sugar; but it owes its perfume and flavour apparently to the same volatile oils which attracted the insects to the flowers from which it is derived, and that it is indeed something very different from common sugar is sufficiently clear to everyone. Chemical analysis is an invaluable aid in the prosecution of scientific investigations, and it is quite astounding to the layman to observe the nicety of the results which modern chemists can arrive at: but still there are some subtile peculiarities of matter which seem to evade all analytical examination. The constituent parts of starch and of gum are very nearly the same as those of sugar, and yet how different to our sight, touch, and taste are all those substances! On this subject Professor Cook remarks as follows:—

"Nectar of flowers and honey are quite different. The former contains more water, is neutral instead of acid, and the sugars taken from the flowers are much modified while in the alimentary canal of the bee in transit from flower to comb. Nectar consists of sucrose, or cane sugar, from twelve to fifteen per cent., and mellose, or uncrystallisable sugar, ten per cent. The remainder is mostly water, though there is always a small amount of nitrogenous material. In honey the cane sugar is largely changed to a substance chemically like glucose: the mellose seems also somewhat modified. There

is a little mannite, probably the result of chemical change in the bee's stomach. The acid condition of honey is plainly recognisable by the taste, as all lovers of honey know."

The small amount of nitrogenous material above referred to is no doubt owing to the minute particles of pollen which get accidentally mixed with the honey in the way already mentioned.

HONEY DEW.

There is a saccharine matter sometimes gathered in considerable quantities by bees in countries of the Northern Hemisphere termed "honey dew." It is quite distinct from ordinary honey, and is usually found on the leaves of certain trees, such as the oak, elm, maple, plane, sycamore, lime, hazel, and cherry, also on the blackberry and currant. It is much inferior to honey. Though considerable difference of opinion has been expressed as to its origin, there can be very little doubt that most of it exudes from the leaves upon which it is found. Probably there is an occasional yield of honey dew in this part of the world, but if so, it must be very small, otherwise we should have heard more about it.

ADULTERATION OF HONEY.

Shortly after the bee-keeping industry began to make considerable headway on modern methods, and while honey commanded a good price upon the markets of the world, a very great deal of the adulterated article, got up in an attractive form, came into competition with the former. The chief seat of this fraudulent industry was the United States of America, where it still appears to be carried on to a more or less extent. The principal adulterant is glucose syrup, a starch sugar made from Indian corn, with a market value of from one penny to three-halfpence per lb. Though considerable quantities of this doctored stuff used to come into these colonies, the extra duty placed upon glucose and the so-called honey, together with the cheapening of the genuine

article, quite killed the trade. As there is no other substance known at the present time that would make a profitable adulterant, consumers may rely upon what honey there is offered on our markets being at least the pure article.

WAX.

Previous to Huber's time it was generally believed, and asserted by writers upon apiculture, that wax was collected by the bees, or formed by them from bee-bread, either in its crude state or after undergoing a process of digestion. The accurate observations of Huber, however, led him to doubt the correctness of that theory, and he ultimately proved its utter fallacy by careful experiments made in the following manner. He confined bees to their hives, without a particle of pollen, and fed them with sugar syrup, and at the end of a few days they had built several beautifully white combs. They were then deprived of these, and supplied with honey and water, when combs were again constructed. This was repeated seven times; all the time the bees were prevented from flying, thereby proving that wax is secreted, and not gathered, by them.

Langstroth remarks, with his usual sagacity and caution, that although Huber has clearly proved

"that bees can construct comb from honey or sugar, without the aid of bee-bread, and that they cannot make it from bee-bread without honey or sugar, he did not prove that they can continue to work in wax when *permanently* deprived of bee-bread. . . . Some bee-bread is always found in the stomach of wax-producing workers, and they never build comb so rapidly as when they have free access to that article. It must therefore either furnish some of the elements of wax, or in some way assist the bee in producing it. Further investigations are necessary, before we can arrive at perfectly accurate results."

He further points out the fact that, while honey and sugar contain by weight about eight pounds of oxygen to one of carbon and hydrogen, the wax contains only one pound of the first to more than sixteen of the two

latter; and that, as the combustion of oxygen is the great source of animal heat, the great quantity consumed in the conversion of honey into wax "must aid

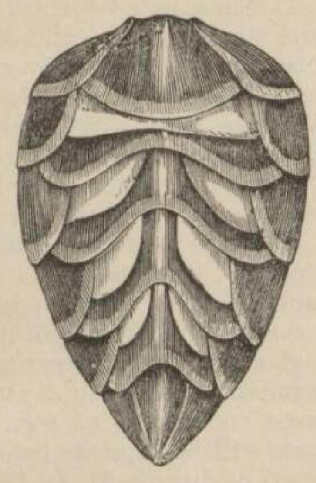


Fig. 11.—UNDER SIDE OF ABDOMEN OF WORKER BEE, SHOWING WAX POCKETS AND WAX SCALES.

in generating the extraordinary heat which enables the bees to mould the softened wax into such exquisitely delicate and beautiful forms." The force of this observation will be seen when we recollect that wax requires a temperature of about 145° to melt it, though it may be moulded, by pressure, at 100° or less. Is it not probable that the way in which "bee-bread assists the bee in producing the wax," as Langstroth expresses it, is that its nitrogenous qualities serve to keep up the bodily strength of the insect during the exhausting work of secreting the wax and building the comb? This appears to be Professor Cook's view. At all events, it is now well known that the wax is exuded from the body of the worker bee, and formed in thin flakes in what are termed the wax pockets, of which four may be observed in the foregoing engraving, on each side of the centre

line on the under part of the abdomen, and which are, in fact, the folds of the shell-like plates covering the abdominal rings.

The wax can only be secreted when the temperature of the hive is above a certain point, and during the time of secretion the bees appear to hang in clusters or festoons, in a state of absolute repose. In the height of the honey season, or so long as new comb is required, this secretion goes on night and day. Langstroth says that "careful experiments prove that from thirteen to twenty pounds of honey are required to make a single pound of wax." This has been until lately accepted as a well-ascertained fact; but within the last few years some American apiarists have begun to doubt if quite so much honey was consumed, and lately it has been stated, on the strength of some isolated experiments, that the bees do not consume more than eight pounds of honey in order to secrete one pound of wax. Many more careful experiments will be requisite before this can be satisfactorily proved or disproved. In the meantime it may be asserted that something between eight and twenty pounds are required, but the exact quantity is still an open question.

ADULTERATED BEESWAX, AND HOW TO DETECT IT.

With the growing scarcity of beeswax during the past twenty years and the consequent increase in price, came the opportunity for the adulterator. At first the adulteration was carried on in a very clumsy style and easily detected, tallow and resin being chiefly used. But of late years the fraudulent imitation of the pure article has been so cleverly made that except by experts or by direct tests it could not be detected. So openly and so extensively had the fraud been going on in New Zealand, that the police stepped in at last and put a stop to it, with the result that a few enterprising individuals were sent to prison for a few months to take a rest from their labours, which their victims appreciated if they did

not. No doubt a stop to this kind of thing has been made for a while at least.

The usual adulterants nowadays, and which are so difficult to detect by the uninitiated, are the ordinary commercial paraffins and ceresins, and for these the simplest way of detecting them is by the alcohol test. Into a clear glass bottle pour a little clean water, then drop in a small piece of beeswax of known purity; the wax being lighter than the water, will float. Now pour in gradually pure alcohol till the wax slowly sinks to and touches the bottom, but no more. Then drop in a piece of the suspected article: if it does not sink slowly like the wax there will be every reason for believing it to be adulterated. When there is more than 5 per cent. of either of the two adulterants present the stuff will float, while the pure beeswax lies at the bottom of the liquid. This is a most excellent test and a handy one.

WILL IT PAY TO RAISE BEESWAX?

I am very much inclined to think that the time is coming, if it has not already arrived, when it will pay as well, or even better, to raise wax than honey. I know it has already been attempted, but so far as I am aware nothing definite has been arrived at, even by those who have given the matter a trial. It is more than reasonable to suppose that in districts where large crops of a low grade of honey only can be raised, such as would be difficult of sale even at a very low price, as in some of our bush country, it would pay well to raise wax instead. Some inexpensive form of large box hives would be all that would be required to put the bees in as they swarmed. Early in the autumn the bees could be driven from, say, half the boxes and united to the others, while the combs from the driven bees would be cleaned and turned into wax. The above is merely a suggestion of what appears to me an easy and feasible method of raising wax that might be worth trying where inferior honey is plentiful.

RENDERING WAX.

The two methods in vogue for rendering combs into wax are by steam and by the heat of the sun. Of the two I greatly prefer the steam, and if one has the facility for turning on a jet of steam to aid him, nothing could be better. In this case an uncapping can is just the thing for the purpose. The combs, etc., to be melted are put into the upper portion of the can and a jet of steam turned on to it, when the clean wax will quickly trickle through the wire cloth into the lower division of the can, leaving the residue, which the Americans call "slumgum," in the upper part.

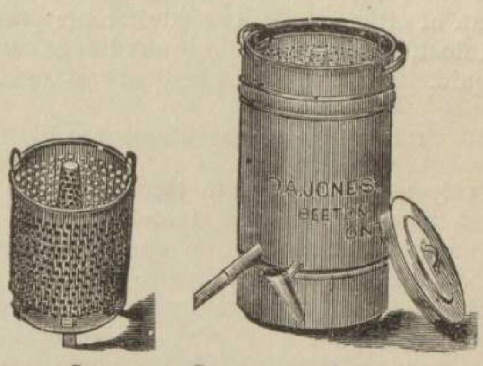


Fig 12.— WAX EXTRACTOR.

Where one cannot command a jet of steam, the Root-Swiss, or the Jones Wax Extractor (Fig. 12), both of which are similar in construction, may be used. The perforated cone in the centre of the basket B conveys the steam up through the mass to be melted.

The basket B is made of perforated tin, and it is into this that the pieces of comb, etc., are to be put. When the basket is filled it is placed in the vessel A, which is in two parts, the lower one being the boiler seen in illus-

tration. The basket rests on metal supports within a shallow pan-like bottom, outside of which there are large perforations allowing the steam from the boiler to ascend around and through the mass. The wax as it melts runs out through the spout, while the "slumgum" is retained in the basket. Where there are a number of colonies a wax extractor will soon pay for its cost by turning into marketable wax odds and ends of comb that would otherwise go to waste.

SOLAR WAX EXTRACTORS.

These usually consist of a long, shallow, oblong box lined with iron or tin and covered with a frame of glass. The combs and wax to be melted rest on a metal tray within the box, which is placed in a sloping position facing the sun, the heat from which separates the wax from the slumgum, the former running down into a vessel placed within the box to catch it. I have rendered large quantities of wax both by steam and the Solar Wax Extractor, but prefer the former by a long way. It is a tedious job in any case, except by the steam jet; but the Solar Extractor I found the most unsatisfactory. For new combs only it is excellent, but for old combs, which are usually those rendered, the Solar Extractor is almost useless. Many times I have had to use steam on combs that have previously been through it to get out the wax the Solar Extractor failed to get. So far as I am concerned it was condemned long ago for general use.

COMB.

Wax, after being produced by the bees, is formed by the workers into comb, which consists of hexagonal-shaped cells of two sizes—one for the deposit by the queen of the worker eggs, the other for the same purpose, for drone eggs; and these are known to apiarists by the names of "worker" and "drone" comb (Fig. 30).

HOW CONSTRUCTED.

The wonderful instinct of these little workers is amply shown in the construction of the comb; for there is no other form known to mathematicians in which the

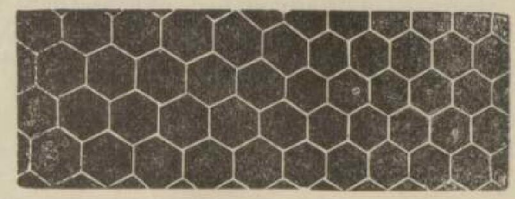


Fig 13.—WORKER CELLS. DRONE CELLS.

cells could be constructed—1st, to occupy the least possible space; 2nd, with a view to consume the least material; 3rd, for the comfort and health of the young bees. The cells are constructed on both sides of the foundation, in a horizontal plane to it, which is perpendicular. Some of our greatest naturalists have made the process of building up honey-comb their special study.

"The expedients tried by Huber unfolded the whole process. He was enabled to bring each bee so completely under view that it could be seen to extract with its hind feet one of the plates of wax from under the scales where they were lodged, and, carrying it to the mouth, in a vertical position, turn it round; so that every part of its border was made to pass in succession under the cutting edge of the jaws. It was thus soon divided into small fragments; and a frothy liquor was poured upon it from the tongue, so as to form a perfectly plastic mass. This liquor gave the wax a whiteness and opacity which it did not possess orginally, and at the same time rendered it tenacious and ductile. These materials, thus blended, having been accumulated in the hollow of the teeth, issued forth like a very narrow ribbon. The tongue, during this process, assumed the most varied shapes, and executed the most complicated operations; and after drawing out the whole substance of the ribbon in one direction drew it forth a second time in an opposite one. It was, doubtless, the issuing of this masticated mass

from the mouth that misled Reaumur and caused him to regard wax as nothing more than digested pollen."—Bevan.

ADVANTAGES OF THE HEXAGONAL FORM OF CELLS.

There are only three geometrical figures into which a given plane surface can be divided into perfectly equal parts—the square, the triangle and the hexagon; and of these three the form which most nearly approaches

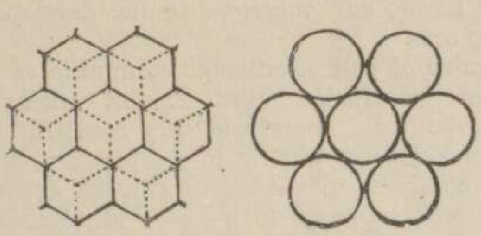


Fig. 14.—HEXAGONAL CELLS. CIRCULAR CELLS.

that of a circle, and therefore the most suited for the development of the larva and nymph forms of the young bees, is the hexagon. The above figures will exhibit at a glance the loss of space and the waste of material that must result if the cells of the comb were built of circular, as compared with the hexagonal form.

The bees, if left to themselves, usually build a large amount of drone comb for storage of honey; and thus in another season a great and what appears to be an unnecessary quantity of drones appear on the stage. This is now obviated by the introduction of artificial comb foundation; for, as will be seen, the apiarist now can regulate the work, and so force the bees to produce either drones or workers, as he may most require.

POLLEN AND BEE-BREAD.

Pollen is the name given to the dust-like particles of farinaceous matter which constitutes the fecundating principle of the stamens of flowers and blossoms of all sorts. The manner in which it is collected by bees has

been already described in Chapter III. It is of great importance in the economy of the hive, as, after being mixed with a little honey, and packed in the cells of the brood combs, it forms the bee-bread, which is indispensable to the nourishment of the young bees, and without which, as has been proved, no brood can be raised. It is very rich in nitrogenous substances, which are necessary for the formation and maintenance of muscular tissue, and therefore to the development of the young bees.

The grains of pollen, although so minute as to form an almost impalpable dust, exhibit when viewed through a powerful microscope very beautiful and distinctive markings, according to the plants from which they are obtained. Previous to Huber's experiments, bee-bread was supposed to be used in comb-building. He, however, proved, as we have seen, that comb could be built by the bees in confinement, by being fed with honey or sugar syrup alone. He was not long in discovering that pollen was used for the nourishment of the young bees. Confining some bees to their hives without pollen, he supplied them with larvæ, honey, and eggs. In a short time the young all died. A fresh supply of brood being given them, with plenty of pollen, the development of the larvæ proceeded in the natural way.

PROPOLIS.

This is a substance used by the bees for glueing things together, and for stopping up all crevices in their hives. In order to make it they gather the resinous matter which exudes from some trees; or when this is scarce, they will take varnish, or even tar, whenever they can find it. They carry this substance home in their pollen baskets, and use it, mixed with wax, wherever they want to fasten any loose parts, or to fill up joints to exclude enemies or air. They make a very liberal use of it at the end of the honey season. It is a great nuisance in some districts.

CHAPTER V.

THE APIARY.

LOCATION.

Taking into consideration the climate, the native flora, and the results which have heretofore followed the introduction of bee culture, in all parts of Australasia, I feel safe in saying that there is no part of these colonies which is at all fitted for European settlement where the culture of bees may not be carried on to a greater or less extent with advantage. But it does not therefore follow that every district is adapted for the working of extensive apiaries. No person should attempt the establishment of a large apiary without first making himself acquainted with the resources of the neighbourhood, and to do this effectually he must first have a knowledge of the flora which is best suited to his purpose. A careful perusal of the chapter on "Bee Forage" will aid him in that respect, so that it is here only necessary to draw attention to the subject.

GENERAL ARRANGEMENT.

I shall here give advice with regard to what I consider the best arrangement and position for a large apiary, say, 50 hives and upwards, so that those who may only contemplate keeping three or four or more can gather from what is said the best position for their own, with due regard to their surroundings and conveniences.

The first consideration should be to have the apiary as convenient to the dwelling of the person who is to work it as may be compatible with a due regard to aspect and shelter. If it can be laid out so as to be within view of the dwelling-house, it will be all the better. It

should not, however, be so near to a public road, or to a railway, that the ground could possibly be shaken by the passing traffic. Shelter, to protect the hives from the prevailing high winds, is absolutely necessary for the welfare of the inmates. Bees do not thrive nearly so well when their hives are exposed to cold and stormy winds, and especially is this the case in early spring, when it is so essential to the bee-keeper to keep them in the best possible condition. Much time is saved in a well-sheltered apiary, as all the necessary manipulations can be got through more rapidly and securely, and with greater satisfaction to the apiarist. At the same time there must be free access to the hives on every side; and there can be no greater mistake made than that of placing hives with their backs close up to a hedge, wall, or paling; first, because the hives have to be manipulated from behind, and from the side, but never from the front; and secondly, because such a position exposes them to the ravages of spiders and other insects, and favours dampness. If the shelter is to be secured by planting, I would advise the selection of trees or shrubs which will not grow very high; ten to twelve feet is high enough for shelter, and if there be no higher trees in the immediate vicinity of the apiary, it may save much trouble in climbing after swarms. There are many kinds of quick-growing evergreen shrubs suitable for shelter hedges, from which a choice may be made; and the bee-keeper should, of course, make it a point, when planting, to get something that will also be ornamental and afford forage for bees, if he can.

The apiary must be well fenced in, so as to be secure from cattle or poultry; the ground should be dry, level, or gently sloping to the front, so that each row of hives may be on a slightly higher level than that in front of it, and clear of everything that would tend to impede a free movement about the hives. Swampy or badly-drained places must be avoided, as excessive moisture is very injurious to bees. Grass, if kept trimmed, looks very neat and tidy, keeps the ground cool in hot

weather, as compared with sand, and as a contrast to the white hives is a great relief to the eye in bright sunshine. If there should not be grass on the plot, sow a mixture of grass and clover seeds, and some bonedust over the surface in autumn and roughly rake it in, and by the following spring there will be a nice growth, which can be kept trimmed with a handy lawn mower.

SHADE.

If the apiary is arranged as I have suggested, and the hives are painted nearly white, there will be no need for providing special shade except for newly-hived swarms. I have tried all kinds of shading, and found them a nuisance. All that needs attending to is the ventilation, which is dealt with elsewhere.

WATER.

A supply of clean water within a short distance of the apiary is very necessary to the well-being of the colonies, especially through the breeding season. A shallow, clear, running stream affords the best drinking-place, but in the absence of this a supply should be provided in shallow troughs filled with pebbles under shade near at hand.

ARRANGEMENT OF HIVES.

If space permits the hives may be placed in rows ten or twelve feet apart, and the same distance asunder

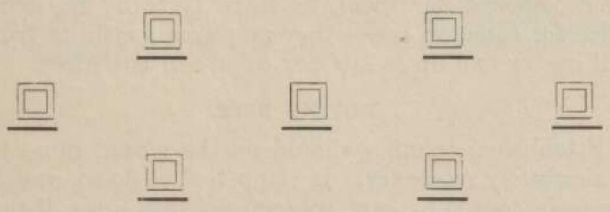


Fig. 15.—ARRANGEMENT OF HIVES.

in the rows in the plan shown in Fig. 15, though if pressed for room a lesser distance will do. For the

convenience of the bees, in giving them a free flight to the entrance of their hive, and for that of their master, that he may, when working at any one hive, not be in the line of flight to that just behind him, the rows must be so arranged that the hives in each shall be opposite the centre of the spaces between those in the row either before or behind it, as shown in the illustration.

EXTRACTING HOUSE, HONEY STORE, AND WORKSHOP.

Some kind of building is necessary in a large apiary in which to carry on the work of extracting and for storing honey, hives, etc. The size and style according to requirements will suggest itself to the apiarist. One building divided off will do, but it should be as convenient to the hives as possible. The arrangement of the extracting house is dealt with in another chapter.

STOCKING AN APIARY.

The best time to start an apiary is in spring or early summer, but it would be almost impossible in New Zealand to obtain a sufficient number of colonies at one time to start on a large scale. The apiary would have to be built up from what colonies could be obtained in the first instance and any that might be procured afterwards. Enquiries should be made from bee-keepers in the district during the previous winter as to where bees could be obtained. The price of stocks will depend upon what is asked for them, as there is really no definite price for common bees—they may cost anything from a shilling or two up to 10/ per colony in box hives.

MOVING BEES.

Established colonies should not be moved more than is absolutely necessary. If compelled to do so, and they are to be moved by cart, waggon or train some distance, a little preparation is needed. If in movable frame hives with loose frames, the latter should be secured by putting half-inch strips of wood down between the frames at each end and wedging the last one off from

the side of the hive. The bottom board is secured to the hive body by screwing two thin battens on each side to both parts, a strip of wire cloth is fastened over the entrance, and the cover is also made secure. The hives are prepared in this way over night and shifted as early as possible the next day. The chief consideration is to secure proper ventilation. In hot weather if they were going far it would be better to remove the covers altogether and tack wire cloth over the tops of the hives. If in box-hives, blow in a few puffs of smoke, then turn the box upside down, and if going far put in a paper wad between each two combs to steady them, tie some paperhanger's scrim of an open kind over the box, and they are ready for removal. If this is done near sundown very few bees will be lost, and they should be moved to their new location at once, if possible. When only to be moved a few hundred yards or less, a couple of men with a hand-barrow could with care remove the hives after dark without disturbing a single bee. In this case it is best to place some little obstruction in front of each hive without blocking the entrance, as the bees seeing something strange to them will then begin to take bearings of their new surroundings. Midwinter is the best time to move bees a short distance, as fewer bees will be lost at that time. Place a good thick layer of straw in the cart or waggon to put the hives on, and arrange the hives with the frames pointing *across* the cart or waggon, but when going by train they should run lengthways of the train.

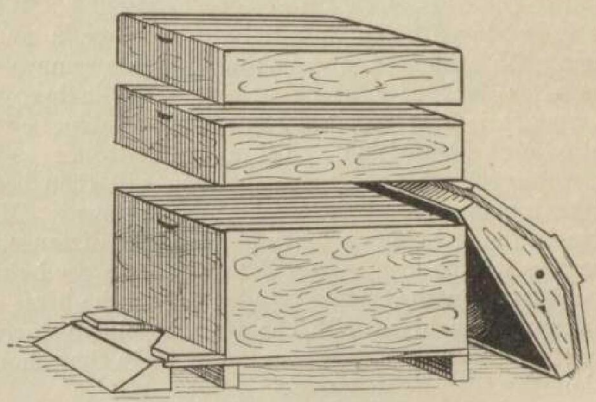
Axiom.

"BEES GORGED WITH HONEY NEVER VOLUNTEER AN ATTACK." *Langstroth.*

CHAPTER VI.

HIVES, FRAMES, AND SECTION BOXES.

Among all the aids to improved apiculture which have been invented, the movable comb-hive stands first in importance. The most advanced improvements in our system of working are traceable back to, and are the result of, this invention. Although the honey-extractor and comb-foundation are invaluable helps which no one can now afford to dispense with, they could not be made use of without the movable comb-hive. Huber had shown,



HOPKINS' IMPROVED LANGSTROTH HIVE.

nearly a hundred years ago, how to obtain control of the combs to a certain extent, and especially for purposes of observation, yet his "leaf or book-hive" was impracticable in the hands of an ordinary person, and for the ordinary purposes of bee-keeping. After Huber's time the attention of apiarists was for many years directed chiefly to improvements in straw skeps or in wooden

box-hives, in order to obtain the surplus honey in good condition, and without the destruction of the bees. The first great step in advance was made some sixty years after the publication of Huber's discoveries, when the Rev. L. L. Langstroth, of America, gave to the world the present simple form of movable comb-hive. No doubt Langstroth was greatly assisted, as he has himself informed us, by his knowledge of what Huber had done; and it is a remarkable coincidence that at the very same time he and another enthusiastic apiarist, Dzierzon, in Germany—already noticed in Chapter I.—were, unknown to each other, pursuing the same object, and that the latter produced also in Germany, nearly simultaneously with the former in America, a movable comb-hive. The two inventions were, however, quite independent of each other; and although the grand principle of having the combs in movable frames is common to both, still there is a very marked superiority in the practical working out of the American one, and it is quite certain that nothing like a simple and practicable form of movable comb-hive had been invented or was known anywhere outside of Germany until that one was introduced. Mr. Langstroth not only gave us a hive which, after the lapse of so many years, stands pre-eminent at the present day, but he also gave us his book, "The Hive and Honey Bee," which, although now necessarily somewhat behind the times in the practical work of the apiary, must always be of the greatest value to the advanced bee-keeper, containing, as it does, a full and interesting account of the writer's able researches in apiculture. I shall always have a grateful remembrance of the name of Langstroth, as I feel indebted to his work for my first insight into the advanced system of bee culture, and for the foundation of my present knowledge of the art. He has held up Huber as the "Prince of Apiarians," and I think he may himself be justly called the Huber of America.

AN IDEAL HIVE.

A complete working hive should be so constructed as to allow of any and every portion of the interior being in-

spected at pleasure with little trouble or loss of time. Its construction should be as simple as possible, consistent with strength, good workmanship, completeness, and durability. It should permit of all necessary operations (such as removal of combs, bees, brood, and surplus honey) being performed without necessarily killing a single bee. While affording ample protection from the weather, it should permit of increased or diminished ventilation at a moment's notice. It should be capable of being contracted, as regards working room, to the smallest space required at any time for the stock, and enlarged to any size that may be found necessary. The entrance should be so arranged as to be easily enlarged or contracted whenever required; the hive should permit of the surplus honey being stored in the best and most convenient form for depriving; and last, though not least, it should have as few loose parts belonging to it as possible.

THE LANGSTROTH HIVE.

I may state at once that in this we have all the qualifications that seem most desirable in an "ideal hive," and although there are a few modifications of the original Langstroth hive in use, the principle is the same in all, the only difference being in size. At the present time the modification attracting most notice in America is the "Danzenbaker" hive, so named after its constructor. Its main features are its shallow closed end frames, which, instead of being suspended in the hive in the usual way, are pivoted in the centre, and so made reversible. The original idea of the constructor was by the use of close-ended frames to obtain most of the advantages of a double-walled hive at practically no extra expense over the cost of an ordinary one, the object being to better conserve the heat of the hive, and so induce or force the bees up into the sections in the supers earlier in the season than would be the case otherwise. To this end he also made the brood frames shallower by one and a-half inches than the Langstroth frame, and reversible. It

is quite possible in a climate where the winter is long and very cold, the honey flow short, and the season comes in with a rush, the Danzenbaker hive in the hands of an experienced apiarist, who would know exactly when to reverse the brood frames, would prove advantageous. But we have none of those conditions in Australasia that would make such a hive desirable as in some parts of the United States of America. At all events I am certain such a hive and its management is too complicated for both the novice and average bee-keeper. I have digressed in order to convey to those who have heard of, but have no knowledge of the particulars of the Danzenbaker hive. I shall now confine myself to a description of the Langstroth hive, than which there is no hive more simple or popular in existence. To go into full particulars of the comparative merits of others would serve no good purpose, but only tend to confuse those desirous of adopting a good hive.

GENERAL DESCRIPTION.

The Langstroth hive complete consists of several movable parts—the floor and alighting boards (which may be attached if desired), the brood chamber or lower hive, the super (one or more), the frames and cover. The outside dimensions of the brood chamber are 20¼ inches by 16 inches by 10 inches in height, including the rabbet. The super used for raising extracted honey is exactly the same size, but the half-storey supers that can be used either for raising extracted or comb honey, while of the same length and breadth, are only 5¾ inches in height. The floor or bottom-board is the same width as the brood chamber, but four inches longer, out of which a V-shaped piece is gouged at the front end of the board, three-eighths of an inch deep, for an entrance, which allows more or less ventilation to be given according as the body of the hive is pushed forwards or backwards on the board.

The brood chamber is intended to contain ten narrow frames of comb; the super, if worked for extracting, has

generally nine of the same frames, the intermediate spaces being left a little wider than in the brood chamber. The half-story supers are made to contain either shallow frames, with section boxes, or a section rack. An inside covering mat is placed on top of the frames in the hive or super just under the cover. The stands and the bottom of the floor-board may be painted a dark colour; the hive itself is better if either white or a light tint; the top of the roof should in any case be of a pure white, in order the better to cast off the hot rays of the sun in summer.

These hives can be procured at very moderate prices, and very complete in every respect, from the manufacturers. For the convenience of those who wish to put their own hives together and to save expense in the transport, they can be had in the flat, that is, all the separate parts complete and ready to be nailed together, and packed as close together as possible in crates or packages containing generally four one-story hives, or three of two stories. If the beginner decides upon getting his hives in this way, and if there be no hives already in use in his neighbourhood, or no one to show him how to set to work, it will be advisable for him to procure one hive complete and fitted together, to serve as a pattern, and the rest in the flat.

INSTRUCTIONS FOR MAKING.

To those not skilled in the use of tools, or who have other occupation, it may be found the most profitable to purchase all their hives as they require them. On the other hand, there will always be some having plenty of spare time, who would prefer to occupy a part of it in making their own hives, had they clear instructions how to proceed. I shall now endeavour, with the aid of illustrations, to give plain instructions for making the Langstroth hive, the one I have already advised my readers to adopt.

The first and principal point to be observed is to use none but thoroughly seasoned wood that will not shrink

or twist after it is made up. Every corresponding part in all hives, be they two or two thousand, must be exactly alike to be interchangeable one with the other. The thickness of the timber used principally throughout the hive is seven-eighths of an inch; and as one-inch boards —the nearest size most easily obtained—when well seasoned are a sixteenth less, there is just sufficient substance left to allow of a smooth surface being put on one side with a plane. The body of the hive, with which I will start, is 10in. deep, and takes exactly 5ft. 11in. of board to form the two sides and two ends; so that boards 12ft x 1ft. will cut two bodies, allowing two inches for saw cuts and waste. I would advise getting 1ft. boards, as the exact 10in. can be cut after they are seasoned. Plane the 12 x 1ft. board on one side, reducing the thickness to seven-eighths of an inch, and run a trying plane along one edge till the edge is perfectly straight. Mark the depth (10in) from the straight edge, and rip off the strip; now cut from your 12ft. board four pieces 16in. long, for end pieces, and four 19½in. long, for sides; then set your gauge to mark three-eighths, and take each of your end pieces, lay them on the bench, planed side up, and run your gauge along the rough edges, marking for the rabbet D shown in Fig.

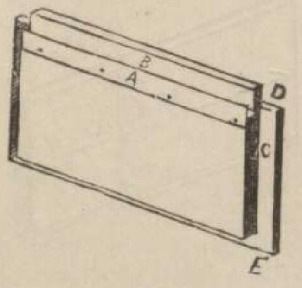


Fig. 17.—END OF HIVE (INSIDE VIEW).

17. Next hold the pieces on their edges, and mark with the same gauge in from the planed side. This will show

the piece to be taken out to form the rabbet D. The pieces should now be turned the planed edges up, and the

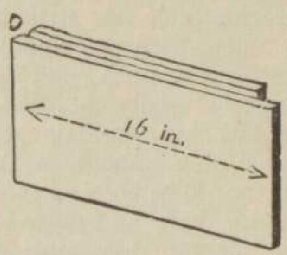


Fig. 18.—END OF HIVE (OUTSIDE VIEW).

same gauge run along the edges from the planed side of the board to mark for the rabbet E, shown in Fig. 17. Now lay the ends flat (rough side up), and mark with same gauge in from the edges for rabbet E, and also run the gauge down the ends of the boards from the planed sides to mark for rabbet C (Fig. 17). Before shifting the gauge, the rabbets on the side pieces can be marked. The rabbets D and E (Fig. 19) are marked exactly the same as the rabbets D and E in Fig. 17. We have now the rabbets D E and the edge of C marked. The gauge will then require to be set at seven-eighths of an inch

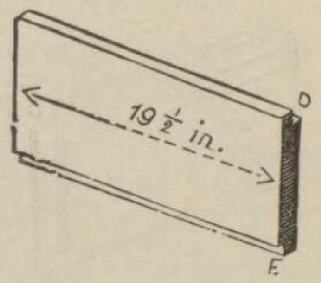


Fig. 19.—SIDE OF HIVE (INSIDE VIEW).

to mark in from the ends of the end pieces on the inside for rabbet C, Fig. 17, and also down from the top edges

for rabbet B, Fig. 17. All that is wanted now is to reset the gauge to a quarter of an inch, and mark on top edges from the inside for rabbet B, Fig. 17.

The rabbets, being all marked, will require cutting out. The best tool for this purpose I have ever used was an iron plough (American). With this tool, fitted with a three-eighths iron and set to a three-eighths gauge, it will scarcely require the marking gauge to be used. By cutting out the rabbets D and E (Fig. 17) first, some little labour will be saved when cutting C. If a saw cut is put in across the latter it will expedite the cutting. For C and B a seven-eighths iron will be required, with the gauge of the plough set to the proper depth. After the rabbets are cut, strips of tin, 1½in. wide by 14in. long, should be folded in the centre to form the metal supports A (Fig. 17). These are tacked on, as shown,

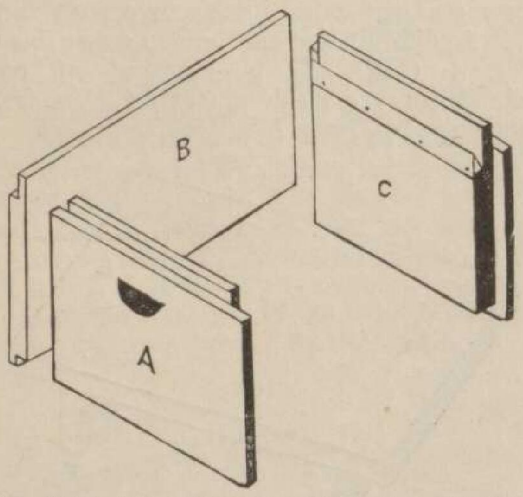


Fig. 20.—SHOWING HOW THE DIFFERENT PARTS OF THE HIVE GO TOGETHER. BOTTOM BOARD.

so as to allow the upper edges to project above the lower part of rabbets about one-eighth of an inch. Metal supports, or, as they are commonly but incorrectly termed,

"tin rabbets," are for supporting the frames, the projecting ends of which rest on them; but I shall have more to say respecting these in another place.

The ends and sides being properly formed will have the appearance of the figures and will themselves suggest how they should be put together. Fig. 20 represents the two ends and one side nearly in place; the ends of the side pieces dropping into the rabbets C (Fig. 17) should fit nicely, and be firmly nailed with three 2½in. wire nails at each end. These should not be driven through the end pieces into the sides, but through the sides into the ends, dovetail fashion.

For the platform of the bottom board a piece of board 2ft. long, 16in. wide, by 1in. thick, is required. Although this may be made out of two or more pieces, it is much better to have it in one, as the joints give facilities for moths and other insects to deposit their eggs where it is difficult for the bees to get at them. The entrance A (Fig. 21) is cut out of one end three-eighths of an inch deep, starting 1½in. from each side and running back 5in. to a point, as shown.

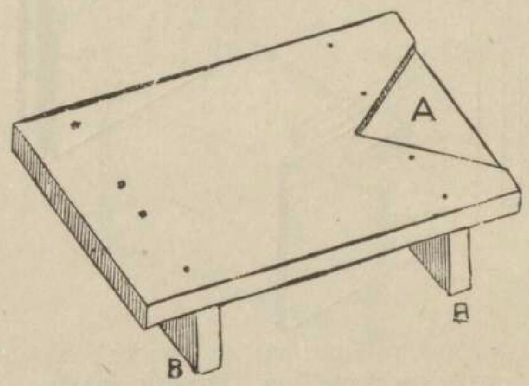


Fig. 21.—BOTTOM BOARD. ALIGHTING BOARD.

After marking it out, a saw-cut can be run on each side to save labour in chiselling. The stands B B are 4in.

wide, 1½in. thick, and 16in. long; nailed on edge, 3in. back from each end. These pieces keep the hive a sufficient height off the ground and prevent the bottom board twisting.

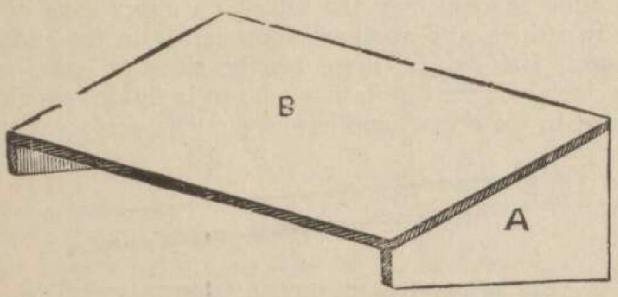


Fig. 22.—ALIGHTING BOARD.

This is a very necessary part of the hive. Placed in front of the entrance, it makes a capital landing stage for the bees, and thus saves many from falling to the ground when heavily laden. The platform B (Fig. 22) is 16in. long, 9in. wide, and five-eighths of an inch thick. The upper edge should be slightly bevelled, to fit snug against the bottom board. The pieces A are 8in. long and 4in. wide at their widest part, tapering down to 1½in. at the outer end. The handiest way of making these is to cut them out of a board 5½in. wide and 1in. thick. Every eight inches of the board will make two without any waste and save a deal of cutting.

COVER.

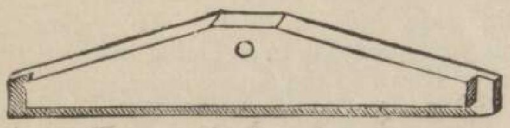


Fig. 23.—END OF COVER (INSIDE VIEW).

This is a part of the hive that requires to be very carefully made. Leaky covers are an abomination. The

ends (Fig. 23) are made in $\frac{7}{8}$in. timber, 16in. long, 4in. wide for $1\frac{3}{4}$in. in the centre, then tapering down to $1\frac{3}{4}$in. wide at each end. A rabbet, $\frac{3}{8}$in. wide by $\frac{3}{8}$in. deep, is taken out of the lower edges on the inner or rough side, to allow it to fit over the rabbet on upper edge of the body of hive, and another rabbet is cut in the ends, as shown, $\frac{7}{8}$in. by $\frac{1}{2}$in. deep, for the sides to house into. An inch hole for ventilation (shown in figure) should be bored in the centre, and have a piece of perforated zinc

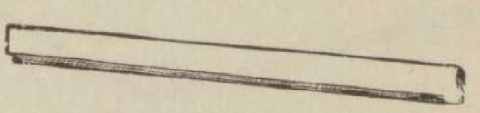


Fig. 24.—SIDE OF COVER (INSIDE VIEW).

tacked over it. The side pieces (Fig. 24) are the same thickness as the ends—$19\frac{1}{2}$in. long, 2in. wide on the insides, and $1\frac{3}{4}$in. wide on the outsides, the upper edges being bevelled $\frac{1}{4}$in. to give them a similar slope to the end pieces. The lower inside edges of these are rabbeted

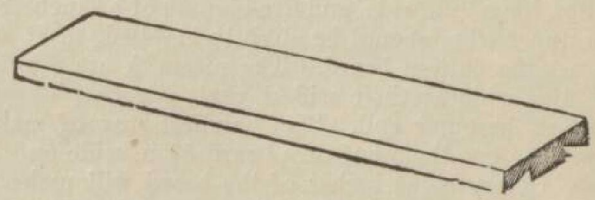


Fig. 25.—RIDGE BOARD OF COVER.

the same as the ends. The ridge board (Fig. 25) is 2ft. long, 4in. wide, and $\frac{7}{8}$in. thick. This should be rabbeted on the under side in a sloping manner, similar to the rabbets shown in the figure, tapering off from nothing at the edge to $\frac{3}{8}$in. at the deepest part. The width of each rabbet from the edge is $1\frac{1}{4}$in., leaving $1\frac{3}{4}$in. of the full thickness in the centre, corresponding with the top centre of end pieces. When making my hives by hand I had an iron fitted to my plough made the shape

of these rabbets, which was the means of saving much time and labour.

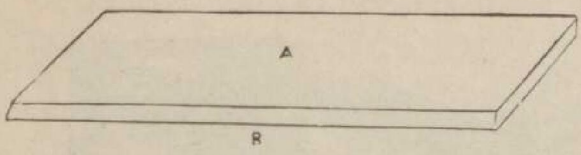


Fig. 26.—ROOF BOARD OF COVER.

The roof boards (Fig. 26) are made of $\frac{5}{8}$in. timber 2ft. long by 8in. wide, the lower edge being slightly bevelled to suit the slope of the cover.

To put the cover together, the sides and ends are nailed first; then place the ridge piece on, allowing it to project an equal distance at each end, but before nailing it, put on one of the roof boards in its place—the upper edge under the ridge, and nail through both ridge and board to the end pieces. Now nail the other board on in the same manner, and fasten both boards securely round the sides. The engraving (Fig. 27) shows the cover finished.

We have now gone through the whole hive, with the exception of the frames, and if every part is made according to the foregoing instruction, they will fit each

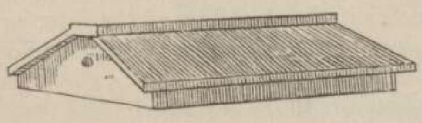


Fig. 27.—COVER COMPLETE.

other like a glove, and when two or three-story hives are required, it is only a question of having extra bodies similar to the one already described.

HALF-STORY BODIES.

These are made in exactly the same way as the full bodies, but only $5\frac{3}{4}$in. deep, and, as already explained, may be used for either extracted or comb honey.

NUCLEUS HIVE.

This hive is used both for the purpose of rearing queens and keeping spare ones in till required.

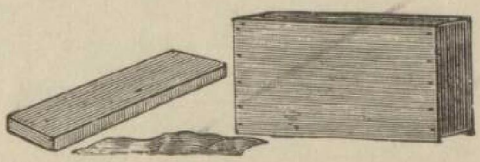


Fig. 28.—NUCLEUS HIVE, WITH COVER AND MAT.

It is the same length and depth as the ordinary hive, but is usually made to contain three frames only. It may be made out of light material and in a more simple manner than the ordinary hive. The bottom board can be nailed on, and the entrance cut out of one end of hive; the figure does not show the bottom board. The width inside should be 4¾in. or 5in. to take three frames. A full explanation of the use of it is given in the chapter on queen rearing.

OBSERVATORY HIVES.

To the majority of people there is not a more pleasing sight than the interior of a hive during the busy season, if the working of the bees can be observed leisurely without danger of receiving a sting. Hives of this nature can be so constructed as to allow of the interior being examined at pleasure by the most timid person without unduly disturbing or exciting the bees. They may be made to hold one or more frames, but as they are somewhat complicated in their construction it is best to order them from some hive manufacturer. They cost from £1 to £2, according to the number of the frames.

Good straight-grained white pine is our best timber for hive bodies, while heart of kauri pine is better suited for the covers and bottom boards. But as I have previously remarked, whatever timber may be used should be thoroughly seasoned. After being put together they should before being brought into use receive three coats

of paint of a very light slate colour approaching white. Zinc white with a little black in it I find best, as it

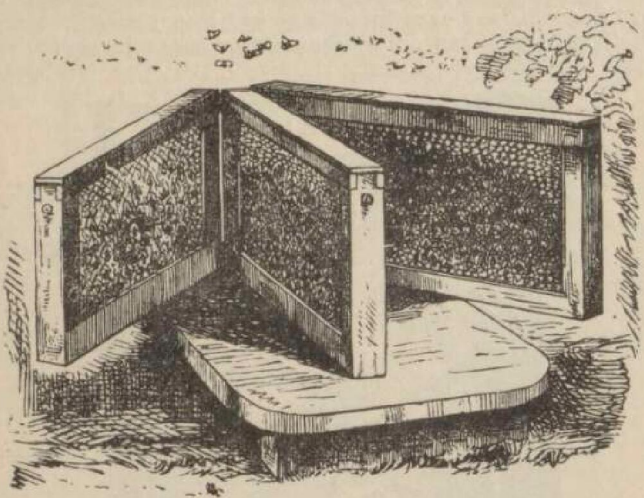


Fig. 29.—A THREE-FRAME OBSERVATORY HIVE. TIMBER FOR HIVE-MAKING AND PAINTING HIVES.

stands the longest. One coat every two years after will preserve the wood for many years and tend to keep the hives cool in hot weather when exposed to the sun.

FRAMES.

Of late years the Hoffman self-spacing frames have deservedly become very popular. So far back as 1878 I tried self-spacing frames, and discarded them as a nuisance, but they were made on a different plan to the Hoffman. The latter, so far as I can see, is almost perfect as a self-spacing frame.

The following is what Mr. Root says of them:—

"This is undoubtedly the best frame yet invented. It seems to combine in itself nearly all the good features needed, and for a hanging frame it is the best self-spacer we know of. It economises labour in that it can be handled in groups of three or four; and any particular frame can be removed without thumbing over nearly all the other frames in the hive to

get room. Beginners and even careless bee-keepers of some experience cannot fail to get them spaced just right. There is no guessing or haphazard fingering; and the consequence is, the combs are even in surface, and of uniform thickness. In these days when out-apiaries are so much in vogue, and

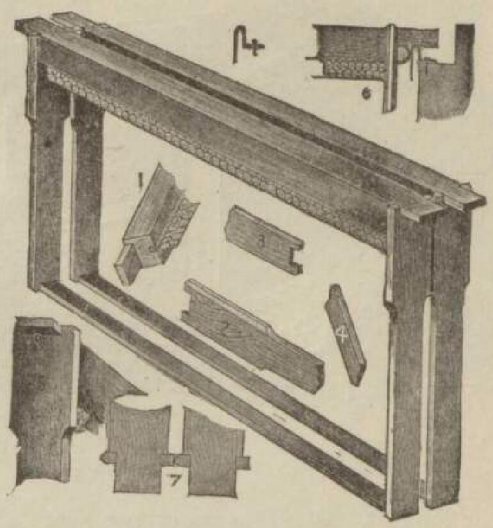


Fig. 30.—THE HOFFMAN BROOD AND EXTRACTING FRAMES.

hives are moved from one point to another, it is highly important the frames be of a kind that will stand hauling from place to place, even over rough roads; and in this respect the Hoffman fills the bill perfectly.

"The end-bars are scant §in. thick, 1in. wide at the narrowest part, and 1§in. at the widest. At the point of contact between the two frames, one edge is a blunt V-edge and the other square. This, in our experience and in that of most of our customers, gives altogether the best satisfaction. When both edges are square, propolis accumulates in considerable quantities—so much so that it increases the spacing to an extent that, if the hive is a little narrow, it is difficult to remove the frames. The V-edge, on the other hand, when pressure is applied, will cut through the propolis, thus maintaining the original spacing from centre to centre.

"The top-bars are of the regulation 1 1-16 x ⅞ thick. On the under side there is a double groove, in one of which the foundation is inserted, and in the other a long wedge-shaped strip. When this last is driven into position so that the wedge its entire length is below the general surface of the wood by a slight fraction, it will hold its position, and the foundation itself will be firmly secured."

SHALLOW EXTRACTING HOFFMAN FRAMES.

These are coming largely into use, and have been greatly appreciated where tried. It has been found that where the honey is extra thick, requiring an increased speed in the revolutions of the extractor to throw out the honey, the full depth combs—even when wired—are

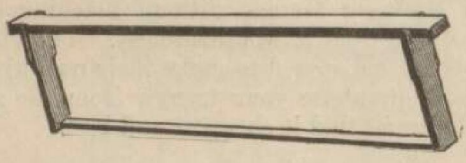


Fig. 31.—SHALLOW HOFFMAN FRAME.

very liable to be damaged, and to bury themselves into the wires of the extractor baskets, thus preventing the honey from coming out.

The shallow, or half-combs, not only stand the strain better, but the trouble and expense of wiring is saved to a great extent, while a lighter grade of foundation can be used. Another advantage may be mentioned, that with broad frames the half-stories can either be used for extracting purposes or for raising comb honey in sections.

BROAD OR SECTION FRAMES.

These are made of a size to hold four 1lb. sections as shown in Fig. 32. The top and bottom bars are the same length as the brood frames, but slightly over 1½in. wide, while the end bars should be a full 4¼in long by 1⅝in. wide.

ABOUT MAKING HIVES AND FRAMES.

Now, there is no reason why a handy man with tools should not be able to make a very decent and accurate hive, but when it comes to frames I feel certain there is

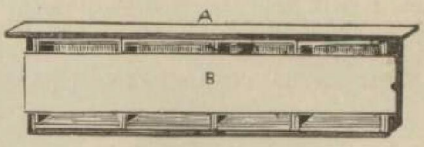


Fig. 32.—HALF-STORY FRAME WITH SECTIONS AND TIN SEPARATOR.

not on an average one out of every fifty men could turn out good Hoffman frames without machinery, to say nothing of the time it would occupy. Therefore, even to those who are disposed to make their own hives, I say by all means purchase your frames from the manufacturers. You will find it cheapest and best.

NUMBER OF FRAMES TO A HIVE.

The hive I have given instructions for making will take ten narrow frames in the brood chamber, and ten (sometimes nine) shallow extracting frames or seven section frames in the half stories. Some bee-keepers in America for a purpose use an eight-frame Langstroth hive; but I feel safe in saying that the brood chamber of such a hive would be too small for the Australasian colonies.

MATS FOR COVERING FRAMES.

Mats answer two purposes—for keeping the bees below the tops of the frames, and conserving the warmth of the hive. They may be made of any thick, coarse material, like light sacking stuff, and should fit accurately over the frames.

SECTION BOXES.

These are now indispensable for raising comb honey, which so many consumers prefer. They are cleanly, very

taking in appearance, and a nice marketable package. These are made by machinery out of one piece of timber, and grooved so that they fold up to make the complete

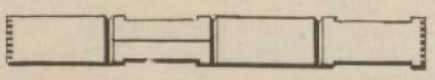


Fig. 33.—ONE-PIECE SECTION.

box, while they are dovetailed at the ends so that they fasten together without trouble, as shown in Fig. 34.

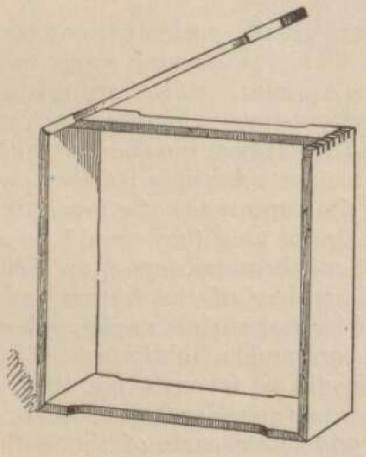


Fig. 34.—ONE-PIECE SECTION BOX FOLDED.

The best section boxes made and obtainable in these colonies are imported from America. They are very accurately made out of basswood, and sandpapered on the outside. They are as near perfection as possible. Their dimensions for the Langstroth hive are 4¼in. square by 1⅞in. wide, and contain when full just about 1lb. of comb honey. They are to be obtained from those who supply hives, etc. The above figure shows a section box partly folded and ready to receive the sheet of comb foundation, which is explained further on.

SEPARATORS.

In raising comb honey it is most desirable to have the section boxes uniformly filled, the combs of an even thickness throughout, built with perfectly flat faces, and not projecting beyond the edges of the sections. To this end temporary partitions or separators are generally placed between each two rows of section boxes while in the hive. Were the bees not confined to each particular box by these divisions or walls, we should be likely to find the combs built very irregular and bits of wax stuck about the edges of them.

Separators are usually made of tin or very thin wood. Just now the "fence" separator seems to be the most popular one in America. They are made of very thin wood slats, thirteen-sixteenths of an inch wide; four of these are bound together at the ends by tin doubled over. There is a space for a bee-way between each two slats, which gives it the appearance of a four-rail fence, hence its name. If tin be used they should be made of very light material, cut three-quarters of an inch longer than the outside dimensions of the frames and 3½in. wide; the ends should be bent at right angles, to hook, as it were, round the end bars, and be lightly tacked to keep them in place. Care should be taken to put them on perfectly flat, and to leave an equal space of a quarter of an inch at the upper and lower parts of the sections to allow the bees to pass in and out and from one box to the others (see Fig. 32).

SECTION RACKS AND CASES.

Hitherto I have only mentioned the broad frame system in connection with sections, but there is another method of placing section boxes on a hive which dispenses with the frames. What is termed a rack is formed, consisting of a light framework of wood, across which thin laths are nailed three-eighths of an inch from the bottom at equal distances apart; on the edges of these the sections rest. The rack is set on top of the frames,

and takes the place of an ordinary super; a deep cover fits over all, and rests on the hive.

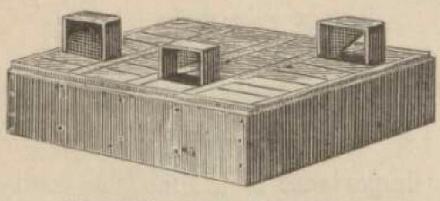


Fig. 35.—SECTION CASE.

The half-story super with very little trouble may be converted into a section case similar to that illustrated; the ordinary cover would then do. The length of the inside is 18½in., and as this space is to take four 4¼in. sections and three division boards (see Fig. 35), we must make the latter of half-inch material, or rather less, so that the sections may slip into their places readily. The divisions should be cut 4¼in. wide and 14¼in. long (the width of the case), and nailed in the body, so that they will divide the length into four compartments of a full 4¼in. each. The upper edge of each division board should be a ¼in. below the top edge of the case. Three strips of stout tin, or, what would be better, thin galvanised iron, 14¼in. long by 1in. wide, are now required; down the centre of each punch a few holes, and nail them along the bottom edges of the divisions, allowing the strips to project a quarter of an inch on each side; these projections are to rest the sections on. Two more strips are required for the ends of the case, which must be bent along their length, so that they may be tacked on in their proper places, allowing only ¼in. to stand out as a support for the sections. The case is now complete.

CHAPTER VII.

THE HONEY EXTRACTOR AND MANIPULATION OF EXTRACTED HONEY.

Next in importance to the movable comb-hive itself, as an apiarian appliance, ranks undoubtedly the honey-extractor. By its means we are enabled to obtain the liquid honey in perfect purity from the comb, in the form best suited for storing and for transport, and without injury to the combs themselves. These can in this way be made to do duty over and over again, a matter which has an important effect upon the quantity and the cost of the honey produced each season by one colony of bees. Without the extractor the improved form of hive could not have developed half its real advantages. It would, of course, have enabled us, as it does now, to raise comb-honey in the best condition, but the importance of honey as an article of general consumption and of commerce could never have been anything like what it is at present if we had been obliged to follow the old system of obtaining it in a liquid state from the combs.

Since the first extractor was invented by Major Francisco de Hruschka, of Venice, in 1865, very great improvements have been made in it at different times, two of the most important being the reversible basket and the side gearing. The two extractors generally used at the present time are Root's "Novice" and "Cowan's Reversible," the latter being the best and most popular.

THE NOVICE'S EXTRACTOR.

The Novice honey-extractor is made on the old principle of fixed baskets, which are fast going out of date, its chief recommendation being that it is somewhat cheaper than the reversible basket extractors, which is

sometimes a consideration with beginners. A glance at Figures 37 and 38 showing the interior of the Cowan Extractors will give a clear idea of the inside gearing

Fig. 36.—TWO-FRAME NOVICE EXTRACTOR.

of the Novice, the difference being that in the latter the baskets do not reverse, which will be explained further on.

THE COWAN REVERSIBLE EXTRACTORS.

Mr. T. W. Cowan, proprietor of the "British Bee Journal," and who is undoubtedly one of the leading authorities in the world on bee matters, some 15 or 18 years ago introduced an extractor in which the baskets containing the combs could be reversed when one side of the latter had been relieved of their honey. This was a very great improvement on the old style, but these have since been greatly improved in detail by Mr. Cowan and others, and they are to-day the best and most serviceable extractors in use. Unlike the "Novice," which is only made in the two-comb size, the Cowan is made in the two, four and six-comb sizes, as shown on following page.

So far back as 1883 I had made and used a six-comb reversible extractor; it was constructed after my own

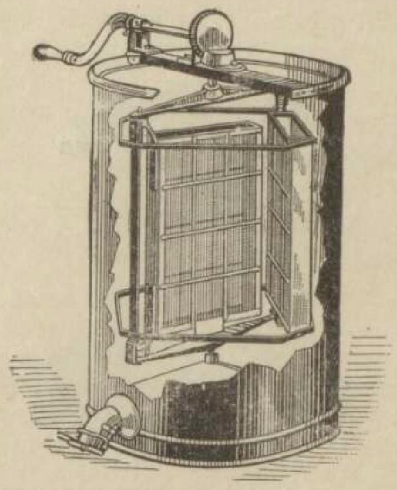


Fig. 37.—TWO-FRAME COWAN.

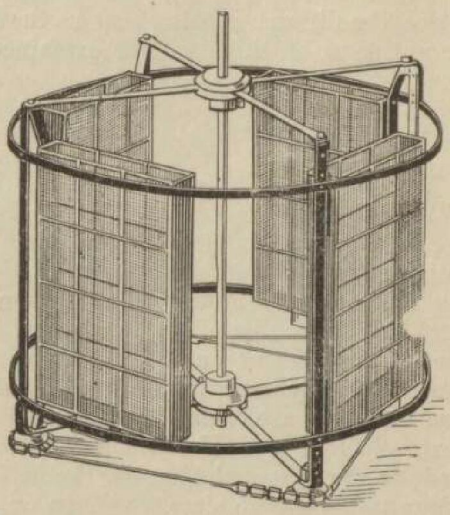


Fig. 38.—REEL OF FOUR-FRAME COWAN.

design, and answered the purpose admirably. It was first driven direct from the handle fixed to the perpendicular shaft, as shown, but was subsequently fitted with side gearing.

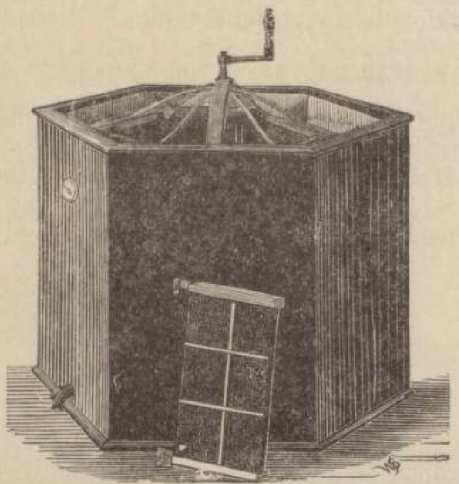


Fig. 39.—REVERSIBLE SIX-COMB HONEY-EXTRACTOR WITH ONE BASKET DETACHED.

As designed and used by Mr. I. Hopkins at the Matamata Apiary in 1883 and following years.

As an incident worth mentioning I have, with the aid of two men—one man uncapping, one at the extractor, and myself at the hives—kept a full stream of clover honey running through the two-inch tap without cessation from 9 a.m. till past 5 p.m.

THE PRINCIPLE OF THE HONEY-EXTRACTOR.

The principle is the same in all extractors, whether they have fixed or reversible baskets: the honey is thrown or extracted from the combs by centrifugal force first from one side and then from the other. In the fixed basket extractors the frames of comb after being relieved of their honey on one side must be lifted out of the ex-

tractor and turned round, whereas in the others the basket is simply reversed, bringing thereby the opposite faces of the combs outwards. This not only effects a great saving in time, but prevents the breakage of new combs, which is unavoidable with the fixed baskets.

PREPARING COMBS FOR EXTRACTING.

As a rule the combs intended for extracting are left in the hives until the cells are sealed or capped. This is a sure indication that the honey is in good condition, as the bees will not seal up any which has not been properly "ripened." In cool and moist weather, when the

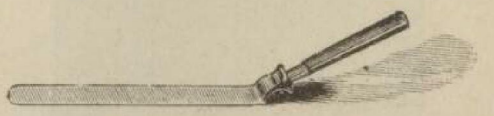


Fig. 40.—ROOT'S UNCAPPING KNIFE.

nectar brought in by the bees is very thin, it is hardly safe to extract the honey before it is sealed, as it may, if not artificially ripened afterwards by evaporation, show a tendency to ferment. In hot weather, however, when the honey is pretty thick, it may safely be extracted as soon as the cells are filled and before the bees have had time to seal them over. When this can be done it saves much valuable time, some labour, and some injury to the combs, inseparable from the process called "uncapping." In most cases, however, some portion, if not all

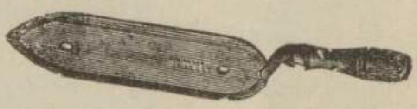


Fig. 41.—BINGHAM PATTERN KNIFE.

the surface of the comb will require to be uncapped before being put into the extractor, and for this purpose an uncapping knife is necessary. These are made of various forms, two of which are shown above.

The blade of the knife is of steel, thin, and sharpened on both sides. The Bingham pattern knife takes more of the form of a trowel, except that it is much thicker in the blade and has bevelled edges. After using both kinds I much prefer the latter. With the aid of one of these knives the operator, after a little practice, can shave off the cappings very easily and cleanly, with the least possible injury to the tops of the cells. While this is being

Fig. 42.—DADANT UNCAPPING CAN.

done the comb must be held on end over an uncapping box or can, so formed as to retain the wax cappings, to be afterwards melted down, and to allow the honey, which is sometimes unavoidably cut off with the cappings or which may trickle from the comb during the operation, to pass through a strainer into a receptacle provided for it. Various contrivances are adopted for this purpose. The "Dadant" (Fig. 42) is the one I have generally used, and can recommend. It is somewhat like the cylinder of a honey-extractor, but made in two

parts—the upper one, to the bottom of which the strainer is attached, slipping a short distance into the lower one. The cone rising from the bottom of the can gives support to the strainer.

Sometimes it is advisable to extract the honey out of a piece of broken comb, or a whole comb not built in a frame. For this purpose a so-called broken-comb basket of the form shown below (Fig. 43) is convenient.

The two pieces of wirecloth are joined by hinges at C C. A wire, with two bent ends, B B, passes through the tin frame of one piece, and can be easily turned to

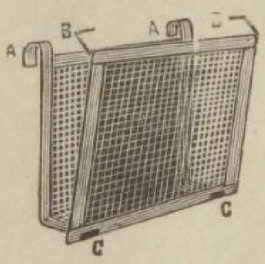


Fig. 43.—BROKEN-COMB BASKET.

hook into the other frame at A when the comb to be extracted has been placed between the two; the whole is then suspended on the top bar of the extractor-basket by means of the hooks A A.

MANIPULATION OF EXTRACTED HONEY.

The honey as it flows out of the extractor is by no means in a fit condition to be filled into the vessels in which it is to be stored or sent to market; no matter what care is taken with the uncapping and extracting, there will be some pieces of wax mixed with the honey, and perhaps some larvæ or dead bees. If it be passed through a suitable strainer, all these foreign substances may be removed, or if it be collected in a tank and allowed to settle long enough, until they, being lighter than honey, accumulate on the surface, the clean honey may then be

drawn off from the bottom of the tank, through a tap or honey-gate. To obtain the honey in the best possible condition, it is desirable that both these processes—the straining and the settling in the tank—should be gone through.

ARRANGEMENT OF EXTRACTING-HOUSE.

Much may be done to save time and labour by a proper arrangement of the extractor, strainer, and tanks in the extracting-house. The sketch of the ground plan of such a house, drawn by the late Mr. T. J. Mulvany, shows the

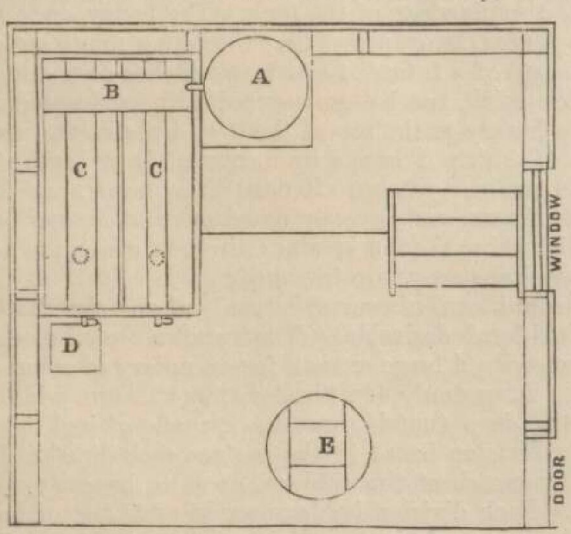


Fig. 44.—GROUND PLAN OF EXTRACTING-HOUSE.

arrangement above referred to, by means of which the honey is allowed to flow direct from the extractor into a strainer, and thence into a tank, the whole process being automatic, so that the pure honey can ultimately be drawn off from the tank without further trouble, direct into the packing tins or other vessels.

In Fig. 44 A represents an ordinary two-comb extractor, fixed on a platform about 2ft. 7in. above the

level of the floor at one end of the extracting-house; B, the strainer; C C, a double tank; D, the position of a 60lb. tin or other vessel ready to be filled from the tank; and E, the uncapping can.

The strainer is a vessel of strong tin, stretching across the double tank, on the outer edges of which it rests by means of flanges attached to its ends. The bottom, for one-half its length, is close, the other half having a fine wire gauze (sixteen wires to the lineal inch) let in and soldered like a milk strainer. By simply turning the strainer end for end, it can be made to work into either of the two divisions of the tank. The honey, as it flows from the extractor, passes first through a rough strainer, consisting of a frame of wood, two inches deep and half an inch thick, the bottom covered with perforated zinc, fitting loosely in the top of the deep tin strainer, on the sides of which it hangs by means of bent lugs. This coarse strainer catches all dead bees, larvæ, and large pieces of wax, and is easily lifted out and cleaned without disturbing the fine strainer, through which the honey passes more slowly into the tank.

The tank can, of course, be made of any size that may be considered desirable. That shown in the sketch was considered large enough for an apiary of a hundred hives. It was only 4ft. 2in. long, by 2ft. 6in. wide, and 1ft. 4in. deep (outside measure), made of inch boards, with a division board in the centre; each division lined with strong sheet tin, soldered so as to be quite watertight. Each division holds upwards of 500lb. of honey. The tank is made in two divisions in order to admit of the honey of any one day's extracting remaining to settle all the next day, even if extracting be going on every day. If more than 500lb. of honey be likely to be extracted in any one day, the tank should be made larger. The process of double straining and settling in the tank tends materially to ensure the complete "ripening" of the honey, and being, as already observed, automatic, it saves all manual labour, all waste of honey, and ensures perfect cleanliness.

I had two double tanks at Matamata, of the following dimensions (inside measure): 6ft. x 4ft. x 18in. deep; each double tank held over 1,800lb. when level full of honey of the specific gravity of 1.488. For a short time each season I found I required both in use at one time, and had over 3,600lb. in the two tanks. If the extracting house is large enough, two such tanks can easily be placed across the room, with the extractor stage between them; so that when one tank is full, the extractor will only require turning round to the other. They are made of 1¼in. timber, lined with stout tin.

HONEY-HOUSE ESCAPES.

No matter how careful a person may be, it is practically impossible to avoid getting a large number of bees every now and again into the extracting-house during the season of extracting. The house, of course, should in the first place be built as near bee-proof as possible; in fact, there should be no spot where a bee can get in when the door is shut, or there will be trouble. Bees are unavoidably carried in when taking the combs backwards and forwards to and from the hives, and as bees fly to the windows when trying to escape, advantage is taken of this to get rid of them without opening the windows by fixing an escape or two on top through which the bees pass to the outside without being able to return by them. They are made somewhat similar to the "Porter" bee escape. A much better plan, however, is one I adopted myself. I had the windows of my extracting and honey-house pivoted in the centre, and fitted so that they would revolve. All I had then to do when the bees accumulated on them was just to give the windows a half turn, when, hey, presto! the bees would be all outside in a flash.

CHAPTER VIII.

COMB FOUNDATION.

The third great improvement introduced of late years, taking rank only after the inventions of the movable frame-hive and the honey-extractor, is that of furnishing the bees with the foundation or septum of the combs which we wish them to build. By this means we are now enabled to dictate to the busy little workers exactly where a comb is to be built, and whether it shall contain

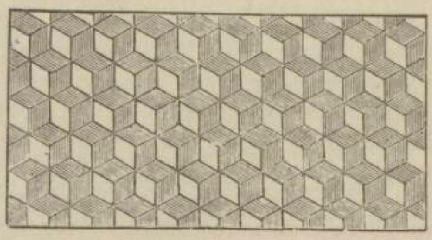


Fig. 45.—COMB FOUNDATION.

worker or drone cells; to secure its being built quite straight, and with an even surface; and to save the bees a great deal of time in the secretion of wax just at the period when their labour can be best employed in the storing of honey. The need of something of the kind must have been felt more or less since bees were first domesticated, but we have no records of anything being attempted to provide such a boon until 1842. From that time on until 1877 various unsuccessful experiments had been made, but in that year Mr. A. I. Root succeeded in bringing it to such a state of perfection that it came into general use shortly after. In 1878 I obtained my first machine from A. I. Root, which was one of the very first to be sent out of America.

ADVANTAGES DERIVED FROM ITS USE.

It has already been stated that bees require to consume a large quantity of honey—taking the mean of experiments, about twelve pounds—in order to secrete one pound of wax. Assuming the honey to be worth only fourpence per pound, each pound of wax thus secreted represents a value of four shillings. By supplying wax foundation, which costs much less, we save considerably in that way. A still greater advantage is the saving of time to the bees, and the opportunities thus given them to store a much greater quantity of honey. Not only can they store, instead of making into wax, some eighteen pounds of honey or thereabouts, represented by some pound and a half of foundation supplied to the ten frames of a hive, but they can have the ten combs fully built out in one-fourth of the time that would be devoted to the building of entirely new comb; and all the bees that would be so employed are set free to store honey instead. We may reckon that in an ordinary season a fair swarm will work out the ten sheets of foundation in a Langstroth hive in one week; without the aid of the foundation it would take them four or five weeks. The time thus gained may make all the difference between profit and loss in a short honey season. Besides this saving of time and gain in honey, we secure straight and even combs, such as are rarely, if ever, built without the aid of foundation; we can control the building of drone-comb, and consequently the breeding of drones within such limits as may be deemed advisable; and it will be found that, even without the precaution of wiring, the combs so built will be much stronger and will withstand the strain of extracting much better than those built without foundation. It is also of very great value in the case of swarms hived late in the season, which are thereby enabled to build their comb in a short time, and put themselves in a better condition for the winter.

PROCESS OF MANUFACTURE.

Within the past six or seven years there has been quite a revolution in the process of manufacturing comb foundation. Instead of making it by the old process of sheeting the wax from the molten condition, it is now made by large manufacturers from the cold blocks of wax put through machinery under a tremendous pressure. This process was first invented by a Mr. Weed in America, and the manufactured article is now known as the "Weed" foundation. There can be little doubt that it is much superior for general use than the ordinary foundation. The process is patented, and as the cost of the permit and machinery to manufacture it runs into a large sum of money, it would not pay anyone in this colony to buy the patent, etc., so that the Weed foundation used here must be first imported, which makes it more expensive than the ordinary foundation made in the colony. Latterly, however, there has been some very superior comb foundation manufactured in these colonies under a new process, which I consider quite equal to the "Weed." It was sold in large quantities last season for the first time in New Zealand by Messrs. Bagnall Bros. and Co., of Auckland. For private use the ordinary foundation is as good as is needed, and much can be saved by those running more than 100 colonies by making their own. But where there are many less than 100, I would advise the bee-keeper to purchase what he requires. As there are sure to be bee-keepers from time to time desiring to make their own, I will give details for making the ordinary foundation to guide them. It is now generally understood that all the foundation made bears the impressions of worker cells only. The wax used for this purpose must be not only pure beeswax, as already stated, but must also be as clean as possible; any dirt mixed with the wax tends to make the foundation brittle. When melting the wax a double boiler should always be used, the inner one for the wax and the outer one for water, in order to prevent the wax from burning; burnt wax is

of no use for foundation. To make rapid work two such double boilers should be used, one in which the wax is melted from its cold state, the other to be kept supplied with melted wax at the proper temperature and used as a dipping boiler. The next things needed are a tub of cold water, two or more dipping boards the length of the

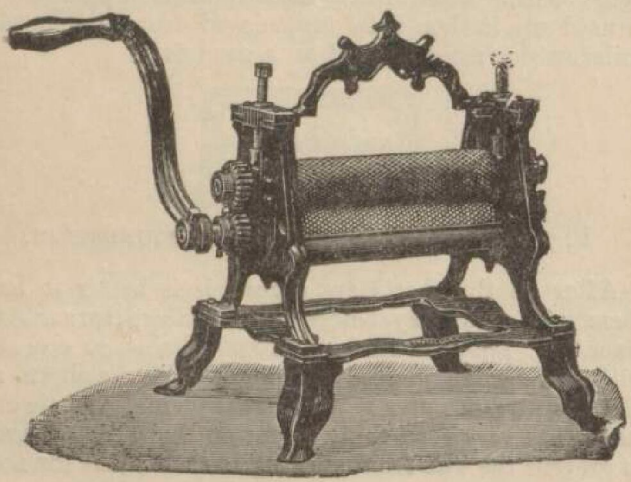


Fig. 46.—A. I. ROOT'S 10IN. ROLLER MACHINE.

sheets required, and a thin knife. The boards should be made of very thin wood—or stout galvanised iron will answer—and made so that they can be reversed when dipping. Wax melts at a temperature of about 145° Fahr., and the contents of the dipping boiler should be kept at very little over that temperature. The boards, after being soaked in the cold water and drained, are at first just slightly touched over with soapy water to give them a start; care should be taken to use no more soap than is absolutely necessary, as it is said the bees dislike it. Take a board and dip it overhead in the wax; lift it out and let it drip; as soon as it has ceased to drip, quickly reverse the board and dip it overhead again; and

repeat the process until the sheet is of the desired thickness. Two or three times is sufficient for stout foundation, and once or twice for thin. After the last dip plunge the board into the cold water, and if everything is right the sheets will peel off without trouble. If the wax is too hot the sheets will break, if too cold they will stick to the board. According as the wax in the dipping boiler is used up it should be replenished from the melting boiler, which must be kept on a good fire.

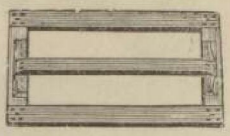


Fig. 47.—GAUGE FOR TRIMMING FOUNDATION.

After all the sheets are dipped it is better to leave them until next day before putting them through the machine. They should be nice and pliable, or else they will break when pressed or rolled. If the sheets are placed in warm water it will soften them. A little thin starch is a very good thing to put on the rollers in order to prevent the wax from sticking to them; tins for holding the starch are supplied with the machines. As the sheets require trimming to fit the frames after coming from the machine, a gauge should be made for that purpose as shown above.

By laying five or six sheets squarely together, and the gauge on the top, so many can be trimmed at once with the aid of a sharp butcher's knife. The sheets of foundation should be cut a quarter inch shorter and half an inch shallower than the inside dimensions of the frames.

FASTENING FOUNDATION IN FRAMES AND SECTIONS.

The Hoffman frames and the sections are so made now that there is no trouble in fastening foundation in either. The sheets are cut the proper size for both, and a glance at the frames and sections will at once suggest the proper method—no melted wax is required as formerly.

WIRING FRAMES AND FOUNDATION.

In order to prevent sagging or bulging of the foundation, owing to undue heat and the weight to which it is sometimes exposed during the operation of comb building, and especially to prevent breakage of the comb when thick honey is being extracted, it has been found desirable to strengthen the septum in some manner. Thin

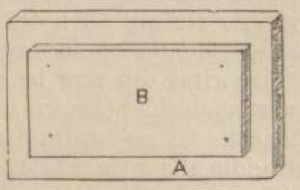


Fig. 48.—WIRING BOARD.

wire run through the foundation and attached to the frame has been found to answer best. Formerly the wires were put into the frames vertically, but it is now found that the horizontal method is by far the best.

The ends of the frames should be pierced with a small bradawl 2in. apart, 1in. from the top bar, and $\frac{3}{4}$in. from

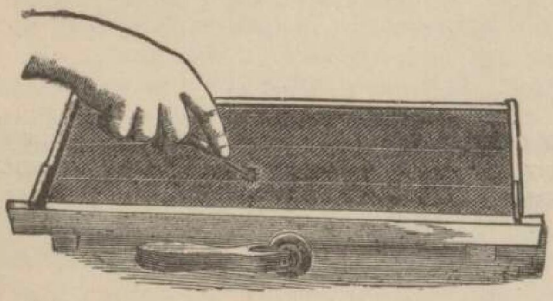


Fig. 49.—SPUR WIRE EMBEDDER IN USE.

the bottom bar. This will provide for four horizontal wires—No. 30 tinned wire should be used, care being taken not to draw the wires too tight. A glance at Fig. 49 will suggest the method.

IMBEDDING THE FOUNDATION.

Cut an inch board (A in Fig. 48) a little larger than the size of the frame; on this screw another piece, B, three-eighths of an inch thick, cut slightly smaller than the inside of the frame, letting the grain of each board cross that of the other, which will prevent twisting. Lay a sheet of foundation on the board B, and a wired frame over it, resting upon the lower board A. One edge of the sheet should be close against the top bar of the frame. The wires can now be embedded by the use of the spur wire embedder (shown in Fig. 49), which is provided with teeth set something like the teeth of a saw, so as to straddle the wire while in the process of embedding it. The comb foundation should, of course, be warm enough to be pliable, otherwise the wire will not embed itself.

Axiom.

IN DISTRICTS WHERE FORAGE IS ABUNDANT ONLY FOR A SHORT PERIOD, THE LARGEST YIELD OF HONEY WILL BE SECURED BY A VERY MODERATE INCREASE OF STOCKS.

CHAPTER IX.

MANIPULATION OF BEES AND FEEDING.

The common, but erroneous, idea prevailing amongst those who have paid little or no attention to the nature and habits of the honey-bee, that to go near one is to run a risk of being attacked by it, may, I think, be attributed to the fact that they have had instilled into their minds while young an idea that the bee is an enemy they have to fear. It is not an uncommon occurrence for a mother, on seeing her infant near flowers on which there are bees flitting about, to say, "Oh! come away, my child; there's a bee, it will sting you," and she immediately takes the child away from the supposed danger. This lesson, to dread the bee, thus early inculcated, is never forgotten.

Again there are many people who believe that bees have a special aversion to them, that they cannot go within fifty yards of one, as they will sometimes tell you, without its making for them and "declaring war;" and no amount of persuasion will convince them that they may be mistaken. A person who has this idea firmly fixed in his mind is likely to act in such a way when a bee is near him as to invite its attack, and so condemn the bee for what he has himself, unconsciously perhaps, been the cause of. It is my opinion that if there are any such people that bees attack without apparent provocation they are very few indeed, and that no one, as far as my experience teaches me, is more liable to be stung than another provided they both act in a like manner. People of a nervous temperament as a rule make very poor manipulators.

HANDLING BEES.

There are certain fixed rules to be observed when handling bees if freedom from stings is to be secured. The most important are: 1st, to avoid jarring the hive;

2nd, to avoid breathing into the hive or upon the bees; 3rd, to avoid making any quick movements about the hive; 4th, to be careful not to stand in the line of flight to the hive; 5th, let all manipulation, as far as possible, be conducted during fine weather and while the bees are flying; 6th, the operator should act in a fearless but gentle manner; and 7th, never strike at a bee, but when one gives warning of stinging bow the head slightly, if unprotected with a veil, and walk slowly away.

Bees are more irritable during cloudy or showery weather, owing, perhaps, as it is said, to the peculiar electrical conditions of the atmosphere. Queenless colonies are more easily provoked to anger than when in their normal condition. So marked is this as a rule

Fig. 50.
WIRE CLOTH BEE-VEIL.

Fig. 51.
TARLATAN BEE-VEIL.

that I can often detect them on first opening the hives. The scent of the poison from their stings will excite bees, and the crushing of one while manipulating will usually make the rest very angry. For the protection of the face the manipulator can wear a

BEE-VEIL.

This should be made of some light material, such as leno or tarlatan, long enough to hang from the brim of a hat to the lower part of the chest, when there will be ample to tuck under the collar of the vest or coat (Fig. 51). A piece of strong elastic run through a hem round the top will keep it tight and close round the hat, which is the better for having a broad brim. Some bee-keepers prefer having a piece of wire cloth sewed into the veil (Fig. 50), on account of the wire being less obstruction to the sight and not confining the breath so much as the other material. A bee-veil should always be worn by a beginner; it gives him a sense of security, and therefore more confidence. My first veil was made about three years after I commenced bee-keeping. I never felt the need of one till I commenced to handle Cyprian hybrids pretty extensively.

BEE-GLOVES.

These I have never worn, therefore I cannot say whether they are useful or not, but as it seems to me that I require the most perfect freedom with my fingers for handling the frames, I should think gloves of any kind on the hands are an encumbrance. Indiarubber gloves are usually sold for this purpose, but a pair of thin woollen gloves covered with cotton ones, and the whole dipped in a strong solution of soda and water, have been highly recommended. I should think that if gloves be worn at all the extreme joints at least of the fingers and thumbs ought to be left free.

QUIETING BEES.

During the season, when honey is being gathered rapidly, bees as a rule can be handled without showing any signs of displeasure, but at other times it may be necessary to proceed with caution, and have at hand some means of quieting them should they resent our interference. Smoke is one of the best bee quieters we

have; a few puffs will generally cause them to gorge themselves with honey, in which condition of super-abundant fulness they may be handled with impunity.

SMOKERS AND SMOKER FUEL.

Smoke without a doubt is the best bee quieter at the bee-keeper's command. There is no need to smother or stupefy the bees with it; a few puffs are sufficient to bring them under control. Two of the best smokers in

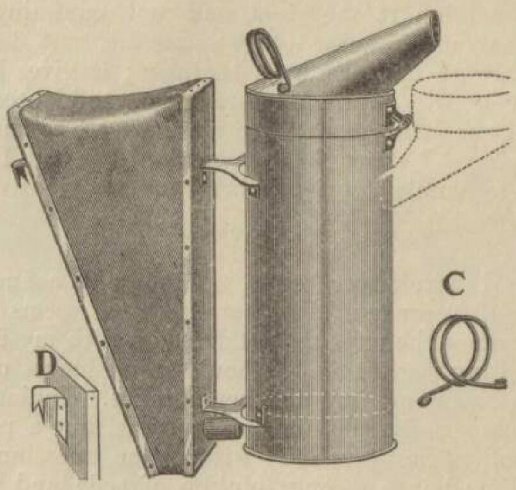


Fig. 52.—IMPROVED CORNEIL SMOKER.

use at the present time are the "Improved Corneil" and the Breech-loading Vesuvius shown in the two engravings. The principle is the same in each, but the "Corneil" is loaded from the top, while the Vesuvius is loaded from the bottom, which appears to be a decided improvement. They both answer the purpose admirably.

Dry rotten wood I have found an excellent fuel for smokers, also old dry sacking cut into strips about 4in.

wide and rolled up loosely in rolls that will conveniently go into the smoker. A few live embers put in with the fuel on top and some puffs from the bellows

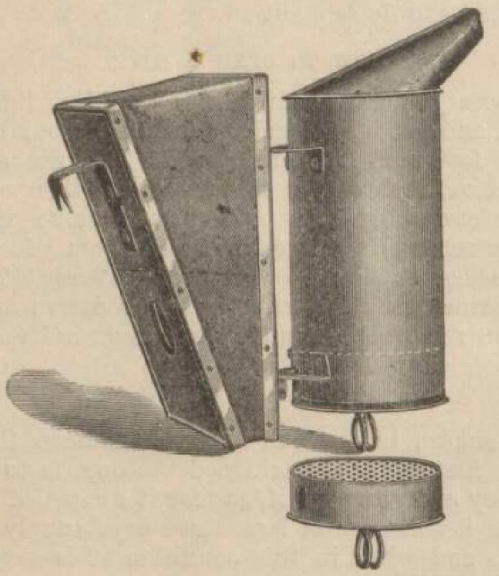


Fig. 53.—VESUVIUS BREECH-LOADING SMOKER.

will quickly get the smoker into working order. Keep the smoker on end when setting it down, but lay it on its side and plug up the nozzle with grass or something when you have done with it.

SECRET IN HANDLING BEES.

I may say at once that the whole secret in handling bees, or, rather, in getting them under control, so that they may be handled without fear of stinging, is to frighten them. It resolves itself into a question of which will be frightened first—you or the bees? If you can succeed in frightening them first you are all right. Smoke is one of the most harmless and best bee quieters

known. I would therefore advise all beginners to use an ordinary bee-smoker, and also a bee-veil to protect the face, as this will give them more confidence at first. It is not necessary to use large quantities of smoke. Very little will do as a rule.

HOW TO OPEN A HIVE.

Suppose you are about to open a hive: light your smoker, and get it well going; then don your bee-veil; blow a few puffs of dense smoke into the entrance of the hive, and wait a minute or so; then carefully lift the cover and blow a few puffs under it. You can now remove it altogether, and as you lift the mat from one corner blow a few puffs of smoke in. The bees by this time will, as a rule, be under control, and you can then remove the frames, or honey, and do as you wish.

HOW BEES ARE CONTROLLED.

The smoke, in the first place, frightened the bees; and the first thing a frightened bee does is to rush to the honey and gorge itself, so that if compelled to leave its home it will have at least three days' supply of food with it, and when in this condition it is very easily handled. Kill as few bees as you can, for the smell of a crushed bee irritates the rest. Have your smoker always beside you, and give a puff of smoke if you find

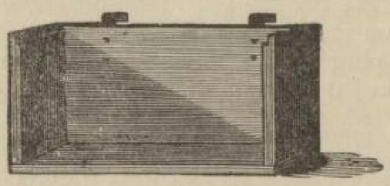


Fig. 54.—SIMPLICITY COMB-HOLDER.

the bees getting restless. Never handle bees at dusk, or on a bad, dull, or showery day. Choose, if you can, a bright, fine day, and any time between 10 a.m. and 3 or 4 p.m.

COMB-HOLDER.

It is very convenient to have at times something you can hang a comb or two on when going through a hive. A very simple comb-holder, easily made, is shown in Fig. 54. A hive body cut in two with a bottom nailed on answers the purpose capitally.

REMEDY FOR STINGS.

As for a cure for stings, that is, something that will stop the pain and irritation or swelling, I may say at once that I know of none. After a person has been stung every pulsation of the heart carries the poison farther and farther away from the wound and over the system, so that anything applied to the wound seems useless. At all events, I have tried all known remedies without good results, therefore I have nothing to recommend. In the case of a collapse, or partial collapse, after one or more stings, a good stimulant in the form of brandy administered two or three times at intervals is the very best remedy I know of. I have seen excellent results therefrom.

FEEDING.

There are times and seasons when a little attention given to the matter of feeding stocks will tend greatly to increase the profits from the apiary. A prudent apiarist will no more neglect feeding his bees when they require it than he would his horse, cow, dog, or any other of his domestic animals. Feeding is resorted to for one of two reasons, viz., either to supply a colony if it has fallen short of the necessary food, or for the purpose of stimulating breeding. The seasons when food is more likely to be required than at other times are at the end of winter, spring, and during a spell of bad weather in the breeding season.

WHAT AND WHEN TO FEED.

Next to sealed honey, a good syrup made from white sugar is the best food we can give. Candy is very good,

and when run into a frame is handy for hanging in the centre of the cluster in winter. I have wintered bees on it, but I think on the whole a fairly thick syrup is best even in winter if placed convenient for the bees. Our winters in any part of Australasia are not so severe, however, as to prevent bees reaching food in any part of a hive.

Recipe for Syrup.—To every pound of sugar add half-pint of water, put it into a saucepan and boil for a few minutes; keep stirring. This when cool is ready for use.

HOW TO FEED SYRUP.

Food should always be given to a colony in such a manner as to be out of the reach of strange bees. A number of different kinds of feeders are made for holding syrup; some for placing on top of the frames, others for hanging on the hive, but only one that I know for placing outside. Undoubtedly the safest plan is to place all food within the hive, where it can best be protected by the inmates. Perhaps the most simple and handiest feeder is the "Simplicity" (Fig. 55), for standing on top of the frame under the mat. As usually

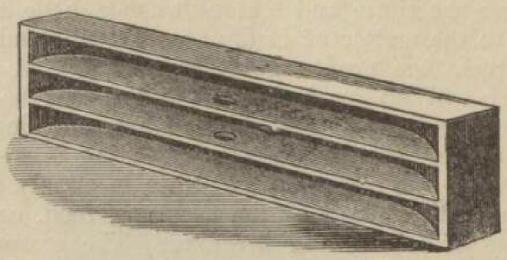


Fig. 55. "SIMPL ICITY" FEEDER.

made, it is cut out of a solid piece of wood 1ft. long, 3in. wide, by 2in. deep. The grooves are cut with a circular saw. I have made them by cutting the grooves with a plough and nailing ends on afterwards. The

partitions afford a foothold for the bees and prevent them getting drowned in the syrup. In wide feeders a thin float should be used. In top feeding the mats must be so arranged as to leave no part of the frames uncovered.

Empty combs can be utilised as feeders, and I am very much in favour of these, as they can be hung in the centre of the cluster of bees. They can be filled by laying them on an inclined board and allowing the syrup to drop through a perforated vessel held about a foot above the combs. They should be hung up for a time after being filled, till there is no drip from them, before being placed in the hives, and all syrup feeding is best done just before sunset.

DRY SUGAR FEEDING.

I have found Simmins' plan of dry sugar feeding an excellent aid during the winter, when the supply of ordinary food has been somewhat limited, and it has been

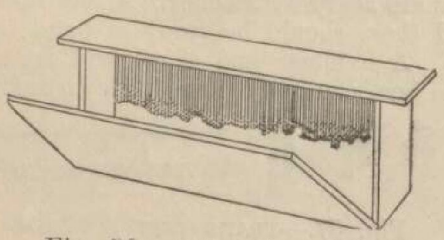


Fig. 56.—DRY SUGAR FEEDER.

necessary to add to it. The feeder can be made out of an ordinary brood frame, but is all the better if the width of a section frame. Thin boards are tacked on back and front, allowing on one side a space of an inch or more under the top bar for the bees to have access to the sugar. Fill the feeder with the best soft crystallized *cane*, not beet sugar, and damp the top layer with a tablespoonful of water, then hang it in the hive at one side of the cluster. The board on one side of the feeder may be hinged for convenience.

CHAPTER X.

TRANSFERRING.

Although the operation of transferring bees and combs from a box to a frame hive may appear a formidable undertaking to the beginner, he will soon find that it only requires a little confidence to get over all the difficulties easily. After he has succeeded with the first case, he feels astonished that he should have felt half afraid to commence.

IMPLEMENTS REQUIRED.

Transferring may be done at any time during the summer, but the best time for it is in the spring, before the combs are heavy with honey. A few tools are necessary, and these should be ready at hand before commencing. A hammer and chisel will be required to knock the box asunder, a long knife to cut the combs,

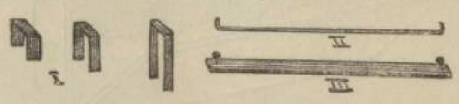


Fig. 57.—TRANSFERRING WIRES.

a lighted smoker, an empty box, a hive with frames, and a box or barrel turned bottom upwards to serve as a bench. Some transferring wires (Fig. 57, No. II.) will also be required for fastening the combs in the frames.

These I usually make out of No. 16 wire in the following manner:—Lay a frame on its side, and cut the wires an inch longer than the outside depth of the frames, and then make a bend in the wires half an inch from each end, so that they can be made to grip the top and bottom bars of the frame. About thirty of these

may be required for each hive. Or the combs may be tied into the frames with narrow tape. A transferring board, of the construction shown in the following figure, is a most useful appliance.

It is easily made, and very convenient when working. The spaces between the bars admit of the transferring wires being fixed on the lower side of the frame as well as on the upper side as it lies with its enclosed comb upon the board.

A fine warm day should be chosen, and I find the morning the best time for this work. Everything required being at hand, blow a few puffs of smoke into

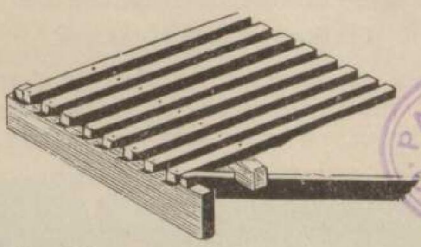


Fig. 58.—TRANSFERRING BOARD.

the entrance of the box, and after a minute or two turn it bottom upwards, just at the back of the place where it stood, and place the empty box over it. A cloth may be tied round the junction of the two boxes, to steady them and to keep the bees confined, if the operator is at all timid. An empty box should be placed where the old one stood, to catch any bees that return from the field during the operation.

DRIVING.

The bees are now to be forced to leave the old box and their combs and to cluster with their queen in the empty box which has been placed on the top, just as a natural swarm does when newly hived. This process of forced swarming is called "driving." It is done by rapping on the sides of the box hive in such a way as to

frighten the bees until they fill themselves with honey and retire from the apprehended danger, as it is their instinct to do under such circumstances. This rapping on the sides of the box may be done with the hands, but better with a pair of sticks, beginning gently and gradually increasing the force of the blows, but not so violently as to endanger the breaking down of the combs inside. When the drumming has been continued without intermission for a period ranging from ten to twenty minutes the bees will be nearly all clustered in the upper box. When this has taken place the upper box may be lifted off and placed on the old stand, free ingress and egress being allowed for the bees in front.

FIXING COMBS IN FRAMES.

The combs are now ready to be transferred. With your long knife cut the combs free from the sides of the box, and take an end and a side off carefully. Now cut

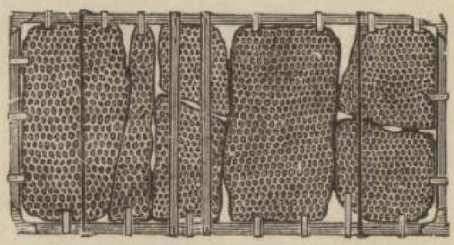


Fig. 59.—PIECES OF COMB TRANSFERRED TO FRAME.

the combs out separately without breaking them, and select the straightest containing brood in the first instance. Lay a comb on the transferring board, with a frame over it, and if it be larger than the frame, cut it just a trifle larger than the inside, so that by springing the frame a little it will go over and grip the comb so cut. If this be neatly done the comb will require no other fastening. According as each frame is finished, hang it in the hive.

When more than one piece is required to fill a frame, select only such as are straight, containing brood or

honey, and secure them in the frames with the wires and clasps, as shown in the above illustration.

With the aid of the transferring board (Fig. 58) the wires can be put on both sides of the frame without moving it. Proceed thus till all the straight worker combs *containing brood or honey* are transferred; take no others, unless there happen to be any perfectly straight worker comb empty large enough to fill the frames in one piece, when these may be used also. Under no circumstances should crooked or drone comb be transferred. The hives may be filled up with frames of comb taken from other hives or with frames of foundation, the brood combs being kept in the centre. Place the hive, as soon as it is ready, where the box-hive stood; raise the front a little, and shake the driven bees out of the box, so that they can enter the hive, which they will do at once, and if all be well, and no accident have happened to the queen, they will proceed without delay to fasten the combs in the frames. In the course of a day or two the wires can be removed.

Other methods are sometimes recommended for securing the combs in the frames, but having tried most, and having transferred some hundreds of colonies with their combs, there is no plan I have found to answer so well as the wires I have described. They are easily put on, and may be taken off without lifting the frames from the hive.

In describing the above plan of transferring I have kept the needs of beginners strictly in view, as I have all through each operation described in this book. Experienced bee-keepers would probably adopt a quicker method, as I have usually done, by merely turning the box-hive up, driving the bees with smoke to one end, then tearing off the other end, cutting out and transferring the combs and shaking the bees into the new hive, which had in the first instance been placed where the old box-hive had stood. The first described process takes a longer time, but it is the best plan for a beginner to adopt.

CHAPTER XI.

INCREASE OF STOCKS—NATURAL SWARMING —DIVIDING.

The question of the increase of stocks in an apiary, how to promote, control, or even to prevent it, is one of importance in all cases, and one which must be treated by each bee-keeper according to the special objects he has in view—the first point to be determined being

WHAT RATE OF INCREASE IS DESIRABLE.

It may be desirable to stock a new apiary as quickly as possible, or, if opportunity offers, to dispose profitably of a number of colonies; in which case the largest increase compatible with the formation of none but strong colonies must be worked for, regardless of a honey harvest. If the object be to form an apiary gradually, and with the least outlay of capital, the best plan will be to try for such a moderate annual increase of stocks as may be consistent with securing a fair return in honey at the same time; or, lastly, if the apiary has attained the full extent intended, the bee-keeper will naturally want to obtain the greatest possible quantity of honey from a fixed number of hives; and it then becomes a question whether that end may be best secured by suppressing *all* increase, as far as it is possible to do so. A careful study of what follows will enable him to attain the object desired.

NATURAL SWARMING.

The natural instinct for swarming, with which bees are endowed, is an admirable provision for the propagation of their race and its spread over any district favourable for their existence. When we recollect that

it is only by means of the queens and drones that the race can be propagated; that these queens and drones cannot exist by themselves, or without the workers of a colony; that the queens require to be renewed every two or three years, in order to keep up strong stocks, while the workers are only for a season, and the drones for a few months; and, finally, that only one queen can be tolerated at a time in any colony, we cannot fail to be struck with admiration at the beautiful manner in which the swarming instinct is adapted to this state of things.

CAUSES OF SWARMING.

The queen and a comparatively small stock of workers pass through the winter months under various conditions, according to the climate, as will be noticed under the head of "Wintering." In spring, as soon as the temperature and the forage are such as to set the workers in a state of full activity, the queen commences her great work of egg-laying, and, as we have seen, she is capable of laying from ten to twenty thousand per week; at all events, after five or six weeks she will, if all be right, have laid so many eggs that if all were hatched, and developed into workers, there would be far more than the number requisite for, or that could be reasonably employed in, an ordinary have. One half of the number will have come to maturity at the end of the six weeks, and the other half will be out in three weeks more. The hive will be already rather overcrowded, and some twenty or thirty thousand bees can be well spared to form a good swarm, there being fully as many in the egg and larva state ready to supply their place within three weeks. In this state of affairs instinct leads the workers to build several queen cells, and the queen, as soon as the queen cells are closed, to lead off the swarm, all filled with honey and ready to commence comb-building at once in their new home, wherever it may be. The bees left behind in the old hive have *several* young queens maturing, lest one or more of them should fail;

they have also the drones, usually flying at this time, or maturing in the drone-comb; an ample stock of workers, also maturing by degrees — therefore all the elements of their future strength. If the old queen has left with her swarm just when the first queen cells were closed, then the first young queen will emerge in eight or nine days, and in the meantime the stock will have been recruited by a large number of young bees. If they still feel themselves over-strong, or are still actuated by a desire for swarming, the first young queens may go off with one or more after-swarms or "casts;" if not, the first out will remain in possession of the hive, and all the others will be destroyed in their cells. In five or six days more the young queen will probably be fertilised, and shortly after will begin to lay eggs. This is the natural course of the swarming, which provides for a multiplication of the self-sustaining stocks or colonies, and at the same time for a succession of young queens.

THE SWARMING SEASON.

With the exception of the most northern parts of Australia, where swarming frequently commences as early as August, there is very little difference in the swarming season throughout the Australasian colonies. From early in October to the end of February may be taken as the main part of the season throughout Australia and New Zealand.

SYMPTOMS OF SWARMING.

In a properly constructed and ventilated hive the only indication of a coming swarm is the presence of newly-constructed queen cells containing either eggs or larvæ within the hive, which can only be ascertained by a careful examination of the combs.

PREPARING FOR SWARMS.

At the approach of the swarming period, everything requisite to facilitate the hiving of swarms should be

in readiness, so that the bee-keeper can lay his hand on the necessary appliances at a moment's notice. All the new hives likely to be required for the season's increase should be placed in position, according to the directions given in Chapter V., great attention being paid to the proper bedding and levelling of the bottom boards.

ISSUE OF THE SWARM.

The actual process of swarming is so admirably described by Langstroth, whose closeness of observation and clearness of description are equally inimitable, that I cannot withhold from the reader a passage from the chapter upon natural swarming in his treatise upon "The Hive and Honey Bee." He says, at p. 112:—

"I have repeatedly witnessed, in my observing hives, the whole process of swarming. On the day fixed for their departure the queen is very restless, and instead of depositing her eggs in the cells, roams over the combs and communicates her agitation to the whole colony. The emigrating bees usually fill themselves with honey just before their departure; but in one instance I saw them lay in their supplies more than two hours before they left. A short time before the swarm rises, a few bees may generally be seen sporting in the air, and with their heads turned always to the hive; and they occasionally fly in and out, as though impatient for the important event to take place. At length a violent agitation commences in the hive; the bees appear almost frantic, whirling around in circles, continually enlarging like those made by a stone thrown into still water, until at last the whole hive is in a state of the greatest ferment, and the bees, rushing impetuously to the entrance, pour forth in one steady stream. Not a bee lurks behind, but each pushes straight ahead, as though flying for dear life, or urged on by by some invisible power in its headlong career.

"Often the queen does not come out until many have left; and she is frequently so heavy, from the number of eggs in her ovaries, that she falls to the ground incapable of rising with her colony in the air. The bees soon miss her, and a very interesting scene may now be witnessed. Diligent search is at once made for their lost mother; the swarm scattering in all directions, so that the leaves of the adjoining trees and bushes are often covered almost as thickly with anxious explorers as with drops of rain after a copious shower. If she cannot be found, they commonly return to the old hive

in from ten to fifteen minutes, though they occasionally attempt to enter a strange one, or to unite with another swarm."

In a case of the sort last mentioned a careful search should be made in the neighbourhood of the hive and between it and the place where the swarm settled, when the queen may be found on the ground, and probably surrounded by a number of her bees, and may thus be saved and returned to the hive. The attempt to swarm will then most probably be repeated the next day, if the weather should prove favourable.

TAKING AND HIVING SWARMS.

To many people the taking of a swarm and hiving it appears rather a dangerous operation, whereas there is nothing connected with the work that need excite the least alarm or prevent any person undertaking it. It has already been stated that the bees fill themselves with honey just previous to swarming, and as "bees gorged with honey never volunteer an attack," they may be handled at this time with little risk of their stinging; and so long as they are not unnecessarily hurt they may be tumbled and shaken about to an astonishing degree without attempting to defend themselves. Usually swarms cluster in such a manner that they may be shaken into a box or other receptacle with the greatest ease, though it may occasionally happen that a swarm will settle in a very awkward place for taking it; however, there are few difficulties in this way that may not, by the exercise of a little ingenuity on the part of the operator, be successfully overcome.

First swarms, headed as they are by laying queens, are not long before they commence to settle. If it is a still, hot day the bees will choose the shady side of a tree or shrub, and, if a windy day, the lee side. Should they, however, cluster in a spot where the hot rays of the sun are beating down upon them, or the wind is blowing the cluster about, it may be taken for granted that the swarm will not remain long in that position,

and if compelled to rise again there is no knowing where the bees may make for; at any rate there would be but little chance left of the owner securing them. A swarm *should always be taken as soon as possible after it has settled.*

With the taking of the swarm comes the question of hiving it. Some prefer to hive it at once by taking the swarm to the hive located on its permanent stand, or, if convenient, taking the hive to the bees; others again, after taking the swarm in a box, leave it shaded near the spot till near sundown, and then carry it to the hive. There is certainly something to be gained by giving the bees an opportunity to start work as early as possible by hiving them at once; in that case it is best to carry the hive to the swarm and hive it on the spot, returning the hive to its permanent position later on in the day. I have tried all plans, but as a general thing I would advise the novice to adopt the plan of leaving the swarm near the spot where it clustered until toward evening before hiving it.

Should the bees have settled on the limb of a tree, as they frequently do, first spread a sack on the ground underneath the cluster, then take a light and convenient box and hold it close up under the swarm; give the limb a smart jar with the hand, and almost every bee will drop into the box. Place it at once on the sack, and after a few seconds prop one side of the box up an inch or so with a stone or something to enable the bees to go in and out. A few will fly up again to the spot they were taken from, but will soon return again to the box. After shading the box with a sack or anything handy, leave it till, say, 5 p.m. In the meantime the hive can be prepared by putting the comb foundation in the frames and setting in its position, propping up the front of the hive from off the bottom board an inch or so to make a big entrance. Lay a sack on the ground across the alighting board with one edge up near the entrance. About the time stated carry the swarm to it and shake all the bees out of the box as near the

entrance as possible. They will soon commence to run in, and when all or nearly all have gone in lower the hive on to the bottom board, leaving a fairly large entrance. In hot weather shade the hive for a few days by laying a folded sack over it.

In hiving on the spot you have simply to take the swarm in the same way, and hive the bees in exactly the same manner, having first brought the hive to the swarm.

Should a swarm settle in the midst of a bush or on the ground, a cloth should be spread as near as possible, and the box placed on it in the most convenient position for brushing some of the bees into it. As soon as the main body of the bees begin to make for the box they may be left to take their own time, care being taken *always* to see that hives and boxes containing new swarms are shaded from the heat of the sun. When a box has to be left, as in the above case, till the swarm clusters in it, it is better to let it remain till a little before dusk before hiving the bees. I have found in the majority of cases that when swarms have been disturbed by trying to hive them before evening, after they have been left long enough in the boxes they were taken in to settle themselves, they have risen again, and sometimes have gone straight away. In the case of a swarm having settled and no one at hand with sufficient courage to hive it, a sheet thrown around it will usually prevent the bees absconding till assistance can be obtained.

Sometimes swarms abscond in a most unaccountable manner, especially is this the case with second swarms headed by a virgin queen. In fact, an experienced bee-keeper can quickly detect such swarms while flying by their vagaries. When once a swarm rises and makes off for parts unknown it is very little use to try to follow it, for when once it makes a start it goes at a very rapid pace.

CLIPPING THE QUEEN'S WING.

For the purpose of obviating some of the inconveniences connected with natural swarming, many leading

bee-keepers have adopted the plan of clipping a wing of the queen *after she has been impregnated,* to prevent her flying with the swarm; in fact, it is largely practised now. Many reasons can be given in favour of this method, while there is only one that I know of which some consider against it.

When a swarm issues, the clipped queen, although she cannot fly, will make an attempt, and consequently fall to the ground close to the hive. The bee-keeper, being at hand, must pick her up and cage her. As soon as the bees are all out, remove the hive to another stand some distance away, and place an empty one, fitted with frames of comb or foundation, and a frame of eggs and brood, in its stead. Open the entrance as wide as possible, and lay the caged queen down close to it. In the meantime the swarm may have settled; but when the bees discover that the queen is not with them they will not be long before they return and naturally enter the new hive. While they are going in, release the queen, and see that she goes in with them. When two or more swarms issue at the same time and form one cluster, they will separate in a short time, and return to their several stands; so that if the bee-keeper has secured the queens and changed the hives before their return, he will have done his hiving with little trouble. Care must be taken to clip a wing of *every queen;* for if there should happen to be one queen in the cluster, the bees will not return.

The objection to this method sometimes put forward is the necessity of having some one constantly on the alert to secure the queen and change the hives. In a large apiary it would be necessary to see the swarm coming out of the hive, or else it would be difficult to find the queen. It is quite certain that if the bees return with or without their queen, they will make another attempt next day, and if they have to return to the old hive again, the probability is that if they find her they will injure or kill the queen, and swarm out with the first young one that emerges; so that some person should

always be at hand during the swarming season. On the other hand, it can be said that where the bees are allowed to swarm at all, some one must be about pretty often, if not all the time, as already noticed in this chapter. The facilities afforded for hiving swarms, and the certainty of not losing any, will no doubt be considered by most bee-keepers sufficient to more than repay for the little extra care required in watching the apiary.

PROCESS OF CLIPPING.

Take hold of the queen by the wings with the thumb and forefinger of the left hand—be careful not to hold her by the body—place her on a board (still keeping the wings between the thumb and finger), so that she can stand upon her feet—this will keep her legs out of the way—now pass the point of a small pair of scissors under the two wings on one side and clip, but *not* close up to the body.

PREVENTION OF SWARMING.

The best aids we can have towards the prevention of swarming are roomy and well-ventilated hives. At the same time very much will depend on the knowledge and tact of the bee-keeper, that is, his knowing what to do and how to do it, and his doing the proper thing at the right time.

There are times when everything depends upon the ability of the bee-keeper to adapt himself to circumstances, when his judgment for the time being is all he can trust to, and if this fail him it may result in the loss of the greater part of the season's crop. Such a time is when the honey season has been retarded or checked by unfavourable weather, when just sufficient honey has been gathered to keep up breeding. The colonies are strong, and it suddenly changes to favourable weather with an extra good flow of honey; considerable tact is then necessary to prevent the bees taking the swarming fever.

If done at the right time, much may be accomplished

in the desired direction by the use of the extractor and giving more room by putting on an extra super, or even two, if they should be needed; and as a great deal will depend upon keeping the brood-nest at its normal temperature, the extra supers should be put on immediately above it. Abundant ventilation can generally be secured in the hives by pushing them forward till the front overlaps the alighting boards an inch or two; should more be required, however, the covers can be raised an inch or so, for while plenty of honey is coming in there need be no fear of robbery. Swarming may be kept down to a great extent in the early part of the season by enlarging the hives in good time before the main honey harvest sets in; but, as I have before remarked, all operations connected with the prevention of swarming require good judgment and foresight on the part of the bee-keeper, that he may hit on the right time to perform them.

It may here be incidentally remarked that some bee-keepers make use of drone and queen excluders at swarming time—among them Mr. Alley, who uses the excluder shown in Chapter XII. When a swarm issues, the queen is trapped behind the excluder, where she can be caught, and the process of hiving is carried out the same as with a clipped queen.

PREVENTION OF AFTER-SWARMING.

This, as compared with the previous question, may be considered an easy matter. In the ordinary course of events a second or after-swarm may be expected in eight or nine days after the first issues, and while there are several embryo queens maturing in the hive. But should unfavourable weather set in about the time for the first leaving, it would be kept back, and may be prevented from issuing till near the time for the young queens coming to maturity. I have even known cases where, owing to the prevalence of bad weather, after all preparations had been made for swarming, the young queens have been destroyed, and swarming given up for

the time. At all events, we can reckon, as a rule, that the first young queen will not emerge from her cell in less than eight days from the time the first swarm issues. Now if we see that all but one of these embryo queens are removed, that is, all the queen cells but one, and only allow this one to come to maturity in the hive, there cannot be any after-swarm, as this queen will be required in the hive. It would not, however, be correct to remove the cells *immediately* after the first swarm leaves, as will be presently shown. The old queen would be laying up to within a very short time of her leaving the hive; consequently there would be eggs in the cells at that time. Supposing the queen cells to be cut out during the first day or two after, the bees would be almost sure to build others, and thus frustrate our plans; but if we let them remain for about five days before we remove them, the larvæ would have grown large by that time, and there would be little likelihood of other cells being started. Choice of a good cell should be made for the one that is to remain in the hive, and the others can be utilized in forming nuclei. (See Queen-rearing.)

DIVIDING—ARTIFICIAL SWARMING.

This method of increasing stocks should only be resorted to in an emergency, when it is desired to work up a large apiary very rapidly, and then only by experienced bee-keepers, who have already reared a number of young fertile queens for the purpose. Dividing should be carried out while there is a good flow of honey on and the colonies populous. If it be desired to double the number of stocks, for instance, and there are a sufficient number of young fertile queens on hand in nucleus hives for the increase, then the nucleus plan may be adopted as follows:—On a fine warm day cage one of the young queens from a nucleus hive, and transfer the frames with the adhering bees to an ordinary hive; hunt up the queen of the hive about to be divided, and place her, with the frame she is on, in an empty hive for the time being, that it may be known where she is. Next move the hive

into which the nucleus colony has been placed alongside the one to be divided and lift four of the central frames well supplied with brood and the adhering bees, and hang them alternately with those of the nucleus colony; also shake the bees from two or three frames into the new hive, and after filling the remaining space with empty combs or comb-foundation, place it in the position formerly occupied by the nucleus hive, and hang the caged queen between two of the central frames. The old queen with her frame can now be placed in her hive again, and the hive filled with frames of comb or foundation in the place of the frames removed. To prevent too many bees returning to the divided colony, I have often blocked up the entrance with wire cloth—taking care to allow plenty of ventilation—till the evening of the following day, and then liberated both bees and queen, but usually the latter is at liberty before that time with the cage I use. In the course of a few days the surplus boxes can be put on. If less increase is desired, the nucleus colony can be made up by taking frames of brood and bees from two or more old colonies in the same way, instead of from one. It should, of course, be seen to that each hive is supplied with sufficient food.

"FORCED" SWARMING.

A method to enable the bee-keeper to control or prevent natural swarming and increase, while at the same time the bees seem to satisfy their natural instinct to swarm, has of late come much into vogue. In my opinion it has been erroneously termed as "forced" swarming, or making "shook" swarms, which is another term used; however, the scheme has its advantages, and that is the main point. The conditions necessary for successfully carrying it out are that the weather shall be warm and settled, a fairly good flow of honey on, and the bees nearly ready for swarming naturally.

The colony to be "forced," and its hive, should be placed on a new stand close alongside the old one, on

which set a new hive furnished with frames of foundation. Prop up the front of the hive an inch or so and lay a sack across near the entrance. Now hunt up the queen and cage her, then take the frames one at the time and shake or brush off the adhering bees near the entrance to the new hive, into which they will run. After most of the bees have been transferred from the old to the new hive replace all the combs again in the old hive, release the queen in the new one, and close all down. There will, of course, be honey and brood in all stages, and hatching every day, queen cells, and a number of old bees in the old hive, sufficient to take care of the brood, providing the weather is warm. In twenty-one days all the brood will have hatched and there will be a young queen in the old hive. Secure her and then shake *all* the bees as before near the entrance of the new hive, remove the old one and distribute the combs among the other hives. The young queen can be made use of if required. Plenty of working room should, of course, be given as needed to the bees in the new hive.

It is claimed for this process that it does away with all desire on the part of the bees to swarm again as much as it would had they swarmed naturally, while the bee-keeper is relieved from watching for swarms, and he prevents increase.

Axiom.

"A MODERATE INCREASE OF COLONIES IN ANY ONE SEASON WILL, IN THE LONG RUN, PROVE THE EASIEST, SAFEST, AND CHEAPEST MODE OF MANAGING BEES."

Langstroth.

CHAPTER XII.

QUEEN REARING.

The rearing of queens forms an important part of the bee-keeper's business, especially so where bee-keeping is carried on as a commercial pursuit. It is not so essential that beginners or those keeping a few colonies as an amusement should make it a study, except as a most interesting feature of modern bee-culture. It is absolutely necessary in an apiary of any pretensions that queen-rearing should form part of the work, so that there may be a supply of young queens ready at hand to replace losses that will occur, and for the purpose of superseding queens that are past their prime.

VARIOUS METHODS.

In speaking of "various methods" of raising queens it is only meant that some of the details differ. One hears of the Doolittle plan and the Alley plan, but the chief difference between them is their methods of starting the queen cells. Mr. Doolittle makes his own cell-cups, into which he transfers worker eggs or larvæ from his best stocks and royal jelly or queen food from a naturally-built queen cell just before it is sealed over, one such cell affording enough for about twenty cell-cups. Mr. Alley, on the other hand, supplies the bees intended for raising queens with selected eggs or larvæ in the natural comb, over which they build their own cells, and they supply the royal jelly. There are also slight variations of both methods. Both Mr. Doolittle and Mr. Alley are old and experienced breeders, and both have their followers. A good many extensive queen-breeders have adopted the Doolittle plan, and probably it may be the most profitable for them. I have

tried all plans, and had at one time sixty strong colonies besides the necessary nuclei engaged at queen-rearing, but I never considered there was sufficient inducement to adopt the artificial cell-cup plan in preference to the Alley method, and I am sure the latter is by far the best system for at least all but those who are in a large way of business. I shall therefore confine myself to that method I have proved for many years and on a large scale to give most excellent results, with a minimum of labour. Those who wish to investigate the Doolittle plan can procure his work on queen-rearing through any bookseller or by writing direct to the A. I. Root Coy., Medina, Ohio, U.S.A.

THE ALLEY METHOD.

Queens can be raised any time during the swarming season or while drones are flying, but if it is desired to rear them early in the season, and especially to have them mated with particular drones, two or more of the best colonies as required should be selected, say, early in September, for the purpose. These should be worked on in advance of the others by slow feeding, or, if need be, by giving them frames of emerging brood from other

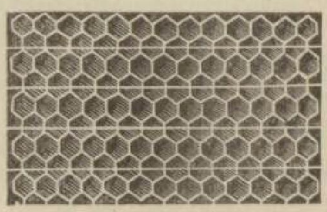


Fig. 60.—COMB CONTAINING EGGS.

colonies, taking care to keep them covered up well. As soon as the one chosen for raising drones is sufficiently strong, insert a clean empty drone-comb in the centre of the brood-chamber. Note the time when the drone-brood is capped, and in eight or nine days after, place

a frame of clean new worker-comb in the centre of the brood-chamber of the hive containing your choicest queen. I would here point out that the cleaner the comb is the better; I find combs built the previous season, that have only contained honey, give the best results. The colony now being pretty strong, with plenty of brood in the combs, the new one inserted will soon be in charge of the queen, and in three or four days will be full of eggs. As soon as the eggs commence to hatch, which will be in three days after they were laid, remove the comb to a warm room, and if more eggs are required, insert another in its place. Lay the frame of comb flat on a table or other convenient place, and with a sharp, thin-bladed knife, dipped in thin starch or diluted honey to prevent its sticking, cut the comb into strips, by running the knife along every second row of cells, as shown by the white lines in Fig. 60, taking care to leave one row of cells containing eggs intact in each strip. Some empty frames will next be required, having two thin laths of wood nailed inside longitudinally, so as to divide the depth into three compartments, as shown below.

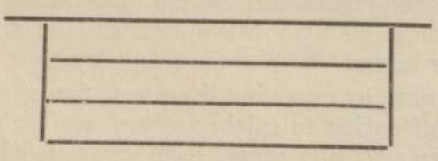


Fig. 61.—FRAME FOR RAISING QUEEN CELLS ON.

Next take the strips of comb, and after destroying the egg in every alternate cell on one side of the strip—which may easily be done by pressing it with the head of a wax match—fasten the strips under the top and two centre bars of the frame with a little melted wax, allowing the cells in which the alternate eggs have been destroyed to point directly downwards. The object of destroying each alternate egg is to prevent the cells being built too close together. (I believe it is better to only

leave one egg in every third cell.) A space intervening gives facilities for cutting them out subsequently without injury. Care must be taken, when fastening the strips, that the wax is not too hot, or else it may melt the comb and kill the eggs. Having filled as many frames as may be required (I have generally found one comb sufficient to afford strips for three frames), the next step to be taken is to remove the queen, every egg, and all uncapped brood from some one or more strong colonies, and place a frame of strips in the centre of the brood-chamber in each case. Mr. Alley recommends preparing the colony by removing the queen, etc., some twelve hours or so before giving them the selected eggs. Mark the date and age of the eggs on the frame, and also upon the cover of the hive. A memorandum book is very useful in connection with this work for keeping records in. The queen and brood removed can be utilized in forming a nucleus colony by caging the queen, removing a strong colony from its stand, placing the hive containing the brood and caged queen in its place, and shaking the bees from a couple of frames down near the entrance, to secure some young bees with the old ones that will return from the removed hive; the queen can be released in twenty-four hours.

We have now, by removing the queen, forced the colony to turn its attention to raising others, and by depriving it of its own eggs and larvæ, have compelled it to raise queens from those supplied to it. We have also, by taking away all its uncapped brood, lessened its labours, and thereby obliged it in a manner to give more heed to the matter in hand.

In less than twenty-four hours after the eggs have been given to the colony, several queen cells will be started over them. Some colonies will build more than others, but I think we may reckon the average at about fifteen with Italian bees, though I have had as many as thirty-five in a frame. There will be more built when honey is plentiful; and if little or none is being

gathered, the bees should be fed while cell-building is going on. Twelve cells are considered enough for one colony to care for, and this is near the number that is usually found in a hive from which a strong colony has just cast a swarm. As soon as the cells are forward enough to be plainly seen, destroy all except about ten or twelve of the largest and best-looking ones.

Having now as far as possible fulfilled on our part every condition necessary to ensure the rearing of good queens, we must be content to leave the rest to the bees for a few days. The cells, when fully formed and capped, will have something of the appearance of Fig. 62, though the engraving is rather a flattering one.

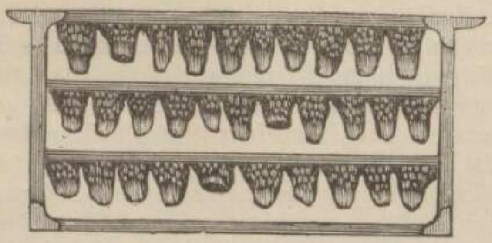


Fig. 62.—FRAME OF QUEEN CELLS.

It will be remembered that the date and age of the eggs—three days—was marked on the frame, so that we can calculate the day when the queens will be at maturity; that will be on the thirteenth after inserting the eggs. Being able to know within a few hours when the queens will emerge is one of the great advantages of this system of queen-rearing. By the old methods, and even when cells are built under the swarming impulse, it is impossible to say correctly how old the embryo queens may be.

As soon as the cells are capped, a frame or two of emerging brood may be given to the colony to strengthen it. It will have been noticed by those who have had any experience in queen-breeding, that there is often a

marked difference between queen cells; some are long, pointed, and dense-looking, while others are stunted and thin-walled. The latter are always reckoned to contain poor queens, and it will be well to shun them, and make use of none but well-formed, rough-looking, long, pointed ones. On the morning of the twelfth day after the eggs were given the nuclei can be formed.

FORMING NUCLEI.

A nucleus colony in connection with queen-rearing is a small colony formed for the special purpose of caring for a young queen during her maidenhood, or until she may be required to do duty in another colony. A nucleus hive, described on page 62, is a small hive suitable for the colony, and is rarely used except for queen-rearing purposes. Some queen-breeders use a very small hive with much smaller frames than their common ones for keeping their queens in till mated, but for several reasons I consider it best to have but the one frame in both the queen-rearing and the ordinary hives. In the first place, a nucleus colony can be formed in a few minutes from any hive by simply transferring two or three frames and the adhering bees from it to a nucleus hive. Then again, a nucleus colony can be built up at any time, or united with another, where the frames are all alike, with very little trouble. And lastly, we have only the one-sized frame to make. I have always used a nucleus hive such as I have described, and would not care to use any other.

The required number of nucleus hives being ready—their entrances covered with wire cloth to confine the bees—take the frame of cells and cut out carefully all but one; then return the frame to the hive until the queen shall have emerged, when it may be removed and a frame of comb or of foundation inserted in its place. Care must be taken that the queen cells are not injured or chilled; a small box, with some soft material to lay the cells upon, is handy to keep them in until they are inserted in the combs. Now go to a strong colony and

hunt up the queen. This is sometimes a difficult task with a strong colony of black bees. If you have an empty hive alongside to place the frames in after you have examined them, much trouble may be saved. Having found the queen, place her with the frame she is on in a hive by herself for the time being, and insert a queen cell in each of the other combs as you take them from the hive, remembering that you require some brood, a fair number of bees, and a fair share of honey in each nucleus. I usually put either one pretty full frame of brood, or two that are not so well filled, with the adhering bees, and a frame with honey, which may be taken from another hive, or else a frame of foundation, in each nucleus. The frames of brood and bees should be taken as equally as possible to form the different nucleus colonies. A strong stock will generally furnish enough for five nuclei. A comb-holder as shown in Chapter IX. will be found very convenient for supporting combs while inserting queen cells.

HOW TO INSERT QUEEN CELLS.

When cutting the cells from the frame, as much as possible of the base should be taken, clear up to the wood. With the frame which is to receive a cell placed on the support or stand in a convenient position, cut a small hole in the comb just large enough to put in the cell without pinching it in any way. In cutting the part for the base let it fit as nicely as practicable, as shown by the white line in the next illustration.

As soon as the cell is inserted, place the comb with the adhering bees in the centre of a nucleus hive; put in the other combs as already explained, and put on the mat and cover. Be sure that you have blocked up the entrance with wire cloth so that no bees can escape. Then proceed with the other nuclei in the same manner. When all are finished, take the nucleus hives to a cool shady place, or if they can be put in a dark, well-ventilated room or shed, it will be better still. Keep them closed till the evening of the second day after that on which the

cells were inserted, when they may be placed where they are to remain, and the bees liberated a little before dusk. By confining the bees in this way for a day or two they

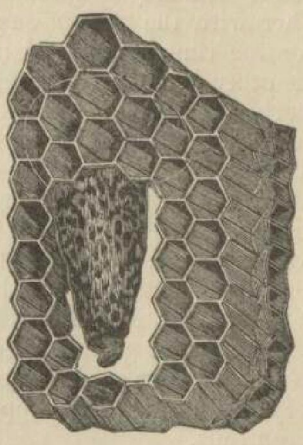


Fig. 63.—INSERTED QUEEN CELL
(from which the Queen has emerged).

become reconciled to their new quarters, and very few fly back to their old hive. Before I adopted this plan I sometimes had a deal of trouble on account of so many bees deserting the nuclei.

The above method of forming nuclei and inserting queen cells is no doubt the best to adopt when queen-rearing is only carried on on a limited scale, and where the loss of a queen cell would be felt, but where, as in my own case, a saving of time is of greater consequence than the loss of a cell now and again, a knowledge of my plan may be of service.

MY METHOD OF FORMING NUCLEI AND INSERTING QUEEN CELLS.

With the nucleus hives, a few spare combs, and provided with some long pins, I go to a hive, and without troubling to look for the queen—except merely to glance

over the combs as I take them out—I insert the cells as quickly as possible. Instead of taking time to fit them nicely, I give a hasty look at the cell, cut a hole in the comb I think will suit, put in the cell and fasten it there by running two pins through the base of it into the comb, one each way—sometimes one is sufficient. Advantage may be taken of a depression in the comb and so save cutting a hole. In this way I can insert the cells and form the nuclei in a very short time. If the queen should be seen during the operation, she is placed with the frame she is on to one side till all is finished, when she is put back into the hive after contracting it with division boards, if necessary. Should she not be seen it only means the loss of one queen cell, which is more than made up for by the time saved in not waiting to find her.

CELL PROTECTORS.

It may, and does sometimes, happen that the bees will tear down the queen cells one after the other, when it becomes necessary to protect them in some way. The "West" Queen Cell Protector shown in Fig. 64 is about

Fig 64.—WEST CELL PROTECTOR.

the handiest and best in use at present. The cell is slipped into the spiral protector, the tin slide put in place, and the whole hooked on to the comb. The young queen emerges from the lower end and is rarely ever molested.

QUEEN NURSERIES.

When queen rearing is carried on extensively as a special business, appliances termed queen nurseries are

frequently brought into requisition to aid the queen breeder. They serve a very useful purpose as temporary nurseries for young queens after they have emerged from their cells, and until the breeder can dispose of them in nucleus colonies. The "Alley" nursery, an illustration and description of which was given in the last edition of this book, is the one generally used, but as nurseries are not required by the ordinary bee-keeper, it is not necessary to go into the matter here.

MATING YOUNG QUEENS.

To return to our nuclei. We left them just after liberating the bees. At that time the queens would be one day old; in four or five more they will take their wedding flight just when our select drones are about fourteen days old and flying. If our plans have been carefully matured there would be no others about.

When the young queens commence to lay, which they will do in a few days after mating, they are ready to be made use of unless we desire to test them, and when raising them for sale they should always be tested for purity and laying qualities for at least a month. By following up with cell-building others may be ready to place in the nuclei when the young laying queens are removed, though there may not be the same chance to have the second lot of queens mated by selected drones unless it can be accomplished by the use of drone excluders, the utility of which, as I have before remarked, I am rather doubtful about. Even then no other bees should be near the apiary.

INTRODUCING QUEENS.

Next to rearing queens we must know how to introduce them safely into strange colonies. The ordinary conditions to ensure safety are—that the colony must first be made queenless, that is, the old queen must be removed. In the next place the new one, when first placed in the hive, should be protected in such a way that while the bees can see her and even feel her with their

antennæ they are prevented from stinging her, as some would be apt to do before they become used to her. And lastly, the colony should be fed if there is no honey being gathered while the queen is being introduced. There are exceptions to the second clause. In the busy season, when honey is coming in rapidly, if the queens can be changed without much disturbance of the hive, the new one is likely to be accepted just as readily if she is turned loose on the frames as she would be were she protected for a day or two. I have often introduced them in this manner with success. On the other hand, I have had great difficulty with some colonies when trying to get them to accept a queen when introduced in the usual way.

INTRODUCING CAGES.

I have tried various cages at different times, but prefer the "Alley" and "Climitz" to all others.

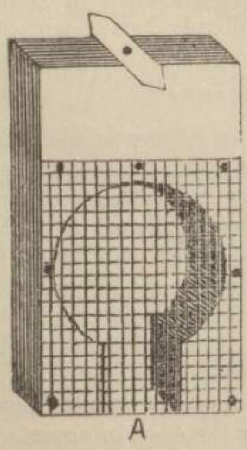


Fig. 65.
ALLEY CAGE.

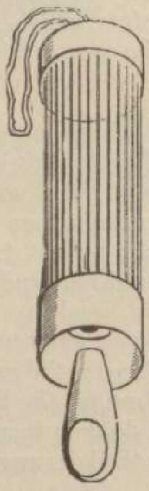


Fig. 66.
CLIMITZ CAGE.

The "Alley" cage is much more easily made than the other, which is turned in a lathe. Take a block of wood

2in. wide by half-an-inch thick, and long enough to cut as many cages as you require, which are each 3in. long. Mark out for each cage and bore 1¼in. holes half-an-inch from the ends, saw them off, then cut a notch A to communicate with the hole large enough to admit a queen easily. Cover both sides with fine wire cloth and tack a strip of tin 2in. long by half-an-inch wide on top as shown, so it can be twisted round.

Place the queen to be introduced in whichever cage is used with as little handling as possible, and *without any bees;* plug up the entrance to cage with candy, or, what I have found equally as good, a bit of newly-constructed comb, pinched lightly together. After the queen you are superseding, together with queen cells (if any), have been removed, hang the cage from the top bars between two of the centre frames and pressed against some honey so the queen can feed herself. Close down the hive and don't disturb it again for three or four days, long before which she will probably have been released, when the cage can be removed.

BALLING QUEENS.

This often happens when the colony is disturbed too soon after introducing a queen, and occurs usually with beginners, who are generally too eager to find out whether the queen has been accepted or not. The bees are certainly not friendly to a queen when they form a ball round her, and the best thing to do in such a case is either to break up the ball with smoke or throw the lot into a basin of water, when the bees will soon loosen their hold. Secure the queen in either case and cage her again. Look through the hive, and if any queen cells have been started destroy them and hang the cage in again. Don't disturb the bees any more for several days.

"GOOD" CANDY.

Warm some honey in a double saucepan or water bath like a glue-pot, and stir in some fine pulverised loaf-sugar until it is pretty stiff, take it out and knead it,

adding more sugar until it is fairly firm. After standing a day or two, should it run, add more sugar. Take care to purchase the loaf-sugar and pulverise it yourself; don't buy it already pulverised, as that usually contains a large amount of starch, which will kill the bees; use the best honey. "Good" candy when properly made will carry bees safely from one end of the world to the other. It is a capital thing for plugging introducing cages and for furnishing mailing cages.

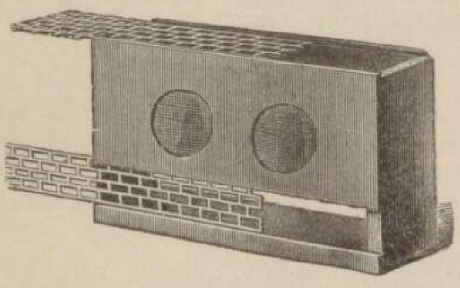


Fig. 67.—ALLEY'S DRONE AND QUEEN TRAP.

This is really one of the most useful appliances one can have in the apiary, and is most valuable to beginners and others who do not pay particular attention to brood-rearing. By its use a hive may be cleared of all the surplus drones in a few hours. Two or three traps will be sufficient for an apiary of fifty hives, as they can be moved about from hive to hive.

ITALIANISING AN APIARY.

I have already advised beginners for the sake of economy to start with black bees, and as soon as the apiary is fairly established to Italianize all the colonies, that is, replace the black queens with Italian queens. If you have decided to try your hand at queen-rearing, then purchase, say, three tested, or select tested, Italian queens from a reliable breeder as early as you can get them in the season, or at any time during the swarming

season will do. Introduce them to strong colonies and follow the instructions herein given for rearing queens. If, on the other hand, you prefer to purchase all the queens at first to Italianize your stocks, then order, say, two tested and the rest untested queens, and after you have Italian drones flying in fairly large numbers start queen-rearing with eggs from your tested queens, and so gradually change the untested queens that turn out to have been mismated to purely mated ones of your own raising, unless you are not particular about having a few hybrid colonies in your apiary.

Axiom.

"QUEENLESS COLONIES, UNLESS SUPPLIED WITH A QUEEN, WILL INEVITABLY DWINDLE AWAY, OR BE DESTROYED BY THE BEE-MOTH OR ROBBER BEES."

Langstroth.

CHAPTER XIII.

SURPLUS HONEY: MODE OF SECURING.

SPRING MANAGEMENT.

With the advent of spring come some of the chief duties of the apiarist. The object of his labours at this time will be to see that his stocks are progressing favourably, and that nothing is left undone to get them into good condition for taking every advantage of the honey season from its commencement. Much of the season's success depends upon good management in spring. Whatever may be the desire of the bee-keeper—whether it be to take all the honey he can, to increase his colonies at the expense of honey, or to secure a share of both—the management in early spring will be the same.

On the first favourable opportunity, after breeding has commenced, an examination of the stocks should be made and the condition of each noted for future reference. The first point is to see that they have a plentiful supply of food, any deficiency to be made up in the manner explained under the head of "Feeding;" and the next, to confine the bees on to as few combs as they can cover. The object of this is to conserve the heat of the bees as much as possible for the benefit of brood-rearing. Hives containing less than will cover five or six frames should be contracted by division boards (Fig. 68), and where there are not sufficient bees to cover three or four frames, unless the colony has a young and valuable queen, it may be better to unite it with another (see page 137). It should be borne in mind that—other circumstances being equal—the more bees there are to cover the brood the more rapidly will brood-rearing proceed.

DIVISION BOARDS.

These prove very serviceable at times; they are cheaply and easily made, and it is well to keep a few on hand. With the aid of a pair of close-fitting division boards I

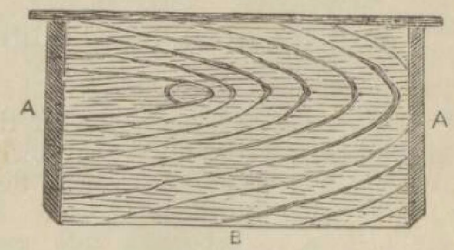


Fig. 68.—DIVISION BOARD.

have been able to keep up brood-rearing in small colonies all through the winter. A hive can be contracted to any size, and be made as snug as possible in a few minutes. I make them out of an inch board 9in. wide,

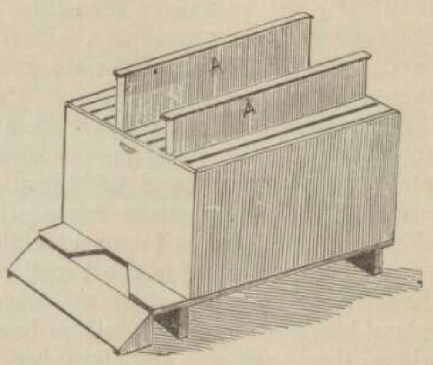


Fig. 69.—HIVE WITH DIVISION BOARDS.

cut off in lengths of 14¼in. (the inside width of a hive). The two ends, A A, are bevelled so as to leave a thin edge to come in contact with the hive. This enables a person to fix them in more readily without injury to the

bees. A top bar of a frame is nailed on the upper edge of each, so that when placed in the hive they should touch the sides and hang just clear of the bottom board, and the top bar should rest on the tin supports, the same as the frames, to keep them steady and in place. When contracting a hive for a small colony, remove or place at the side all the unoccupied combs, leaving just as many in the centre as are sufficient for present requirements; then place a division board on each side of them, as shown in Fig. 69. A A are the division boards raised in order to show them. An extra mat or two placed over the frames will keep the interior snug and warm.

PUTTING ON SURPLUS BOXES.

Having followed out the foregoing instructions and worked the stocks into good condition by the commencement of the main honey harvest, they may, if increase is the principal object in view, either be allowed to swarm, or be divided, as the case may be, before putting on the surplus boxes; but if honey only, or honey with a moderate increase, is desired, these boxes should be put on before the bees make the slightest preparations for swarming.

My own method is to place the surplus boxes on when the hives are fairly full of bees, plenty of young ones emerging, the weather warm, and honey commencing to come in pretty steadily, taking care to get them on before any queen cells are started. To induce the bees to start work at once in them I lift one or two of the side frames from the lower hive containing honey only, with the adhering bees, and place them in the centre of the top box, with an empty comb between them, replacing those from below with empty combs, which may be put toward the centre of the brood nest. By this plan swarming is kept back, and in the course of a day or two, if the weather is favourable, comb-building and honey-storing will be going on above. As the season advances and more honey is being gathered, and the top box is getting well stocked with workers, if I wish to

keep swarming down, I place another super with empty combs or frames of foundation, *next the lower hive under the super already on,* and commence to extract from the combs wholly or partly sealed, always taking care to keep the lower super well supplied with empty combs. After a while the hive contains an enormous force of workers, and when it does throw off a swarm it is an extra large one—one that is large enough to occupy a hive and surplus boxes at once; while if the queen cells are cut out of the parent stock and it is supplied with a young laying queen it will scarcely feel the loss of the swarm. Or even if nothing more be done than to prevent after-swarms issuing, the colony will not be long before it is in a very strong condition again.

The same method applies when raising comb-honey, but to induce the bees to enter the sections some half-worked ones should be placed in each super; if these are

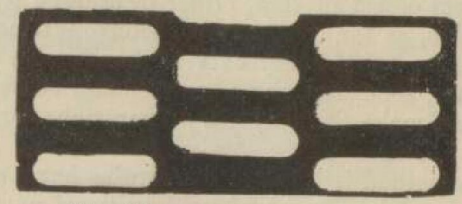


Fig. 70.—QUEEN EXCLUDER.

not to be obtained a clean new comb may be cut into sizes to fit the sections and fixed in them. If the frame system be adopted, then half-story supers should be used, and as soon as the bees are fairly started to work in the first one another should be placed underneath; the same applies to section cases. Much closer attention to ventilation and supplying extra room in the surplus boxes is needed to keep down swarming when working for comb than for extracted honey.

QUEEN EXCLUDER HONEY BOARD.

This device is for preventing the queen entering and laying in the upper boxes. It is usually made of a sheet

of perforated zinc (Fig. 70), and is placed over the frames of the lower hive. The perforations are a scant 5-32 of an inch in width; this space allowing the workers to pass through, but restraining the queen. They are largely used by some bee-keepers, but I do not favour them. I believe that any advantages gained by their use will be more than counterbalanced by some great disadvantages, such as creating a tendency to swarm by confinement of the brood-chamber, and the extra time taken by the workers getting into the supers. It is invariably the case during the height of the honey season that the bees will crowd the brood combs with honey, and thus curtail the space for breeding. When this occurs the bees will at once make preparations for swarming unless the queen can find room for laying in some other part of the hive; hence the chief reason she takes to the super. Under these conditions if she is confined to the brood chamber the result will be swarms, just the very thing to avoid—it is bees, not swarms, that are wanted in the height of the honey season. If the queen is capable of occupying both the brood chamber and super, let her have them, and put on another super, or even two, above, if needed. Every few days examine the brood chamber and remove combs heavy with honey and crowd all the brood possible below. Keep the brood chamber as clear of honey as you can. It will be found more profitable to spend the money in extra supers than in excluders.

TAKING SURPLUS HONEY.

When storing in the surplus boxes is in full swing, and honey coming in rapidly, it should be taken away as soon as ready. Sections should be removed as soon as finished (but not until every cell has been capped), and empty ones put in their places. Any propolis or wax that may be about the edges of the boxes should be scraped off, and the boxes placed for a day or two on shelves in the honey room, which must be dry and well ventilated, after which they can be crated for market.

I find crates holding one or two dozen sections to be best for handling and selling. These may be obtained from hive manufacturers at from 4/ to 5/ per dozen, and are usually charged for when sold with the honey, unless arrangements are made for their return.

Any unfinished sections at the end of the season should have the honey extracted from them, and be put away for next season's use. By careful management there need be but few, if any, unfinished sections when the honey season closes. As soon as the honey yield begins to fall off, the partly-finished sections should be distributed among the strongest colonies and placed in the centre of the supers, and as they are finished no more should be given; by this plan it is possible to get nearly every section at the end of the season fit for market.

Frames of honey for extracting may be removed as soon as about one-third capped. Some prefer to leave the combs in the hives until the whole of the cells are sealed, while others, again, remove them as soon as they are full, whether sealed or not, and ripen the honey after it is extracted. There is certainly a great saving of labour by the latter method, little or no uncapping to be done, and the honey can be thrown from the combs with much less trouble. I prefer to see combs partly capped, but I think there is no necessity to wait till they are sealed all over, if proper precautions are afterwards taken to finish the ripening of the honey before putting it up for market.

COMB BASKET AND BRUSH.

When removing surplus honey from the hives it is necessary to have something to place the frames or sections in, both for convenience of carrying and to keep the honey secure from the bees until it is safe in the honey or extracting house. I find tin comb-baskets, similar to the one shown on page 133, answer the purpose admirably. They are light, strong, clean, and handy. They should be made so that the frames will hang in

them the same as in a hive, and should have a space of at least two inches below the bottoms of the frames, to hold any honey that may drip from the combs after

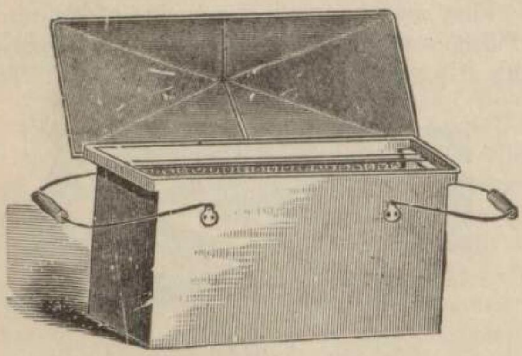


Fig. 71.—COMB BASKET.

they have been uncapped. To hold six frames conveniently they should be at least 8in. wide inside.

Another indispensable appliance is a brush of some kind for brushing the bees off the combs when removing them from the hives, and the kind shown in Fig. 72 is about the best for the purpose.

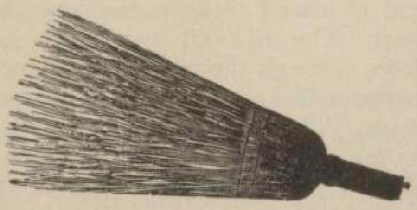


Fig. 72.—BEE BRUSH.

This is a sort of whisk broom especially made for brushing bees. The strands are thinned out and are longer than ordinary hand brooms so as to give a soft, pliable, easy sweep of the combs.

BEE ESCAPES.

Bee escapes as aids to removing surplus honey, more especially comb-honey, have come much into use of late years. They may be made the means of saving a great deal of time and trouble to the busy bee-keeper, and of avoiding stings on the part of the novice. Out of a

Fig. 73.—PORTER BEE ESCAPE.

number of different patterns that have been tried the "Porter Spring Bee Escape," a part of which is shown in Fig. 73, is the most popular at the present time. The body of the device shown is made of tin, inside of which is a steel spring seen on either side of the bee. The escape is fixed in the centre of a thin board made to fit closely between supers, or between a super and the brood nest. When comb-honey is to be removed the escape-board is placed between the super and the next body below it. The only exit then for the bees from the super is down through the round hole shown in Fig. 73 and out between the spring, back through which they cannot return. The best time to put on the escapes is in the evening. Lift up the super, place the escape underneath and set down the corner square upon it, allowing no hole or crevice round the edge by which the bees can return; by morning all the bees will be out and the super can be removed to the honey house, be relieved of its honey, and returned without being bothered by bees. With, say, a dozen escapes or more, the same number of supers on different hives can be dealt with at once.

RIPENING EXTRACTED HONEY.

The ripening of all honey, but more especially of extracted honey, before putting it up for market, is a matter of very great importance in every respect. Unripe honey quickly ferments and becomes useless except for making vinegar, and when honey is put upon the market in this condition it not only causes a direct loss to the raiser, and probably to the buyer as well, but it does a lasting injury to the brand. Honey when first gathered usually contains an excess of moisture, and even if not extracted until sealed it should always remain exposed to a warm, dry atmosphere in shallow vessels (tanks) as explained in Chapter VII. until it shows signs of granulating before being tinned. It is of no use to try to ripen honey in deep vessels; it will not. The larger the surface exposed the better and quicker will the surplus moisture evaporate, and until that is accomplished the honey is not fit for market.

Axiom.

"THE FORMATION OF NEW COLONIES SHOULD ORDINARILY BE CONFINED TO THE SEASON WHEN BEES ARE ACCUMULATING HONEY; AND IF THIS, OR ANY OTHER OPERATION, MUST BE PERFORMED WHEN FORAGE IS SCARCE, THE GREATEST PRECAUTIONS SHOULD BE USED TO PREVENT ROBBING."

Langstroth.

CHAPTER XIV.

WINTERING—UNITING—ROBBING.

It seems almost needless to devote space to the subject of wintering in this part of the world, where the average temperature the year round and the climate suggests perpetual summer, as compared with the severe winters of some of the principal bee-keeping countries of the Northern Hemisphere. It is, however, necessary to give a few instructions on the management of the apiary during those months which constitute our winter period. After the close of the honey season, that is, the season in which we secure our surplus honey, right on through the autumn up to the middle or end of May, more or less honey is gathered—as a rule sufficient to keep up breeding and afford at least some winter stores. Care, however, should be taken toward the close of the honey season not to deprive the bees too close in case of an unfavourable autumn, otherwise it might be necessary to feed them.

LATE BREEDING.

In order to secure what is most desirable, that is, strong colonies in early spring, it is necessary that there should be plenty of young bees in the hive in late autumn. To this end breeding should be kept up, or rather there should be no check to it more than is natural at that time of year. The supply of food in the hives and what is coming in regulates the breeding. With plenty of food stored and ever so little being gathered, breeding will go on satisfactorily; on the other hand, a scarcity of stores will check it at once, so that this must be seen to and regulated accordingly.

With the advent of spring comes the heaviest work for the field bees, carrying water and pollen for the

brood. The older bees with their frayed wings rapidly die off at this time, and unless there are plenty of young bees (bred in the previous late autumn) in the hive, breeding is checked, the colony gets weak and we get what is known as "spring dwindling." Should the colony survive it will take so long to recover itself that it may be of very little use till half the season has gone.

UNITING WEAK AND QUEENLESS COLONIES.

Weak colonies, from whatever cause, are a nuisance at all times, and should not be tolerated, and, of course, the same applies to those that become queenless. Should there be any such discovered after the honey season is over, unite them with others at once, as they are a danger in themselves inasmuch as they are likely to be attacked by robber bees. Very often both the above are to be found in early spring, when the only profitable course is to unite the bees with other colonies.

When the hives containing the colonies to be united are located some little distance apart move the weakest a few feet every evening till it is alongside the other. Should one of them contain a young or more valuable queen than the other, catch and cage her, then catch the other and kill her. Place the frames with the adhering bees from the weakest colony on one side of the other hive, and the others on the opposite side with the other frames between them, close down the hive quietly and watch for a while. If they show signs of fighting give two or three good doses of smoke. The caged queen should be suspended between the frames as in "Introducing Queens," which see. Another very good plan is to spread a sack down in front of the hive and shake all the bees from both hives together on the sack near the entrance, and as they are running in sprinkle a pinch of flour over them (not much); in this case let the queen run in with them. By the time they clean one another they become friendly and very rarely fight. Where there is no choice of queens, the two can be left

to fight for the queenship themselves. Always have the smoker ready to stop fighting.

VENTILATION.

Good and sufficient ventilation is as much needed in winter as at any other time to prevent dampness of the combs. In colonies of normal strength a wide entrance of six inches or more can be left, as it is chiefly by the entrance the bees ventilate the interior. This I have proved by some long-extended experiments with the assistance of the Rev. Father Madan.

ROBBING.

Bees are terrible robbers after the honey season closes, when they can find nothing better to do. They will go for anything containing saccharine matter, jams, sauces, syrups, or anything of that kind, and it is astonishing how quickly they can hunt out these things. Weak and queenless colonies become a prey to robber bees very quickly, and herein lies the danger of having such colonies in the apiary, for when once robbing has started it is a very difficult matter to stop it.

"Robbers" will be found at the close of the honey season visiting all the hives in the neighbourhood, flying round the covers and joints, trying, like burglars, to effect an entrance without being seen by the inmates. If, in these expeditions, they should come across a weak colony, they are bold enough to go in by the entrance door. If one bee should be fortunate enough to get away with a pilfered load, he will soon be back with some more of his hive companions; and this will go on systematically until in the end the hive is emptied of its honey, leaving the inmates in a starving condition. In most cases these villains will find the queen and kill her, and while the colony is, in consequence, in a demoralised state, "do a good business" in their nefarious practices. They also exert an evil influence over the inmates of the robbed hive; for these will sometimes

join with the robbers, and help to steal their own stores, leaving their old home to take up their quarters with the plunderers.

HOW TO KNOW ROBBER BEES.

It is rather difficult at first for the inexperienced to detect robber bees approaching a hive, but by careful observation one may soon become familiar with them. A robber bee, instead of alighting at once at the entrance, will fly and "dodge" about, making now and then a feint to settle; but should one of the sentinel bees at the entrance approach her, she at once starts back, as it were, out of the sentinel's range. If she finds the entrance too well guarded, she will try to find some other place to enter, hovering about the sides and back of the hives, and examining the joints of the floor-board, super, and cover, which the proper inhabitants of the hive would not be likely to do. Should there be reason to suspect that robbing has been started in any particular hive—and somethimes it is not easy to detect it at first—watch the bees as they come *out* of the hive; and if they appear to be loaded (which can be seen by the increased size of their abdomen), and find it difficult to rise and fly away, you may be certain that they are robbers. To find out which hive—if in your own apiary—the robbers have come from, dust the suspected bees with flour as they leave, and watch the other hives to see which they enter with their loads. A sure sign that robbing has been going on in a hive is the appearance of small pieces of wax—cappings of cells scattered about the entrance.

PRECAUTIONS TO BE OBSERVED.

More can be done in the way of precaution to guard against the starting of robbing than to put a stop to it when once started. A very slight cause may give rise to the first attempts; and if the bees once get infected with the desire, it may materially affect the prosperity of the apiary for the time being. No honey, pieces of

comb, or sweets of any sort should be left lying about where the bees can get at them. No hives should be opened more than is absolutely necessary when robbers are about. The honey house should be particularly guarded at this time. Robbing is likely to occur both in autumn and spring, but the first four or five weeks after the close of the honey season I have always found to be the worst in that respect.

HOW TO STOP ROBBING.

I have adopted the following methods to stop or check robbing, when it has taken place. Take a watering-pot, fitted with a fine rose, containing water, and, with a cloth laid across the entrance of the robbed hive, pour the water on to the cloth and over the bees that are flying about the front. In a short time remove the cloth and let any bees that wish to do so come out, without letting those outside get in. As soon as they are out, put the cloth back, and again wet it. This process I repeat two or three times. This appears to frighten the robbers, and in most cases I have found it effectual; but in extreme cases I have tried the following plan, which has had a satisfactory result: Found out where the robbers have come from, and changed the places of the robbed and robber hives. There are other methods; but having found the two above described successful, I think it is not worth while to go into them and perhaps confuse the beginner.

A light tent composed of a lath framework covered with strong mosquito netting large enough to cover hive and operator is sometimes used when the manipulation of a hive is absolutely necessary while robbers are about.

CHAPTER XV.

DISEASES OF BEES.

The only disease of any consequence that New Zealand bee-keepers are troubled with is foul brood, and surely that is bad enough. Though dysentery and paralysis may occasionally appear, they give very little trouble in this colony. Dysentery is, I think, usually caused by bad management, by allowing the interior of the hives to get damp and the food in consequence to become soured. It generally appears in winter and early spring, and if allowed to continue will eventually kill off the bees of a colony. The remedy is to transfer the bees to a clean, dry hive and combs, and give sweet, wholesome food in the shape of honey or syrup.

Bee paralysis, though I remember seeing one case, I believe it was the only one ever came under my observation, and then it could only have been a mild case, as the bees were all right again in a day or two. The disease appears to be very rare in New Zealand, otherwise I should have heard more about it. The symptoms according to Root and others are as follows:—Black and greasy appearance of the sick bees, in addition to greatly extended abdomens. Such bees will be seen dragging their semi-paralysed bodies out of the entrance and over the alighting board, while their trembling reminds one of palsy. No one appears to know the cause of the disease, and it is more prevalent in some parts of the world than in others. In the Southern States of America it causes great trouble, as it sometimes affects whole apiaries. There is no reliable remedy known at present, but I saw recently someone recommending dry powdered sulphur sprinkled over the bees as a remedy; but one should be very careful in trying it lest he did more harm than good.

BACILLUS ALVEI (Foul Brood).

If we could only cope with this disease we might look upon all other ailments of bees as of little consequence.

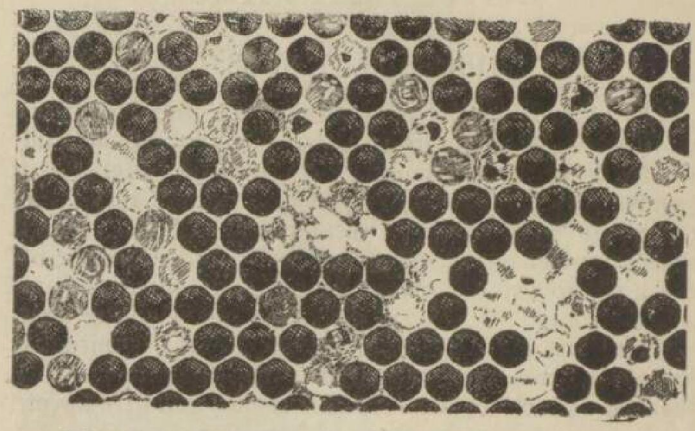


Fig. 74.— COMB AFFECTED WITH FOUL BROOD.

The above illustration is an excellent representation of diseased comb.

Mr. T. W. Cowan, of the "British Bee Journal," has given a very concise and clear "Life History of Foul Brood" in one of his books, from which I extract the following:—

SYMPTOMS OF FOUL BROOD.

"Some of the brood fails to hatch. Cappings here and there are sunken and perforated at the centre. On opening one of these cells there will be found a dead larva lying on one side, somewhat shrunken, and of a brownish colour, varying all the way from a light pale brown to a dark brown. In the more advanced stages the brown is of the colour of a coffee berry after being roasted. In the incipient stages the brown is of the colour of the coffee we drink, when greatly diluted with milk. But so far all these symptoms may be present as the result of overheated, chilled, or starved brood. But to determine whether it is the real foul brood, run a toothpick into the dead larva, and then slowly draw it out. If the matured mass adheres to the

end of the pick, about like spittle, and finally the fine thread breaks when the pick is drawn back, it is probably a case of foul brood. With all other forms of dead brood, with perhaps one exception, this ropiness does not appear; but with foul brood it invariably appears. Now, there is another symptom; and that is, the odour, while not exactly foul, resembles greatly that from a cabinetmaker's glue-pot; and when the disease is pretty well advanced in the hive, the odour will make itself manifest upon lifting the cover or quilt, even before exposing the brood. If other colonies are affected in a similar way, and the disease appears to spread, it is unquestionably a case of foul brood."

REMEDIES.

Not one of the drug remedies yet recommended, and their name is legion, appear to be effective as a cure in the hands of bee-keepers. The most the best of them appear to do when carefully applied is to check the disease: even that is a boon.

THE McEVOY TREATMENT.

Mr. Wm. McEvoy, the Canadian foul-brood inspector of Ontario, than whom no one living has a better knowledge of the disease, or who has treated it more successfully, condemns the drug remedies entirely, and I think with good reason, seeing that so little good has resulted from their use. Mr. McEvoy's treatment is very simple and, according to all accounts, most effective. It is claimed for him that he has cured thousands of colonies, and no doubt his remedy is the most successful known at the present time. He says:—

"In the honey season, when the bees are gathering freely, remove the combs *in the evening* and shake the bees into their own hive; give them frames with comb-foundation starters on, and let them build four days. The bees will make the starters into comb during the four days, and store the diseased honey in them which they took with them from the old combs. Then on the evening of the fourth day take out the new combs and give them comb-foundation [full sheets, I presume] to work out, and then the cure will be complete."

MEDICATED SYRUP.

The two drugs which are recommended as antiseptics for medicating syrup are carbolic acid crystals (phenol) and napthol beta. The former is used as follows:—One-quarter ounce to each 10lbs. of syrup. The carbolic acid should be added to the syrup when cool and carefully mixed by stirring.

Napthol beta is used in the following proportion: To each pound of sugar used in making syrup add three grains of napthol beta that has first been dissolved in alcohol; add and mix with the syrup while hot.

To make the syrup: Add half a pint of water to every pound of sugar, mix well over a slow fire and stir till it comes to a boil, when it can be removed. By feeding either of these syrups occasionally, especially in late autumn and early spring, it would at least kill the bacilli if it could not destroy the spores, and so keep the disease in check. Take care when handling diseased colonies that no robbers are about, and thoroughly cleanse the hands afterwards.

OTHER DISEASES.

There are other bacterial and fungoid diseases known which may occasionally be seen among bees. Dr. Wm. R. Howard, Professor of Bacteriology in Fortworth University, Texas, has recently been making some exhaustive inquiries into bee diseases, and differentiates three: Foul brood, Black brood, and Pickled brood. He gives brief instructions by which each may be distinguished:—

"Foul Brood—Glue-like consistence of the mass, and the offensive smell.

"Black Brood—Jelly-like consistence of the mass, the absence of ropiness noticed in foul brood, and the peculiar-like sour smell.

"Pickled Brood—Always watery, turning black after being attacked with the mucer fungus—a black mould—and by placing the larvæ in a sterilized chamber, keeping warm and dark, in three or four days the white fungus of pickled brood appears."

As Dr. Howard recommends for all these diseases a slightly modified form of the McEvoy treatment, there is no occasion to bother much which it is—treat the affected colonies at once. Too much reliance, however, should not be placed on any diagnosis of diseases other than foul brood at present, as there is considerable difference of opinion prevailing among bacteriologists.

DISINFECTING HIVES, ETC.

I thoroughly believe in disinfecting all hives and other material as they drop out of use in the autumn before storing them away for winter, and also at other times if needed. Calvert's No. 5 carbolic acid in solution is a capital disinfectant; instructions for diluting it are always given on the bottle. A thorough scrub with it both inside and outside the hives and all other parts cannot help but be beneficial.

SPRAY DIFFUSER.

A very handy appliance is shown in the following engraving; it is useful for spraying combs, when

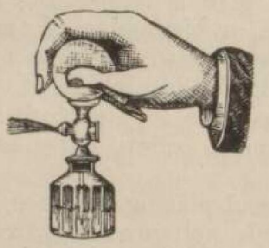


Fig. 75.—SPRAY DIFFUSER.

necessary, and is sometimes used for sprinkling bees with scented syrup to prevent fighting when uniting two or more colonies. There are some of a different construction to that shown, any of which can be purchased for a few shillings at most chemists' or hive manufacturers'.

CHAPTER XVI.

ENEMIES OF BEES.

The list of enemies of the bee usually set down in bee books published in the Northern Hemisphere includes ants, bee moths, some kinds of birds, mice, toads, and wasps. They omit, however, the very worst enemy the bee has—the careless and negligent bee-keeper. All the other so-called enemies combined are as nothing compared with him; in fact, it is chiefly through such bee-keepers that we have to speak of bee enemies, for there are none so formidable in my opinion as to cause the careful bee-keeper much concern.

ANTS

New Zealand is singularly free from the larger kinds of ants. In some parts of Australia they are troublesome more or less, but it is not difficult to deal with them. The best plan is to seek out and destroy their nests. Kerosene, or bisulphide of carbon, poured into holes made in the nests with an iron rod or crowbar, will destroy them. If the bisulphide is used care must be taken with it, as it is very explosive; kerosene is the safest to use, and I believe quite as effective as the other.

Some recommend placing poisoned saccharine matter or meat in vessels well protected from the bees by a covering of wire-cloth, and putting these near the hives where the ants are numerous. Large numbers may be trapped in this way; but the destruction of their nests is the best method of dealing with them.

THE BEE OR WAX MOTH.

There are, I believe, several different varieties of wax moths, two of which have come under my notice; the

smaller of the two, which has become familiar to most bee-keepers in New Zealand and Australia, is, I understand, known to entomologists as *Achroea grissella*, Fabr., and the larger one as *Galleria mellonella*, Linn. Until about the year 1880 the only wax moth known among bee-keepers in the Australasian colonies was the smaller one, but about that time the larger one was accidentally introduced with an imported colony of Italian bees, since when it has spread all over Australia, and there is every indication that it has now become established in New Zealand.

As the habits of all the wax moths are similar, I shall confine myself to a description of the larger one—*Galleria mellonella*, Linn., first mentioning that just previous to writing this I submitted to Professor Kirk, Government Biologist, Wellington, a caterpillar sent me by Messrs Betts and Son, of Hawera, and which I believed to be that of the large moth. The grub had developed into the pupa stage when it reached Professor Kirk, consequently he could not state *positively* what it was, but judging from a dead caterpillar in the same box he had very little doubt about it being the grub of the large moth. So far as I am aware it is the first time this moth has been noticed in New Zealand, and in all probability it has reached here with bees or queens imported from Australia.

The following interesting and instructive description and illustrations of the grub and large wax moth, by Mr. Sidney Oliff, Government Entomologist for New South Wales, are taken from the New South Wales *Agricultural Gazette*:—

"The larger of the beeswax moths—properly known as Galleria mellonella, Linn., but sometimes called by the name Galleria cereana, Fabr., is a very widely distributed species, being found throughout Europe and North America, in India, and even in the cold regions of Northern Siberia; indeed, it appears to have a range that is co-extensive with that of the bee-hive itself. In warm countries it is much more abundant, and therefore destructive, than in temperate or cold climates, a fact which is probably accounted for by the varying num-

ber of broods or generations which occur in a season under different climatic conditions. With us in New South Wales the first brood of moth appears in the early spring from caterpillars which have passed the winter in a semi-dormant condition, within the walls of their silken coverings, and only turned to pupæ or chrysalids upon the approach of warm weather. These winter (or hibernating) caterpillars feed very little, and usually confine their wanderings to the silken channels which they have made for themselves before the

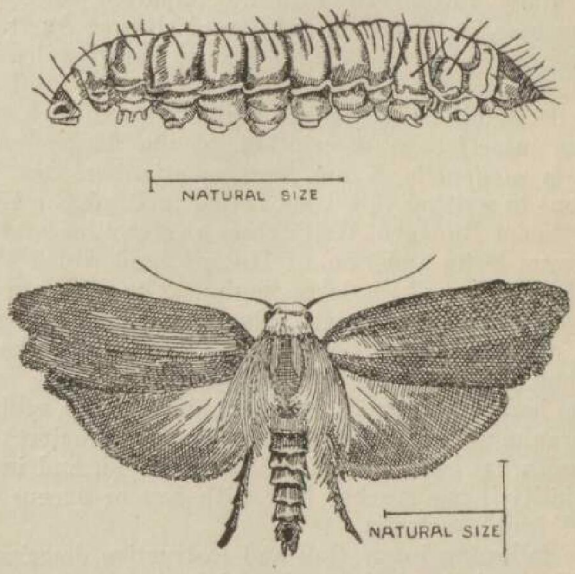


Fig. 76.

1. LARVA OR CATERPILLAR OF LARGER BEESWAX MOTH, MALE (much enlarged). 2. LARGER BEESWAX MOTH (much enlarged).

cool weather sets in. Upon the return of the desired warmth the caterpillars spin a complete cocoon for themselves, and turn to the chrysalis stage, and in from ten days to a fortnight the perfect moth appears. The moth then lays eggs in any convenient spot, such as the sides and bottoms of the frames, on the walls of the hive itself, or on the comb. In each case I have had an opportunity of observing the process.

the moth chose the sides of the frames, as near to the brood-comb as possible, the young larvæ having a decided preference for this comb. The larvæ having once made their appearance, which they usually do in from eight to ten days after the laying of the eggs, their growth is exceedingly rapid, the average time before they are ready to assume the chrysalis stage being only some thirty days. The average duration of the chrysalis period is about a fortnight, so it can easily be seen with what great capabilities for rapid reproduction we have to deal. As we have said, the number of generations, or broods, which develop in a season, i.e., between early spring and late autumn, varies with locality and climate, but it may be worth while to record that, in my opinion, we have sufficient evidence to prove the existence of four broods in the Sydney district under ordinary circumstances. I have myself bred three generations, or broods, from a comb received in early spring from the Richmond River; and I am convinced

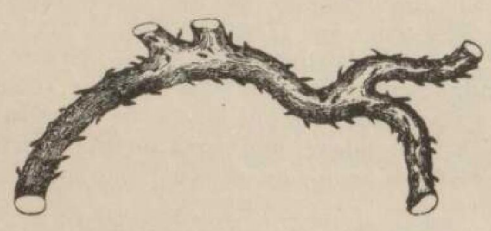


Fig. 77.— SILKEN TUBE OF BEE MOTH LARVA.

that a fourth might have been bred from the same stock but for an unfortunate accident to the eggs obtained from my third brood. Upon first hatching, the larva is pale yellow in colour, with a slightly darkened head; and, when full grown, it is of a dull grayish flesh colour, with a dark reddish-brown head. Its average length is about an inch, and, like the majority of the caterpillars of moths, it has sixteen legs. The chrysalis of the larger beeswax moth is of the ordinary type, and is enclosed in a very compact cocoon of tough white silk, usually spun up in one of the silken channels or galleries made by the larva which we have previously referred to. The perfect insect, or moth, has reddish brown-gray fore-wings, which are distinctly lighter in colour towards the outer or hinder margins. The sexes may readily be distinguished by the outline of the wings, as will be seen by a glance at the plate accompanying this article."

REMEDIES.

The very best remedy against the bee moth and all other insect enemies of the bee, is care on the part of the bee-keeper, and to *keep all colonies strong*. Where the large moth prevails Italian bees should be cultivated, as these are absolutely proof against its inroads in their hives; but black bees cannot hold out long against their attacks, and eventually succumb under careless management.

FUMIGATING COMBS.

This is very often necessary before putting away spare combs for the winter to destroy bee-moth larvæ or other small insects that may have obtained a lodgment in them. The following is the method:—Hang them in a small close room (or if only a few, a large close box will do as well), burn one pound of sulphur to every one hundred cubic feet contained in the room or box. To burn it, get an iron pot, put some ashes in the bottom, with live embers, and pour on the sulphur; shut the door of the room, or close up the box, for two or three days.

When combs are stowed away during the winter months, they should be looked over occasionally, and if necessary fumigated again as above described. Combs containing honey stowed away should also be fumigated, if worms of bee moth are detected in them. I have often placed spare combs in bodies of hives over strong colonies of Italian bees during the winter with very good results.

Axiom

"QUEENLESS COLONIES, UNLESS SUPPLIED WITH A QUEEN, WILL INEVITABLY DWINDLE AWAY, OR BE DESTROYED BY THE BEE-MOTH OR ROBBER BEES."

Langstroth.

CHAPTER XVII.

BEE FORAGE.

Some of the best and most generally known sorts of bee forage are of a character which plainly invites the establishment of apiaries in their neighbourhoods, wherever they are found extensively, such as clover, heather, wild thyme or wild sage, large orchards with their abundance of fruit blossoms, or forest trees of some particular descriptions. The heaths of Scotland and Ireland, the wild thyme of Greece and the wild sage of California, are not to be sought for in New Zealand or Australia; but, on the other hand, the clovers and the fruit trees of all kinds flourish so well in many parts of these countries as to hold out the strongest inducements for their cultivation, and the great majority of the bush or forest trees are peculiarly valuable, not only on account of their honey-bearing qualities, but also because they vary so much in their times of blossoming that some of them are available at almost every season of the year.

NATIVE FLORA OF NEW ZEALAND.

Most of the forest trees indigenous to New Zealand are honey-bearing, some of them remarkably so. The following are the native, English, and botanical names of the principal ones:—

1. Rewa-rewa .. Honeysuckle, *Knightia excelsa.*
2. Pohutukawa .. Christmas tree, *Metrosideros tomentosa.*
3. Rata .. .. Oak-elm, *Metrosideros robusta.*
4. Hinau .. .. .. *Elaeocarpus hinau.*
5. Kahikatea .. White pine, *Podocarpus dacrydioides.*
6. Matai .. .. Black pine, *Podocarpus spicata.*
7. Miro .. .. .. *Podocarpus ferruginea.*
8. Puriri .. .. New Zealand oak, or teak, *Vitex littoralis.*
9. Kohekohe .. Cedar, *Hartighsea spectabilis.*
10. Tawai .. .. .. *Leiospermum racemosum.*
11. Kowai .. .. .. *Edwardsia microphylla.*
12. Nikau .. .. Native palm, *Areca sapida.*

In the bush also are generally found the native fuchsia, wild clematis, rata creeper (white and red), karaka (laurel, *corinocarpus*), koromiko (*veronica*), and many other flowering shrubs or creepers; in the open, both on hillsides and swampy places, cabbage trees (*Cordyline Australis* and *Dracaena Australis*), and the New Zealand flax (*Phormium tenax*), and in the fern-lands generally, manuka (tea-tree, *Leptospermum scoparium*), rawiri (*Leptospermum ericoides*), and tutu (*Coriaria sarmentosa*).

With regard to the periods of blossoming of much of the native flora of the northern parts of New Zealand, I am indebted to Mr. J. Blair, of the Great Barrier Island, for the following information. He says:—

"Here the cabbage tree blooms in October-November; flax, November-December. Tea-tree, it is possible to get a specimen of bloom all the year, but for practical purposes it blooms from the last week in March to the end of December, and the bees work on it all the time. My bees have been working on it now a fortnight, but it only gives honey in quantity from the beginning of October to the end of December, and during that time they gather honey only. From March to October they gather both honey and pollen. From October to December any one can both taste and see the honey in the blossom. Rewa-rewa blossoms from September 20th to December 10th: any one can lick the thick honey off it with the tongue. When the bees get properly started on these, they don't take notice of any honey lying about.

"In the middle of November the tree rata and pohutukawa begins, and lasts to the middle of February. The white rata (creeper) begins in December, and lasts till April; red rata (creeper) begins in January, and lasts till May; koromiko begins in January, and lasts till June; nikau begins in February; puriri begins in March, and lasts till November, although it is easy to get a specimen all the year; hohere (it has a thick stringy bark), kohekohe cedar, mangeo, and another I do not know the name of, all bloom in April, May, and June. These are the principal trees we get honey from here. There are plenty of other tres that bees work upon, but they either give honey in small quantities, or we have not got them in sufficient number for the bees to store honey from."

WHITE CLOVER.

White clover is very abundant in many districts of New Zealand, and I imagine there are very few parts of the world where white clover honey can be obtained so near its purity as in this colony. The wide stretches of clover pasturage to be seen with very little of any other bee forage about will account for this. My experience at Matamata, where I raised a score or two of tons of almost pure white clover honey, enabled me to compare it with samples sent me of the best honeys raised in different parts of the world, and I have no hesitation in saying that none can compare with New Zealand's best honey. I believe white clover with some dandelion growing near together forms the finest bee forage in the world, and produces the grandest honey that can be conceived. It was my good fortune to be able to raise this class of honey at Matamata.

NATIVE FLORA OF AUSTRALIA AND TASMANIA.

All the species of those two great families of trees so peculiar to Australia, EUCALYPTUS and ACACIA, are splendid for bee forage, yielding both nectar and pollen in abundance, and, what is of especial importance in a climate like that of most of the Australasian colonies, where the bees can gather surplus honey nearly all the year round, they seem as if specially designed to supplement each other; the eucalypti blooming, as a rule, in the summer half, and the acacias in the winter half of the year.

Several of the chief honey-bearing eucalypti are mentioned in a Queensland Government work I have before me. They comprise:—

E. tereticornis, blue gum.
E. platyphylla, poplar gum.
E. saligna, grey gum.
E. maculata, spotted gum.
E. botryoides, woollybutt.
E. hemiphloia, gum-topped box.
E. populifolia, poplar box.
E. corymbosa, common bloodwood.
E. trachyhloia, white bloodwood

The kinds of eucalypti that flourish in different parts of Australia vary considerably, but most of them form excellent bee forage. The same may be said of the acacias, of which there are many.

Tasmania can also boast of a splendid native bee flora in the different varieties of eucalypti and acacias, especially the bluegum and boxwoods. I had the pleasure of seeing and tasting a number of samples of eucalyptus honey of different kinds when on a visit to Australia, and I can only speak very highly of it, and think it ought to find a ready sale in Europe if well-graded before being sent.

The following are a few of the many honey-bearing acacias that are cultivated in New Zealand, and which blossom in the order numbered from April to September, affording more or less bee forage all through the winter months:—

1. *A. lophantha*, common wattle.
2. *A. decurrens*, black wattle.
3. *A. dealbata*, silver wattle.
4. *A. pycnantha*, golden or broad-leaf wattle.
5. *A. longifolia*, long-leaf wattle.
6. *A. melanoxylon*, lightwood or blackwood.
7. *A. undulata*, Kangaroo Island prickly acacia.

ARTIFICIAL BEE FORAGE.

By artificial bee forage I mean something grown and cultivated specially for bees. I am often asked what is best to grow for bees; my reply invariably is, "White clover, if you can grow a large area of it and have other profitable uses for it besides affording forage for bees." At one time it was thought to be profitable to cultivate for bees, but experience has taught us differently. Anything grown for bee forage must cover a considerable area, say, a number of acres, to be profitable; but unless you can make other use of the crop it would, I am afraid, prove very unprofitable. My advice to anyone intending to go into bee-keeping as a business, be it large or small, is to choose a good locality, where good

bee forage is abundant, and don't bother about growing anything specially for your bees.

FLIGHT OF BEES.

There is considerable difference of opinion as to the distance bees will fly for food; some think they will go six miles or more if there is sufficient inducement. What concerns bee-keepers most is not how far they will fly, but how far can they go to gather honey with profit to their owner; or, in other words, how near to their forage should they be. The consensus of opinion is, they should not have to fly beyond a radius of two miles in any direction, and I am of the same opinion myself.

IN DISTRICTS WHERE FORAGE IS ABUNDANT ONLY FOR A SHORT PERIOD, THE LARGEST YIELD OF HONEY WILL BE SECURED BY A VERY MODERATE INCREASE OF STOCKS.

Langstroth.

CHAPTER XVIII.

CALENDAR.

VARIABILITY OF SEASONS.

No *invariable* rules can be laid down for the work to be done in an apiary each month, which can be strictly followed in *every* place, nor even in the same place in *every* year. The whole plan of operations must be suited in the first place to the normal climate of the district in which the apiary is situated, the nature of the bee forage available both in the spring and the honey season, and to the natural habits of the bees as influenced by their local peculiarities. If these circumstances be properly taken into account, a set of general rules may be established suitable to the average of seasons; but even these must be liable to modifications at the judgment of the apiarist, according to the variations, or the more or less abnormal features, of different seasons.

In the arrangement of apiary work for the different months throughout the year, as a handy guide to the novice, I have chosen the dates of the average bee seasons for the latitude of Auckland, New Zealand, as a basis to calculate from. In many parts of Australia the seasons are earlier, while those in Tasmania approximate closely to those in New Zealand to the South of Auckland.

January.—In average seasons a goodly proportion of the crop of honey is secured this month in districts South of Auckland, and very often in late seasons the main portion is taken. Swarming still continues, but every effort should be made to keep it down, otherwise it will seriously interfere with the honey yield. Remove sections from the hives as soon as completely

sealed, and place them in the honey house for a few days to ripen before packing them for market; take care that there are no bee moths in the house. Extract as often as necessary the surplus honey in frames. Supersede old queens.

February.—Unless the weather is hot and dry, as it occasionally is this month, a considerable quantity of honey is gathered during the first half, but care should be taken not to deprive the hives too closely in case the honey season suddenly closes, when the bees would be left short of food. Beware of robber bees as soon as the honey flow ceases, and don't give them an opportunity to pillage, otherwise there will be trouble. Return any swarms that issue. Supersede old and defective queens.

March.—Robbers will still be troublesome where they have the least chance to carry on their work of plundering. Keep a good look-out for them. See that each colony has a plentiful supply of food, so that brood-rearing may be kept up. The honey season practically closes at the early part of this month. All hives, etc., as they drop out of use should be disinfected with a solution of carbolic acid before being stored away for the winter. Now is a good time to paint hives and repair covers.

April.—It is important that brood-rearing should be kept up all through the autumn, so that there may be plenty of young bees to go into winter quarters; to this end there should be plenty of food in the hives. All weak and queenless colonies should now be united with others. Symptoms of foul-brood are more distinct at this time and in the spring of the year, and should be dealt with accordingly.

May.—All colonies should be overhauled and be prepared for winter as early as possible this month. Unite weak and queenless colonies overlooked last month, see that there is plenty of food in each hive, and that there are no leaky covers.

June.—This should be a quiet month in the apiary if the previous instructions have been carried out. The less bees are meddled with during winter the better.

July.—Look out for leaky covers and damp mats, remove and repair defective covers, and give dry mats where required. Remove all surplus boxes that are now on the hives, and put on one or two extra mats, as breeding will commence toward the end of the month.

August.—All hives should be well overhauled on the first fine days this month and the condition of each noted. See to the food supply, and feed where short, as a larger quantity will now be required for feeding the brood. Clean the bottom boards, and put in division boards where required. As breeding will have commenced, care should be taken to keep the interior of the hives warm. Remove any combs that are mouldy. Place the hive on a stand alongside while cleaning the bottom board. Unite weak and queenless colonies, and stimulate those required for queen-rearing purposes. Make up hives, frames, etc., and send orders to the manufacturers for material required for the coming season. Willows and early-flowering peach-trees blossom at the end of the month.

September.—The food supply should be attended to as advised last month. Brood-rearing should now go on steadily. Should the weather be against the bees see that they don't run short of food. Look out for symptoms of foul-brood and deal with it at once. Queen-rearing may be started. Swarming commences to the North of Auckland, and also in many of the warmer parts of Australia this month.

October.—The honey season in districts North of Auckland and in Australia begins this month. Swarming becomes pretty general throughout New Zealand sooner or later this month, according to the season. Transferring should be done as early as possible. Put on top boxes where swarms are not required. See to

the ventilation as the weather gets warmer. Unite small colonies. Transferring may be done.

November.—The first batch of queens should be ready this month, though in the warmer parts of Australasia they would have been ready for distribution more than a month ago. This is the best month for Italianising the apiary. Give plenty of working room for the bees, and remove surplus honey as soon as it is ready. Look out for swarms.

December.—Supersede all worthless queens, and keep down swarming by affording sufficient working room. The first of the clover honey is usually secured this month, and everything should be done to assist in securing the largest crop while the clover lasts.

HONEY RECIPES.

There are quite a number of ways of using honey to advantage—as food, in making wholesome drinks, and medicinally. It makes the finest pickling vinegar known. Space will not admit of my giving more than a few recipes.

Vinegar.—Procure a barrel of the size required, take out the head, then fill, or nearly fill, with water, into which mix in the proportion of about one pound of honey to each gallon of water. To test when it is sufficiently sweet, put a fresh-laid egg in the liquid, and when it floats with only a small round disc showing above the surface everything is right. Cover the top of the barrel with fine cheesecloth, and allow it to stand in a warm spot—on a verandah in the sun is a very good place during the summer, provided the rain cannot beat into it. It will take from nine to twelve months to make, but will well repay the trouble.

LIGHT BEVERAGES.

Cheap Harvest Drink.—To those engaged in harvesting and other occupations tending to create thirst, we recommend the following preparation, which makes a very palatable and healthful drink in hot weather:—Take 12 gallons of water, 20lbs. of honey, and 6 eggs, using the whites only. Let these boil one hour; then add cinnamon, ginger, cloves, mace, and a little rosemary. When cold, add one spoonful of yeast from the brewer. Stir it well, and in 24 hours it will be good.

Honey Mead.—Take three gallons of water of blood warmth, three half-pints of honey, two-thirds of a tablespoonful of ginger; one-third of a tablespoonful of allspice, and mix well together with a gill of yeast; let it stand over night, and bottle next morning. It will be in good condition to drink in 24 hours.

Hydromel.—This is a very nice drink and easily made. For 11lbs. of honey take from 26 to 52 pints of water, according to the strength you wish to give the drink; boil in a copper saucepan for an hour or two on a moderate fire; take off the scum as soon as it forms. Remove from the fire, let it cool, and pour it into a clean barrel, which must be quite filled, and place it with the bung-hole open in a dry, wholesome place, having a temperature from 60° to 66° Fahr. At the end of two or three days fermentation takes place. If long in fermenting add a little yeast; it will be active enough in a few days. Take care to fill the cask out of a bottle previously filled for that purpose. In a month or six weeks the cask may be closed and put in a cellar. The liquid clears and is soon fit to drink.

MEDICINAL.

Honey Gargle (Consumptive Hospital recipe for sore throat).—Borax, 1 drachm; honey, 2 drachms; water, 4 ounces. Mix.

Honey Paste (pate au miel), for chaps, etc.—Clarified honey and cold cream, equal parts, rubbed smooth together.

Honey and Borax, for sores in children's mouths.—Dissolve 1 ounce of borax in 1 ounce of glycerine, and then add 6 ounces clarified honey.

To Clarify Honey.—Melt in a water bath (i.e., place a vessel containing honey in a saucepan of water and heat), and strain while hot through flannel previously moistened with warm water.

INDEX.

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