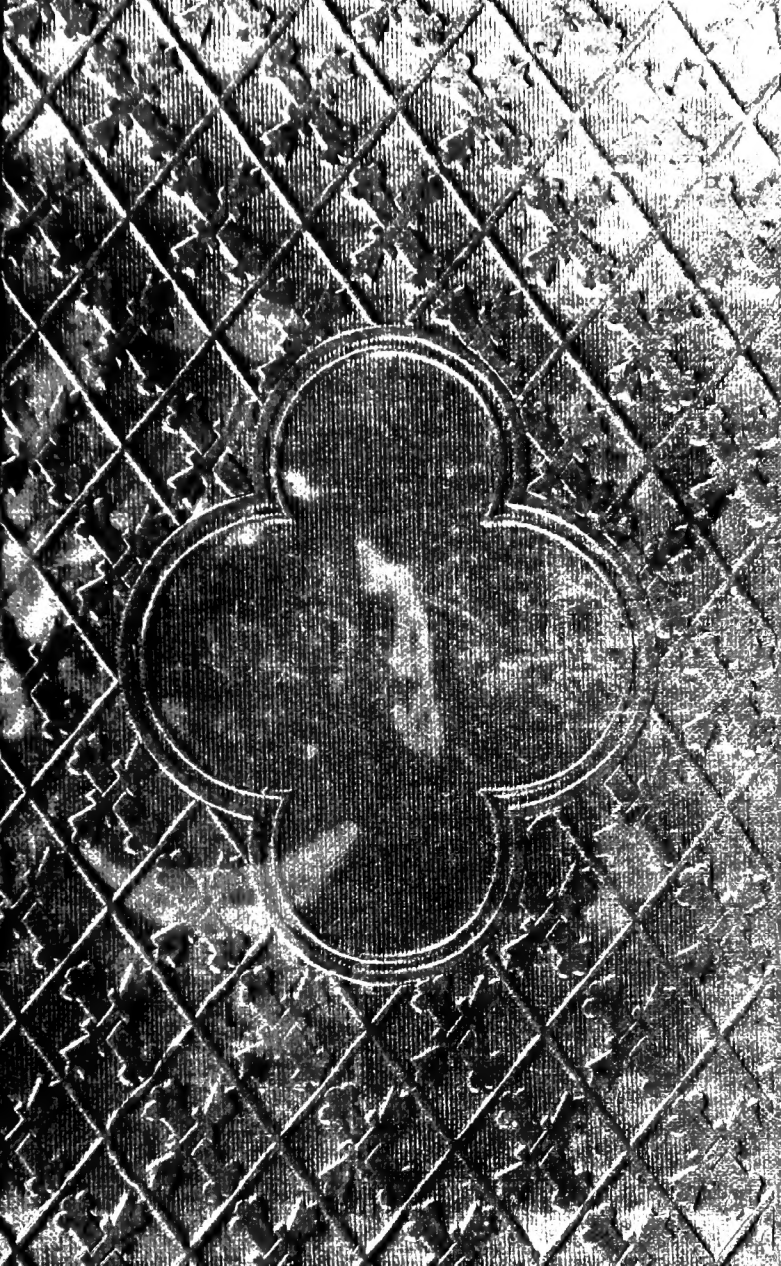
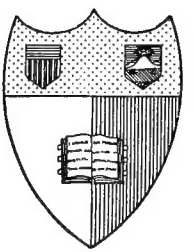
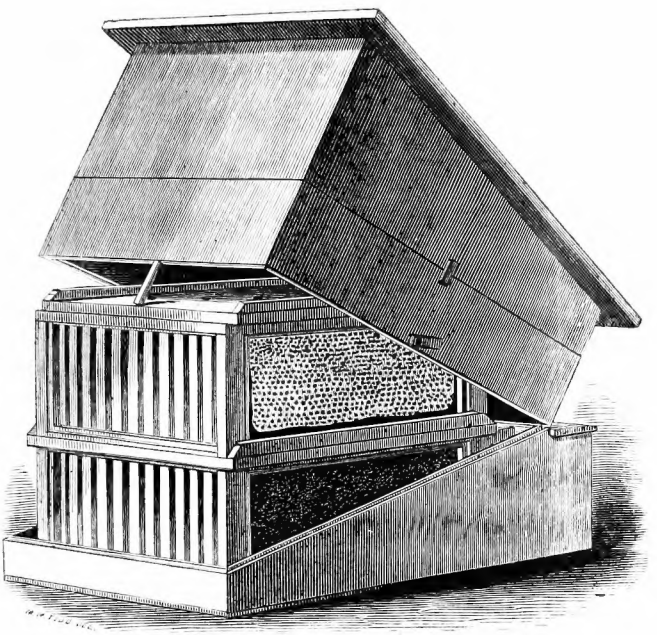




So work the Honey Bees,
Creatures, that by a rule in Nature, teach
The art of order to a peopled kingdom.—*Shakspeare.*



Movable Comb Hive, with glass on all sides.

A

PRACTICAL TREATISE

ON THE

HIVE AND HONEY-BEE,

BY L. L. LANGSTROTH,

WITH AN INTRODUCTION, BY REV. ROBERT BAIRD, D.D.

SECOND EDITION, ENLARGED, AND ILLUSTRATED WITH NUMEROUS ENGRAVINGS.

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1857.

C. A. MIRICK, PRINTER, GREENFIELD, MS.

INTRODUCTION.

I AM happy to learn from my friend Mr. Langstroth, that a new edition of his work on the economy and proper treatment of the Honey-Bee, is called for; I consider it by far the most valuable treatise on this subject, which has come under my notice. Some years before it was published, I became acquainted with the main characteristics of the method which he pursues and which it describes. Even then, I believed that method to be incomparably superior to all others of which I had either read or heard. This conviction has been amply strengthened by the testimony of others, as well as by results which have come under my own observation.

In my earlier life I had no inconsiderable experience in the management of bees, and I am bold to say that the hive which Mr. Langstroth has invented, is in all respects

greatly superior to any which I have ever seen, either in this or foreign countries. Indeed, I do not believe that any one who takes an intelligent interest in the rearing of bees, can for a moment hesitate to use it; or, rather, can be induced to use any other, when he becomes acquainted with its nature and merits.

At length the true secret has been discovered, of making these most industrious, interesting and useful of insect-communities, work in habitations both comfortable to themselves and wonderfully convenient for their aggregation, division and rapid increase; and all this without diminishing their productive labor, or resorting to the cruel measure of destroying them.

Mr. Langstroth teaches us in his book, how bees can be taken care of without great labor, and without the risk of suffering from the weapon which the Creator has given them for self-defence. Even a delicate lady need not fear to undertake the task of cultivating this fascinating branch of rural economy. Nothing is easier for any family that resides in a favorable situation, than to have a number of colonies, and this at but little expense. I sincerely hope that many will avail themselves of the facilities now placed before them, for prosecuting this easy branch of industry, not only for the sake of the large profit in proportion to its expense, which it may be made to yield, but also for the substantial pleasure which they

may find in observing the habits of these wonderful little creatures. How remarkably does their entire economy illustrate the wisdom and skill of the GREAT AUTHOR of all things.

I cannot but believe that many of the Ministers of the Gospel, residing in rural districts, will accept of Mr. Langstroth's most generous offer to give them the free use of his Invention. With very little labor or expense, they can derive from bee-keeping considerable profit, as well as much pleasure. No industrial or material employment could be more innocent or less inconsistent with their proper work.

There are few portions of our country which are not admirably adapted to the culture of the honey-bee. The wealth of the nation might be increased by millions of dollars, if every family favorably situated for bee-keeping would keep a few hives. No other branch of industry can be named, in which there need be so little loss on the material that is employed; or which so completely derives its profits from the vast and exhaustless domains of Nature.

I trust that Mr. Langstroth's labors will contribute greatly to promote a department of rural economy, which in this country has hitherto received so little scientific attention. He well deserves the name of Benefactor; infinitely more so than many who have in all countries

and in all ages received that honorable title. Not many years will pass away without seeing his important invention brought into extensive use, both in the Old and New World. Its great merits need only to be known; and this Time will certainly bring about.

R. BAIRD.

NEW YORK, March 5th, 1857.

PREFACE.

GRATEFUL for the favor with which this Treatise on the Hive and Honey-Bee has been received, the Author respectfully submits to the candid perusal of his Readers, a Revised Edition, illustrated by numerous beautiful wood-cuts, and containing the results of his latest discoveries and improvements. The information here presented, is believed to constitute a decided advance, in some important respects, on anything which has hitherto been furnished to the Apiarian Public; and while specially adapted to the wants of those who use the Movable-Comb Hive, it aims to set forth the true principles which lie at the foundation of all profitable Bee-Keeping, with any hive or on any system of management.

Debarred to a painful extent, by the state of his health, from the more appropriate duties of his Sacred Office, and compelled to seek some employment calling him as much as possible into the open air, the Author indulges the hope that the result of his labors in an important department of Rural Economy, may prove serviceable to the community as well as to himself. Such has been the satisfaction which he has taken in these researches, that he has felt desirous of awakening a more general interest in a pursuit, not merely profitable in its pecuniary results, but most admirably adapted to instruct and delight all intelligent observers. Scientific Bee-keeping is regarded, in Europe, as an Intellectual pursuit, and no one who studies the wonderful habits of this useful Insect, need apprehend that the materials for new observations will ever become exhausted. The Creator has stamped the seal of his own Infinity, on all his works, so that it is impossible even in his minutest pro-

ducts to exhaust the store-house of the Divine Knowledge, so as "by searching" to "find out the Almighty to perfection." But while "a present Deity" may be seen in all the wide extent of Animated Nature, in few things has He displayed himself more clearly than in the wise economy of the Honey-Bee:

"What well appointed commonwealths! where each
Adds to the stock of happiness for all;
Wisdom's own forums! whose professors teach
Eloquent lessons in their vaulted hall!
Galleries of art! and schools of industry!
Stores of rich fragrance! Orchestras of song!
What marvellous seats of hidden alchymy!
How oft, when wandering far and erring long,
Man might learn truth and virtue from the BEE!"

Bowring.

The attention of Ministers of the Gospel is particularly invited to the study of this branch of Natural History. An intimate acquaintance with the wonders of the Bee-Hive, while benficial to them in various ways, might lead them, by drawing their illustrations more from natural objects and the world around them, to adapt them better to the comprehension and sympathies of those who hear them; they would thus, in their preaching, imitate more closely the example of their Lord and Master, whose practice it was to illustrate his teachings, from the birds of the air, the lilies of the field, and the common walks of life and pursuits of men.

It affords me sincere pleasure to acknowledge my obligations to Mr. Samnel Wagner, of York, Pennsylvania, for material assistance in the preparation of this Treatise: to his extensive and accurate acquaintance with bee-keeping in Germany, my readers are indebted for much exceedingly valuable information.

L. L. LANGSTROTH.

PHILADELPHIA, March 10th, 1857.

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ADVERTISEMENT.

L. L. LANGSTROTH'S MOVABLE COMB HIVE.

Patented October 5th, 1852.

EACH comb in this hive is attached to a separate movable frame, and by following the directions given in this Treatise, they may be all taken out in a few minutes, without cutting or injuring them in the least, or at all enraging the bees. By this arrangement, weak stocks may be easily strengthened, by helping them to combs, honey, or maturing brood taken from strong ones, and queenless colonies saved from certain ruin, by giving them the means of obtaining another queen.

As all the stocks in the Apiary, by the control of the combs, can be kept strong in numbers and in possession of a fertile queen, the ravages of the bee-moth may be effectually prevented.

If the bee-keeper suspects that anything is the matter with a hive, he can open it, and by actual examination of its combs, ascertain, in a few minutes, its true condition, and thus apply intelligently the remedies which it needs.

New colonies may be formed in less time than is usually required for hiving natural swarms; or the hive may be managed on the common swarming plan, or enlarged, (without any alteration of existing parts,) so as to afford ample accommodation for a non-swarming stock.

By a very simple arrangement, the queen may be confined to the hive while the workers have their liberty, so that bees may be left at any time, without the least risk of their swarming in the absence of the bee-keeper. The drones when in full flight may, by the same device, be excluded from the hive and destroyed.

The surplus honey may be stored in an upper box, in frames so secured as to admit of safe transportation, any one of which may be taken out separately and disposed of; or if

It is now more than seventeen years since I first turned my attention to the cultivation of bees. The state of my health having compelled me, of late years, to live more and more in the open air, I have devoted a large portion of my time to a careful investigation of their habits, and to a series of minute and thorough experiments in the construction of hives, and the best methods of managing them, so as to secure the largest practical results.

Very early in my Apiarian studies, I procured an imported copy of the work of the celebrated Huber, and constructed a hive on his plan, which furnished me with favorable opportunities of verifying some of his most valuable discoveries; and I soon found that the prejudices existing against him, were entirely unfounded. Believing that his discoveries laid the foundation for a more extended and profitable system of bee-keeping, I began to experiment with hives of various construction.

The result of these investigations fell very far short of my expectations. I became, however, most thoroughly convinced that no hives were fit to be used in exposed situations, unless they furnished uncommon protection against extremes of heat, and, in our Northern States, more especially of cold. I accordingly discarded all thin hives made of inch stuff, and constructed my hives of doubled materials, enclosing a "dead air" space all around.

These hives, although more expensive in the first cost, proved to be much cheaper in the end, than those I had previously used. The bees wintered remarkably well in them, and swarmed early and with unusual regularity. Some of them now stand in my Apiary, in Greenfield, Massachusetts, containing vigorous stocks in their twelfth year, which, without feeding, have endured all the vicissitudes of some of the worst seasons ever known for bees. My next

step in advance, was, while I secured my surplus honey in the most convenient, beautiful and salable forms, so to facilitate the entrance of the bees into the honey receptacles, as to obtain the largest fruits from their labors.

Although I felt confident that my hive possessed some valuable peculiarities, I still found myself unable to remedy many of the perplexing casualties to which bee-keeping is liable. I was now convinced that no hive could be made to answer my expectations unless it gave me the *complete control of the combs*, so that I might remove any, or all of them at pleasure. The use of the Huber hive had convinced me that with proper precautions, the combs might be removed without enraging the bees, and that these insects were capable of being domesticated or tamed, to a most surprising degree. A knowledge of these facts was absolutely necessary to the further progress of my invention, for without it, I should have regarded a hive designed to allow of the removal of the combs, as quite too dangerous in use, to be of any practical value. At first, I used movable slats or bars placed on rabbets in the front and back of the hive. The bees were induced to build their combs upon these bars, and in carrying them down, to fasten them to the sides of the hive. By severing the attachments to the sides, I was able, at any time, to remove the combs suspended from the bars. There was nothing new in the use of movable bars; the invention being probably, at least, a hundred years old; and I had myself used such hives on Golding's plan, as recommended by Bevan, very early in the commencement of my experiments. The chief peculiarity in my hives, as now constructed, was the facility with which these bars could be removed without enraging the bees, and their combination with my new mode of obtaining the surplus honey.

With hives of this construction I commenced experimenting

on a larger scale than ever, and soon arrived at results which proved to be of the very first importance. I found myself able, when I wished it, to dispense entirely with natural swarming, and yet to multiply colonies with much greater rapidity and certainty than by the common methods. I could, in a few minutes, strengthen my feeble colonies, and furnish those which had lost their Queen with the means of obtaining another. If I suspected that anything was the matter with a hive, I could ascertain its true condition by making a thorough examination of every part, and if the worms had gained a lodgment, I could quickly dispossess them. In short, I could perform all the operations which will be explained in this treatise, and I believed that bee-keeping could be made highly profitable, and as much a matter of certainty, as any other branch of rural economy.

I perceived, however, that one thing was yet wanting. The *cutting* of the combs from their attachments to the sides of the hive, in order to remove them, was attended with much loss of time, both to myself and the bees, and in order to facilitate this operation, the construction of my hive was necessarily somewhat complicated. This led me to invent a method by which the combs were attached to MOVABLE FRAMES, and suspended in the hives, so as to touch neither the top, bottom, nor sides. By this device, I was able to remove the combs at pleasure, and if desired, I could speedily transfer them, bees and all, without any cutting, to another hive. I have experimented largely with hives of this construction, and find that they answer most admirably, all the ends proposed in their invention.

While experimenting in the city of Philadelphia, in the Summer of 1851, with some observing hives of a peculiar construction, I ascertained that bees could be made to work in glass hives, exposed to the full light of day. A knowledge

of this discovery, procured me the pleasure of an acquaintance with Rev. Dr. Berg, pastor of a Dutch Reformed church in that city. From him, I first learned that a Prussian clergyman, of the name of Dzierzon, (pronounced Tseertsone,) had attracted the attention of crowned heads, by his important discoveries in the management of bees. Before he communicated to me the particulars of these discoveries, I explained to Dr. Berg my system of management, and showed him my hive. He expressed the greatest astonishment at the wonderful similarity in our methods of management, both of us having carried on our investigations without the slightest knowledge of each other's labors. Our hives, he found to differ in some very important respects. In the Dzierzon hive, the combs are not attached to movable frames, but to bars, so that they cannot, without cutting, be removed from the hive. In my hive, which is opened from the top, any comb may be taken out, without at all disturbing the others; whereas, in the Dzierzon hive, which is opened from one of the ends, it is often necessary to cut and remove many combs, in order to get access to a particular one; thus, if the tenth comb from the end is to be removed, nine combs must be first cut and taken out. All this consumes a large amount of time. The German hive does not furnish the surplus honey in a form which would be found most salable in our markets, or which would admit of safe transportation in the comb. Notwithstanding these and other disadvantages, it has achieved a great triumph in Germany, and given a new impulse to the cultivation of bees.

The following letter from Samuel Wagner, Esq., Cashier of the bank in York, Pennsylvania, will show the results which have been obtained in Germany, by the new system of management, and his estimate of the superior value of my hive to those in use there.

York, Pa., Dec. 24, 1852.

Dear Sir: — The Dzierzon theory and the system of bee-management based thereon, were originally promulgated, *hypothetically*, in the "Eichstadt Bienen-zeitung," or Bee-journal, in 1845, and at once arrested my attention. Subsequently, when in 1848, at the instance of the Prussian government, the Rev. Mr. Dzierzon published his "Theory and Practice of Bee Culture," I imported a copy, which reached me in 1849, and which I translated prior to January 1850. Before the translation was completed, I received a visit from my friend, the Rev. Dr. Berg, of Philadelphia, and in the course of conversation on bee-keeping, mentioned to him the Dzierzon theory and system, as one which I regarded as new and very superior, though I had had no opportunity for testing it practically. In February following, when in Philadelphia, I left with him the translation in manuscript — up to which period, I doubt whether any other person in this country had any knowledge of the Dzierzon theory; except to Dr. Berg I had never mentioned it to any one, save in very general terms.

In September, 1851, Dr. Berg again visited York, and stated to me your investigations, discoveries and inventions. From the account Dr. Berg gave me, I felt assured that you had devised substantially the *same system* as that so successfully pursued by Mr. Dzierzon; but how far *your hive* resembled his I was unable to judge from description alone. I inferred, however, several points of difference. The coincidence as to system, and the principles on which it was evidently founded, struck me as exceedingly singular and interesting, because I felt confident that you had no more knowledge of Mr. Dzierzon and his labors, before Dr. Berg mentioned him and his book to you, than Mr. Dzierzon had of you. These circumstances made me very anxious to

examine your hives, and induced me to visit your Apiary in the village of West Philadelphia, last August. In the absence of the keeper, I took the liberty to explore the premises thoroughly, opening and inspecting a number of the hives, and noticing the internal arrangement of the parts. The result was, that I came away convinced that though your system was based on the same principles as Dzierzon's, yet that your hive was almost totally different from his, in construction and arrangement; that while the same objects *substantially* are attained by each, your hive is more simple, more convenient, and much better adapted for general introduction and use, since the mode of using it can be more easily taught. Of its ultimate and triumphant success I have no doubt. I sincerely believe that when it comes under the notice of Mr. Dzierzon, he will himself prefer it to his own. It in fact combines all the good properties which a hive ought to possess, while it is free from the complication, clumsiness, *vain whims*, and decidedly objectionable features which characterize most of the inventions which profess to be at all superior to the simple box, or the common chamber hive.

You may certainly claim equal credit with Dzierzon for originality in observation and discovery in the natural history of the honey bee, and for success in deducing principles and devising a most valuable system of management from observed facts. But in invention, as far as neatness, compactness, and adaptation of means to ends are concerned, the sturdy German must yield the palm to you. You will find a case of similar coincidence detailed in the Westminster Review for October, 1852, page 267, et seq.

I send you herewith some interesting statements respecting Dzierzon, and the estimate in which his system is held in Germany. Very truly yours,

SAMUEL WAGNER.

Rev. L. L. Langstroth.

The following are the statements to which Mr. Wagner refers :

" As the best test of the value of Mr. Dzierzon's system, is the *results* which have been made to flow from it, a brief account of its rise and progress may be found interesting. In 1835 he commenced bee-keeping in the common way, with twelve colonies, and after various mishaps, which taught him the defects of the common hives and the old mode of management, his stock was so reduced that in 1838 he had virtually to begin anew. At this period he contrived his improved hive in its ruder form, which gave him the command over all the combs, and he began to experiment on the theory which observation and study had enabled him to devise. Thenceforward his progress was as rapid as his success was complete and triumphant. Though he met with frequent reverses, about seventy colonies having been stolen from him, sixty destroyed by fire, and twenty-four by a flood, yet in 1846 his stock had increased to three hundred and sixty colonies, and he realized from them that year six thousand pounds of honey, besides several hundred weight of wax. At the same time most of the cultivators in his vicinity who pursued the common methods, had fewer hives than they had when he commenced.

In the year 1848, a fatal pestilence, known by the name of " foul brood," prevailed among his bees, and destroyed nearly all his colonies before it could be subdued, only about ten having escaped the malady, which attacked alike the old stocks and his artificial swarms. He estimates his entire loss that year at over five hundred colonies. Nevertheless he succeeded so well in multiplying by artificial swarms, the few that remained healthy, that in the fall of 1851 his stock consisted of nearly four hundred colonies. He must, therefore, have multiplied his stocks more than three-fold each year.

The highly prosperous condition of his colonies is attested by the Report of the Secretary of the Annual Apiarian Convention, which met in his vicinity last Spring. This Convention, the fourth which has been held, consisted of one hundred and twelve experienced and enthusiastic bee-keepers from various districts of Germany and neighboring countries, and among them were some who, when they assembled, were strong opposers of his system.

They visited and personally examined the Apiaries of Mr. Dzierzon. The report speaks in the very highest terms of his success, and of the manifest superiority of his system of management. He exhibited and satisfactorily explained to his visitors, his practice and principles; and they remarked, with astonishment, the *singular docility* of his bees, and the thorough control to which they were subjected. After a full detail of the proceedings, the Secretary goes on to say:

"Now that I have seen Dzierzon's method practically demonstrated, I must admit that it is attended with fewer difficulties than I had supposed. With his hive and system of management it would seem that bees become at once more docile than they are in other cases. I consider his system the simplest and best means of elevating bee-culture to a profitable pursuit, and of spreading it far and wide over the land; especially as it is adapted to districts in which the bees do not readily and regularly swarm. His eminent success in re-establishing his stock, after suffering so heavily from the devastating pestilence, in short the recuperative power of the system demonstrates conclusively, that it furnishes the best, perhaps the only means of reinstating bee-culture to a profitable branch of rural economy.

Dzierzon modestly disclaimed the idea of having attained perfection in his hive. He dwelt rather upon the truth and importance of his theory and system of management."

From the Leipzig Illustrated Almanac—Report on Agriculture for 1846:

"Bee culture is no longer regarded as of any importance in rural economy."

From the same for 1851, and 1853:

"Since Dzierzon's system has been made known, an entire revolution in bee culture has been produced. A new era has been created for it, and bee-keepers are turning their attention to it with renewed zeal. The merits of his discoveries are appreciated by the government, and they recommend his system as worthy the attention of the teachers of common schools."

Mr. Dzierzon resides in a poor, sandy district of Lower Silesia, which, according to the common notions of Apiarians, is unfavorable to bee culture. Yet despite of this and of various other mishaps, he has succeeded in realizing nine hundred dollars as the product of his bees in one season!

By his mode of management, his bees yield, even in the poorest years, from 10 to 15 per cent. on the capital invested, and where the colonies are produced by the Apiarian's own skill and labor, they cost him only about one-fourth the price at which they are usually valued. In ordinary seasons the profit amounts to from 30 to 50 per cent., and in very favorable seasons from 80 to 100 per cent."

In communicating these facts to the public, I have several objects in view. I freely acknowledge that I take an honest pride in establishing my claims as an independent observer; and as having matured by my own discoveries, the same system of bee-culture, as that which has excited so much interest in Germany; I desire also to have the testimony of the translator of Dzierzon to the superior merits of my hive. Mr. Wagner is extensively known as an able German scholar. He has taken all the numbers of the Bee Journal,

a monthly periodical which has been published for more than fifteen years in Germany, and is undoubtedly more familiar with the state of Apiarian culture abroad, than any man in this country.

I am anxious further to show that the great importance which I attach to my system of management, is amply justified by the success of those who, while pursuing a similar one with inferior hives, have attained results, which to common bee-keepers, seem almost incredible. Inventors are too prone to form exaggerated estimates of the value of their labors; and the American public has been so often deluded with patent hives, devised by persons ignorant of the most important principles in the natural history of the bee, and which have utterly failed to answer their professed objects, that they are scarcely to be blamed for rejecting every new hive as unworthy of confidence.

There is now a prospect that a Bee Journal will before long, be established in this country. Such a publication has long been needed. Properly conducted, it will have a most powerful influence in disseminating information, awakening enthusiasm, and guarding the public against the miserable impositions to which it has so long been subjected.

Three such journals are now published monthly in Germany, one of which has been in existence for more than seventeen years; and their wide circulation has made thousands well acquainted with those principles which must constitute the foundation of any enlightened and profitable system of culture.

The truth is that while many of the principal facts in the physiology of the honey bee have long been familiar to scientific observers, it has unfortunately happened that some of the most important have been the most widely discredited. In themselves they are so wonderful, and to those who have

not witnessed them, often *so incredible*, that it is not at all strange that they have been rejected, either as fanciful conceits, or bare-faced inventions.

Many persons have not the slightest idea that every thing may be *seen* that takes place in a bee-hive. But for more than half a century hives have been in use, containing only one comb, enclosed on both sides, by glass. These hives are darkened by shutters, and when opened, the queen is exposed to observation, as well as all the other bees. Within the last four years, I have discovered that with proper precautions, colonies can be made to work in observing hives, without shutters, and exposed continually to the full light of day ; so that observations may be made at all times, without in the least interrupting the ordinary operations of the bees. By the aid of such hives, many intelligent persons from various States in the Union, have seen in my Apiaries, the queen bee depositing her eggs in the cells, and constantly surrounded by an affectionate circle of her devoted children. They have also witnessed, with astonishment and delight, all the mysterious steps in the process of raising queens from eggs which, with the ordinary development, would have produced only the common bees. Often, for more than three months, there has not been a day in which some of my colonies were not engaged in making new queens to supply the place of those taken from them, and I have had the pleasure of exhibiting all the facts to bee-keepers who never before felt willing to credit them. As all my hives are so made that each comb can be taken out, and examined at pleasure, those who use them, can obtain from them all the information which they need, and are no longer forced to take anything upon trust.

May I be permitted to express the hope that the time is now at hand, when the number of practical observers will

be so multiplied, and the true principles of bee-keeping so thoroughly understood, that ignorant and designing men will neither be able to impose their conceits and falsehoods upon the public, nor be sustained in their attempts to depreciate the valuable discoveries of those who have devoted years of observation and experiment, to promote the advancement of Apiarian knowledge.

CHAPTER II.

The Honey Bee capable of being Tamed or Domesticated, to a most Surprising Degree.

If the bee had not such a necessary and yet formidable weapon, both of offence and defence, multitudes might easily be induced to enter upon its cultivation, who are now afraid to have anything to do with it. As the new system of management which I have devised, seems to add to this inherent difficulty, by taking the greatest possible liberties with so irascible an insect, I deem it important to show clearly, in the very outset, how bees may be managed, so that all necessary operations may be performed in an Apiary, without incurring any serious risk of exciting their anger.

Many persons have been unable to control their expressions of astonishment, as they have seen me open hive after hive, removing the combs covered with bees, and shaking them off in front of the hives, forming new swarms, exhibiting the queen, transferring the bees with all their stores to another hive, and, in short, dealing with them as if they were as harmless as so many flies. I have sometimes been

asked if my bees had not been subjected to a long course of instruction, to prepare them for public exhibition; when the very hives which I was opening, contained swarms which had been brought only the day before to my Apiary.

Before entering upon the natural history of the bee, I shall anticipate some principles in its management, in order to prepare my readers to receive the statements in my book, without those doubts which would otherwise be very natural, and to convince them that almost any one favorably situated, may safely enjoy the pleasure and profit of a pursuit, which has been most appropriately styled "the poetry of rural economy;" and that, without being made too familiar with a sharp little weapon, which can most speedily and effectually convert all the poetry into very sorry prose.

It must be manifest to every thinking mind, that the Creator intended the bee, as truly as he did the horse or the cow, for the comfort of man. In the early ages of the world, and indeed until quite modern times, honey was almost the only natural sweet; and the promise of "a land flowing with milk and honey," had then a significance, the full force of which it is difficult for us to realize. The honey bee, therefore, was created not merely with the ability to store up its delicious nectar for its own use, but with certain properties which fitted it to be domesticated, and to labor for man, and without which he would no more have been able to subject it to his control, than to make a useful beast of burden of a lion or a tiger.

One of the peculiarities which constitutes the very foundation, not merely of my system of management, but of the ability of man to domesticate at all so irascible an insect, has never, to my knowledge, been clearly stated by any other writer, as a great and controlling principle. It may be thus expressed:

A HONEY BEE, WHEN IT IS GORGED OR FILLED WITH HONEY, NEVER VOLUNTEERS AN ATTACK, BUT ACTS SOLELY ON THE DEFENSIVE.

This is a law of the honied tribe, as universal in its application as the law of gravity in physics; and I should just as soon expect a stone to rise into the air without any propelling power, as a bee well filled with honey to offer to sting, unless crushed or injured by some direct assault. The man who first attempted to lodge a swarm of bees in an artificial hive, must have been most agreeably surprised at the ease with which he was able to accomplish the feat; for bees when intending to swarm, usually fill their honey-bags to their utmost capacity. This is wisely ordered, that they may have materials for commencing operations immediately in their new habitation; that they may not starve if several stormy days should follow their emigration; and that when they leave their hives, they may be in a suitable condition to be secured by man.

They issue from their hives in the most peaceable mood that can well be imagined; and unless they are abused, allow themselves to be treated with great familiarity. The hiving of bees by those who understand their nature, could always be conducted without risk, if it were not the case that some improvident or unfortunate ones occasionally come forth without the soothing supply; and not being stored with honey, are filled instead with the gall of the very bitterest hate against all mankind and animal kind in general, and any one who dares to meddle with them in particular. Such thriftless radicals are always to be dreaded, for they must vent their spleen on something, even though they perish in the attempt.

Suppose a whole colony, on sallying forth, to possess such a ferocious spirit; no one would ever dare hive them, unless

clad in a coat of mail, at least bee-proof, and not even then until all the windows of his house were closed, his domestic animals bestowed in some place of safety, and sentinels posted at suitable stations, to warn all comers to look out for something almost as much to be dreaded as a fiery locomotive in full speed. In short, if the propensity to be exceedingly good natured after a hearty meal, had not been given to the bee, it could never have been domesticated, and our honey would still be procured from the clefts of rocks, or the hollows of trees.

A second peculiarity in the nature of the bee, and one of which I continually avail myself with the greatest success, may be thus stated:

BEES CANNOT, UNDER ANY CIRCUMSTANCES, RESIST THE TEMPTATION TO FILL THEMSELVES WITH LIQUID SWEETS.

It would be quite as easy for an inveterate miser to look with indifference upon a golden shower of double eagles, falling at his feet and soliciting his appropriation. If then we can contrive a way to call their attention to a treat of running sweets, when we wish to perform any operation which might provoke them, we may be sure they will accept it, and under its genial influence, so long as we do not hurt them, allow us without molestation, to do what we please.

We must always be particularly careful not to handle them roughly, for they will never allow themselves to be pinched or hurt without thrusting out their sting to resent the indignity. I always keep a small watering-pot or sprinkler, in my Apiary, that when I wish to operate upon a hive, as soon as the cover is taken off, and the bees exposed, I may sprinkle them gently with water sweetened with sugar: they help themselves with the greatest eagerness, and in a few moments are in a perfectly manageable state. The truth is, that bees managed on this plan are always glad to

see visitors, and you cannot look in upon them too often, for they expect at every call to receive a sugared treat by way of a peace-offering. The greatest objection to the use of sweetened water, is the eagerness of the bees from other hives, to regale themselves on its contents. When there is any scarcity of honey in the fields, they will often surround the Apiarian, as soon as he presents himself with his watering pot, ready to plunge into any hive which he may open, and steal if possible a portion of its treasures.

A third peculiarity in the nature of the bee, and one which gives an almost unlimited power of control over them, may be expressed as follows:

BEES, WHEN THEY ARE FRIGHTENED, IMMEDIATELY BEGIN TO FILL THEMSELVES WITH HONEY FROM THEIR COMBS.

If the Apiarian can only succeed in frightening his little subjects, he will, in a few minutes, make them as peaceable as though they were incapable of stinging. By the use of a little smoke from decaying wood, or punk, as it is often called, the largest and most fiery colony may at once be brought into complete subjection. As soon as the smoke is blown among them, they retreat from before it, raising a subdued or terrified note, and at once, as though they imagined that their honey was to be taken from them, they cram their honey-bags to their utmost possible capacity. They act either as though they were aware that all they can lodge in this inside pocket is perfectly safe, or else as though expecting to be driven away from their stores, they were determined, as in swarming, to start with a full supply of provisions for the way. The same result may be obtained by shutting them up in their hive and then drumming upon it for a short time. The various processes, however, for inducing bees to fill themselves with honey, will be more fully explained in the chapter that treats of the formation of Artificial Swarms.

By the use of sweetened water or smoke, or by drumming I can superintend a large number of hives, performing every operation that is necessary for pleasure or profit, and yet not run the risks of being stung, which must frequently be incurred in attempting to manage, in the simplest way, the common hives.

Let all your motions about your hives be gentle and slow. Accustom your bees to your presence; never crush or injure them, or breathe upon them in any operation; acquaint yourself fully with the principles of management detailed in this treatise, and you will find that you have but little more reason to dread the sting of a bee, than the horns of your favorite cow, or the heels of your faithful horse.

Armed with one of my bee-hats and a pair of india-rubber gloves, even the most timid, by availing themselves of these principles, may open my hives and deal with their bees, with a freedom utterly astonishing to the oldest cultivators of bees, on the common plan. In the management of the most extensive Apiary, no operation will ever be necessary, which by exasperating a whole colony, impels them to assail, with almost irresistible fury, the person of the bee-keeper.

CHAPTER III.

The Queen or Mother-Bee, the Drones, and the Workers; with various Highly Important Facts in their Natural History.

Honey Bees can flourish only when associated in large numbers, as a colony. In a solitary state, a single bee is almost as helpless as a new-born child, being unable to

endure even the ordinary chill of a cool Summer night. If a strong colony is examined, a short time before it swarms, three different kinds of bees will be found in the hive.

1st, A bee of peculiar shape, commonly called the *Queen Bee.*

2d, Some hundreds, more or less, of large bees called *Drones.*

3d, Many thousands of a smaller kind, called *Workers* or common bees, and similar to those which are seen on the blossoms. A large number of the cells will be found filled with honey and bee-bread ; while vast numbers contain eggs, and immature workers and drones. A few cells of unusual size, are devoted to the rearing of young queens, and are ordinarily to be found in a perfect condition, only in the swarming season.

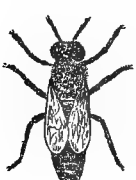
The *Queen Bee* is the only *perfect female* in the hive, and all the eggs are laid by her. The *Drones* are the *males*, and the *Workers* are *females*, whose ovaries or " egg-bags " are so imperfectly developed that they are incapable of breeding, and which retain the instinct of females, only so far as to give the most devoted attention to rearing the brood.

These facts have all been repeatedly demonstrated, and are as well established as the most common facts in the breeding of our domestic animals. The knowledge of them in their most important bearings, is absolutely essential to all who expect to realize large profits from any improved method of rearing bees. Those who will not acquire the necessary information, if they keep bees at all, should manage them in the old-fashioned way, which requires the smallest amount of knowledge and skill.

I am perfectly aware how difficult it is to reason with a large class of bee-keepers, some of whom have been so

often imposed upon, that they have lost all faith in the truth of statements made by any one interested in a patent hive, while others stigmatize all knowledge which does not square with their own, as "book knowledge," entirely unworthy the attention of practical men.

If any such read this book, let me remind them again, that all my assertions may be put to the test. So long as the interior of a hive, was to common observers, a profound mystery, ignorant and designing men might assert what they pleased, about what passed in its dark recesses; but now, when all that takes place in it, can, in a few moments, be exposed to the full light of day, and every one who keeps bees, can see and examine for himself, the man who attempts to palm upon the community, his own conceits for facts, will speedily earn for himself, the character both of a fool and an imposter.



The Queen Bee, or as she may more properly be called *the mother bee*, is the common mother of the whole colony. She reigns therefore, most unquestionably, by a divine right, as every good mother is, or ought to be, a queen in her own family. Her shape is widely different from that of the other bees. While she is not near so bulky as a drone, her body is longer, and of a more tapering, or sugar-loaf form than that of a worker, so that she has somewhat of a wasp-like appearance. Her wings are much shorter, in proportion, than those of the drone, or worker; the under part of her body is of a golden color, and the upper part usually darker than that of the other bees. Her motions are generally slow and matronly, although she can, when she pleases, move with astonishing quickness.

No colony can long exist without the presence of this all-

important insect. She is just as necessary to its welfare, as the soul is to the body, for a colony without a queen must as certainly perish, as a body without the spirit hasten to inevitable decay.

She is treated by the bees, as every mother ought to be by her children, with the greatest respect and affection. A circle of her loving offspring constantly surround her, testifying, in various ways, their dutiful regard; gently touching or embracing her with their antennæ, offering her honey, from time to time, and always, most politely backing out of her way, to give her a clear path when she wishes to move over the combs. If she is taken from them, as soon as they have ascertained their loss, the whole colony is thrown into a state of the most intense agitation; all the labors of the hive are at once abandoned; the bees run wildly over the combs, and frequently, rush forth from the hive, exhibiting all the appearance of anxious search for their beloved mother. Not being able to find her, they return to their desolate home, and by their mournful tones, reveal their deep sense of so deplorable a calamity. Their note, at such times, more especially when they first realize their loss, is of a peculiarly mournful character; it sounds somewhat like a succession of wailings on the minor key, and can no more be mistaken by the experienced bee-keeper, for their ordinary, happy hum, than the piteous moanings of a sick child could be confounded by an anxious mother, with its joyous crowings when overflowing with health and happiness.

I am well aware that all this will sound to many, much more like romance than sober reality; but I have determined, in writing this book, to state facts, however wonderful, just as they are; confident that in due time they will be universally received, and hoping that the many wonders in the economy of the honey bee will not only excite a wider inter-

est in its culture, but lead those who observe them, to adore the wisdom of Him who gave them such admirable instincts.

The fertility of the queen bee has been entirely underestimated by most writers. It is truly astonishing. During the height of the breeding season, she will often, under favorable circumstances, lay from two to three thousand eggs, a day! In my observing hives, I have seen her lay at the rate of six eggs a minute. The fecundity of the female of the white ant, is, however, much greater than this, as she will lay as many as sixty eggs a minute; but then her eggs are simply extruded from her body, and carried by the workers into suitable nurseries, while the queen bee herself deposits her eggs in their appropriate cells.

On the way in which the Eggs of the Queen Bee are Fecundated.

I come now to a subject of great practical importance, which, until recently, has been attended with difficulties apparently insuperable.

It has been noticed that the queen bee usually commences laying very early in the season, and always long before there are any males in the hive. (See remarks on Drones.) In what way, then, are her eggs impregnated? Francis Huber of Geneva, by a long course of the most indefatigable observations, threw much light upon this subject. Before stating his discoveries, I must pay my humble tribute of gratitude and admiration to this wonderful man. It is mortifying to every scientific naturalist, and I might add, to every honest man acquainted with the facts, to hear such an Apiarian as Huber, abused by the veriest quacks and imposters; while others who are indebted to his labors for nearly all that is of any value in their works,

"Damn with faint praise, assent with civil leer,
And without sneering, teach the rest to sneer."

Huber, in early manhood, lost the use of his eyes. His opponents imagine that in stating this fact, they have thrown merited discredit on all his observations. But to make their case still stronger, they delight to assert that his servant, Francis Burnens, by whose aid he conducted his experiments, was only an ignorant peasant. Now this, so-called, ignorant peasant, was a man of strong native intellect, possessing the indefatigable energy and enthusiasm so indispensable to a good observer. He was a noble specimen of a self-made man, and afterwards rose to be the chief magistrate in the village where he resided. Huber has paid the most admirable tribute to his intelligence, fidelity and indomitable patience, energy and skill.*

It would be difficult to find, in any language, a better specimen of the inductive system of reasoning, than Huber's work upon bees, and it might be studied as a model of the only true way of investigating nature, so as to arrive at reliable results.

Huber was assisted in his researches, not only by Burnens, but by his own wife, to whom he was engaged before the loss of his sight, and who nobly persisted in marrying him, notwithstanding his misfortune, and the strenuous dissuasions of her friends. They lived for more than the ordinary term of human life, in the enjoyment of uninterrupted domestic happiness, and the amiable naturalist, in her assiduous attentions, scarcely felt the loss of his sight.

* A single fact will show the character of the man. It became necessary, in a certain experiment, to examine separately all the bees in two hives. "Burnens spent *eleven* days in performing this work, and during the whole time he scarcely allowed himself any relaxation, but what the relief of his eyes required."

Milton is believed by many, to have been a better poet, in consequence of his blindness; and it is highiy probable that Huber was a better Apiarian, from the same cause. His active and yet reflective mind demanded constant employment; and he found in the study of the habits of the honey bee, full scope for all his powers. All the facts observed, and experiments tried by his faithful assistants, were daily reported, and many inquiries were stated and suggestions made by him, which would probably have escaped his notice, if he had possessed the use of his eyes.

Few, like him, have such a command of both time and money, as to be able to prosecute for a series of years, on a grand scale, the most costly experiments. Apiarians owe more to Huber than to any other person. Having repeatedly verified the most important of his observations, I take the greatest delight in acknowledging my obligations to him, and in holding him up to my countrymen, as the PRINCE OF APIARIANS.

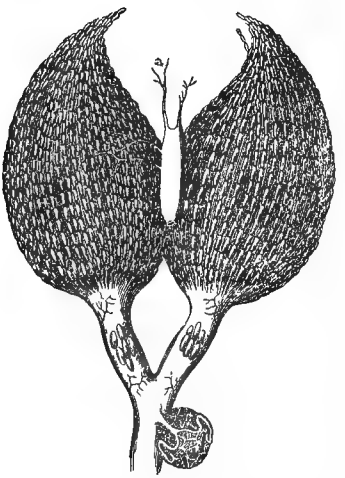
To return to his discoveries on the impregnation of the Queen Bee. By a long course of experiments, most carefully conducted, he ascertained that like many other insects, she is fecundated in the open air, and on the wing, and further that the influence of this lasts for several years, and probably for life. He could form no satisfactory conjecture how the eggs which were not yet developed in her ovaries, could be fertilized. 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. Dzierzon, who must be regarded as one of the ablest contributors of modern times, to Apiarian science, maintains this opinion, and states that he has found such a receptacle filled with a fluid resembling the semen of the drones. He nowhere, to my knowledge, states that he ever made

any microscopic examinations, so as to put the matter on the footing of demonstration.

In January and February of 1852, I submitted several Queen Bees to Dr. Joseph Leidy of Philadelphia, for a scientific examination. I need hardly say to any Naturalist in this country, that Dr. Leidy has obtained the very highest reputation, both at home and abroad, as a skillful naturalist and microscopic anatomist. No man in this country or Europe, was more competent to make the investigations that I desired. He found, in making his dissections, a small globular sac, not larger than a grain of mustard seed, (about $\frac{1}{33}$ of an inch in diameter,) communicating with the oviduct, and filled with a whitish fluid, which when examined under the microscope, was found to abound in spermatozoa, the animalculæ which are the unmistakable characteristics of the seminal fluid. Later in the season, the same substance was compared with some taken from the drones, and found to be exactly similar to it.

These examinations have settled, on the impregnable basis of demonstration, the mode in which the eggs of the Queen are vivified. In descending the oviduct to be deposited in the cells, they pass by the mouth of this seminal sac or spermatheca, and receive a portion of its fertilizing contents. Small as it is, its contents are sufficient to impregnate hundreds of thousands of eggs. In precisely the same way, the mother wasps and hornets are fecundated. The females alone of these insects survive the Winter, and they often begin single handed, the construction of a nest, in which, at first, only a few eggs are deposited. How could these eggs hatch, if the females which laid them, had not been impregnated, the previous season? Dissection proves them to have a spermatheca, similar to that of the Queen Bee. It never seems to have occurred to the opponents of Huber, that the

existence of a permanently impregnated mother wasp, is just as difficult to be accounted for, as the existence of a similarly impregnated Queen Bee.



The celebrated Swammerdam, in his observations upon insects, made in the latter part of the sixteenth century, and published after his death, in 1737, has given a highly magnified and exceedingly accurate drawing of the Ovaries of the Queen Bee, a reduced copy of which I here present to my readers. The small globular sac, communicating with the oviduct, which he thought secreted a fluid for sticking the eggs to the base of the cells, is the seminal reservoir or spermatheca. Any one who will carefully dissect a Queen Bee, may see this sac, even with the naked eye.

It will be seen that the ovaries are double, each one consisting of an amazing number of ducts filled with eggs, and that the eggs gradually increase in size as they approach the oviduct.*

* Since the first edition of this work was issued, I have ascertained that Posel, (page 54,) describes the oviduct of the Queen, the spermatheca and its contents, and the use of the latter in impregnating the passing egg. His work was published at Munich, in 1784. It seems also from his work, (page 36,) that before the investigations of Huber, Jansha, the bee-keeper royal of Maria Theresa, had discovered the fact that the young queens leave their hive in search of the drones.

Effect of Retarded Impregnation on the Queen Bee.

Huber, while experimenting to ascertain how the Queen was fecundated, confined some of his young Queens to their hives, by contracting the entrances, so that they were not able to go in search of the drones, until three weeks after their birth. To his amazement, these Queens whose impregnation was thus unnaturally retarded, never laid any eggs but such as produced drones!

He tried this experiment repeatedly, but always with the same result. Some Bee-Keepers, long before his time, had observed that all the brood in a hive were occasionally drones, and of course, that such colonies went rapidly to ruin. Before attempting any explanation of this astonishing fact, I must call the attention of the reader to another of the mysteries of the Bee-Hive.

Fertile Workers.

It has already been remarked, that the workers are proved by dissection to be females, all of which, under ordinary circumstances, are barren. Occasionally, some of them appear to be more fully developed, so as to be capable of laying eggs: these eggs, like those of Queens whose impregnation has been retarded, always produce drones! Sometimes, when a colony has lost its Queen, and has thoroughly despaired of obtaining another, these drone-laying workers are exalted to her place, and treated with equal respect and affection, by the bees. Huber ascertained that these fertile workers were generally reared in the neighborhood of the young Queens, and he thought that they received some particles of the peculiar food or jelly on which the Queens are reared. He did not pretend to

account for the effect of retarded impregnation; and made no experiments to determine the facts, as to the fecundation of these fertile workers.

Since the publication of Huber's work, more than sixty years ago, no light has been shed upon the mysteries of drone-laying Queens and workers, until quite recently. Dzierzon appears to have been the first to ascertain the truth on this subject; and his discovery must certainly be ranked as unfolding one of the most astonishing facts in all the range of animated nature. This fact seems, at first view, so absolutely incredible, that I should not dare mention it, if it were not supported by the most indubitable evidence, and if I had not determined to state all important and well ascertained facts, without seeking, by any concealments, to pander to the prejudices of the ignorant and conceited.

Dzierzon advances the opinion that impregnation is not needed in order that the eggs of the Queen may produce drones; but, that all impregnated eggs produce females, either workers or Queens; and all unimpregnated ones, males or drones. He states that he found drone-laying Queens in several of his hives, whose wings were so imperfect that they could not fly, and that on examination, they proved to be unfecundated. Hence he concluded that the eggs laid by the Queen Bee and fertile worker, had from the previous impregnation of the egg from which they sprung, sufficient vitality to produce the drone, which is a less highly organized insect than the Queen or worker. It had long been known, that the Queen deposits drone eggs in the large or drone cells, and worker eggs in the small or worker cells, and that she makes no mistakes. Dzierzon inferred, therefore, that there was some way in which she was able to decide as to the sex of the egg before it was laid, and that she must have a control over the mouth of the

seminal sac, so as to be able to extrude her eggs, allowing them to receive or not, just as she pleased, a portion of its fertilizing contents. In this way he thought she determined their sex, according to the size of the cells in which she laid them. Mr. Samuel Wagner of York, Pa., has recently communicated to me a very original and exceedingly ingenious theory of his own, which he thinks will account for all the facts, without admitting that the Queen Bee has any special knowledge or will on the subject. He supposes that when she deposits her eggs in the worker cells, her body is slightly compressed by the size of the cells, and that the eggs, as they pass the spermatheca, receive in this manner, its vivifying influence. On the contrary, when she is laying in drone cells, this compression cannot take place, the mouth of the spermatheca is kept closed, and the eggs are, necessarily, unfecundated. This theory may prove to be true, but at present, it is encumbered with some difficulties, and requires further investigations, before it can be considered as fully established.

Leaving then, for the present undecided, the question whether the Queen exercises any volition in this matter, I shall, by stating some facts which have occurred in my own Apiary, endeavor to relieve, as far as possible, this intricate subject from some of the difficulties which embarrass it.

In the Autumn of 1852, my assistant found in one of my hives a young Queen, whose progeny consisted entirely of drones. The colony had been formed by removing part of the combs containing bees, brood and eggs, from another hive; and had only a few combs, and but a small number of bees, which raised a new Queen in the manner to be hereafter particularly described. This Queen had laid a number of eggs in one of the combs, and the young were already emerging from the cells. I perceived, at the first glance,

that they were drones. As there were none but worker cells in the hive, they were reared in them, and not having space for full development, they were dwarfed in size, although the bees, in order to give them more room, had pieced out the cells so as to make them larger than usual. Size excepted, they appeared as perfect as any other drones.

I was not only struck with the singularity of finding drones reared in worker cells, but with the equally singular fact that a young Queen, who at first lays only the eggs of workers, should be laying drone eggs at all; and at once conjectured that this was a case of a drone-laying unimpregnated Queen, as sufficient time had not elapsed for her impregnation to be unnaturally retarded. I saw the great importance of taking all necessary precautions to determine this point. The Queen was removed from the hive, and carefully examined. Her wings, although they appeared to be perfect, were so paralized that she could not fly. It seemed probable, therefore, that she had never been able to leave the hive for impregnation.

To settle the question beyond the possibility of doubt, I submitted this Queen to Prof. Leidy for microscopic examination. The following is an extract from his report: "The ovaries were filled with eggs; the poison sac was full of fluid, and I took the whole of it into my mouth; the poison produced a strong metallic taste, lasting for a considerable time, and at first, it was pungent to the tip of the tongue. The spermatheca was distended with a perfectly colorless, transparent, viscid liquid, *without a trace of spermatozoa.*"

This examination seems perfectly to sustain the theory of Dzierzon, and to demonstrate that Queens do not need to be impregnated, in order to lay the eggs of males.

I must confess that considerable doubt seemed to rest on the accuracy of Dzierzon's statements on this subject, and

chiefly because of his having hazarded the unfortunate conjecture that the place of the poison bag in the worker, is occupied in the Queen, by the spermatheca. Now this is so completely contrary to fact, that it was a very natural inference, that this acute and thoroughly honest observer, made no microscopic dissections of the insects which he examined. I consider myself peculiarly fortunate in having obtained the aid of a Naturalist, so celebrated as Dr. Leidy, for microscopic dissections. The exceeding minuteness of some of the insects which he has completely figured and described, almost passes belief.

On examining this same colony a few days later, I found the most satisfactory evidence that these drone eggs were laid by the Queen which I had removed. No fresh eggs had been deposited in the cells, and the bees, on missing her, had commenced the construction of royal cells, to rear if possible, another Queen, which they would not have done, if a fertile worker had been present, by which the drone eggs had been laid.

Another very interesting fact proves that *all* the eggs laid by this Queen, were drone eggs. Two of the royal cells were, in a short time, discontinued, and were found to be empty, while a third contained a worm, which was sealed over the usual way, to undergo its changes to a perfect Queen.

I was completely at a loss to account for this, as the bees having an unimpregnated drone-laying Queen, ought not to have had a single female egg from which they could rear a Queen.

At first I imagined that they might have stolen it from another hive, but when I opened this cell, it contained, instead of a Queen, *a dead drone!*

I then remembered that Huber has described the same

mistake on the part of some of his bees. At the base of this cell, was an unusual quantity of the peculiar jelly or paste, which is fed to the young that are to be developed as Queens. One might almost imagine that the poor bees in their desperation, had dosed the unfortunate drone to death; as though they expected by such liberal feeding, to produce some hopeful change in his sexual organization.

In the Summer of 1854, I found another drone laying Queen, in my Apiary; her wings were *shrivelled*, so that she could not fly. I gave her successively to several queenless colonies, in all of which she continued to deposit nothing but drone eggs.

On the 14th of July, 1855, a Queen which hatched in one of my observing hives, after remaining in the hive for nine days without exhibiting any external appearance of impregnation, began to lay a few eggs on the edges of the combs instead of in the cells. She persisted in this for some days, until I transferred her to a colony which had been queenless for some weeks, hoping that she might make an excursion from their hive to meet the drones. The observing hive in which she was born was exposed to the full light of day: the entrance was small and not very easy to find, and I had noticed on several occasions that in the afternoon, when the drones usually leave the hive in greatest numbers, the Queen seemed unable to get out. She manifested unusual excitement, and the whole colony were almost as much agitated as though they were swarming. After she had been in the second hive a short time, I examined it carefully, and found that she had laid a considerable number of drone eggs. They were deposited near the bottom and edge of the comb; not in drone cells, but yet in cells a little larger than the worker size, and which the bees had begun to lengthen, the better to adapt them to the growth of their occupants.

I could find no other brood in the hive. In making another examination (August 9th) in order to remove this Queen and give the colony another, I found the combs nearly filled with worker brood, in a state considerably *less advanced* than the drones! Is there any reason to doubt that these drone eggs were laid by the Queen while yet unfecundated, and that the worker brood was deposited by her after impregnation?

In Italy a variety of the honey bee described by Virgil is still found, differing considerably in size and color from the common kind. If an unimpregnated Queen of this variety is crossed with the common drones, her drone progeny will all be *Italian drones*, while her worker brood will be a cross between the two kinds! thus showing that the kind of drones which she will produce has no dependence upon the male by which she is fertilized.

These facts appear to constitute all the links in a perfect chain, and to demonstrate, beyond the possibility of doubt, that unfecundated Queens are not only capable of laying eggs, (a thing no more remarkable than the same occurrence in a hen,) but that these eggs are possessed of sufficient vitality to produce drones. Aristotle, who flourished before the Christian era, had noticed that there was no difference in appearance, between the eggs producing drones and those producing workers; and he states that drones only are produced in hives which have no Queen; of course the eggs producing them, were laid by fertile workers. Having now the aid of powerful microscopes, we are still unable to detect the slightest difference in size or appearance in the eggs, and this is precisely what we should expect if the same egg will produce either a worker or a drone, according as it is or is not impregnated. The theory which I propose, seems perfectly to harmonize, with all the observed facts on this subject.

I believe that after fecundation has been delayed for about three weeks, the organs of the Queen bee are in such a state that impregnation can no longer be effected; just as the parts of a flower, after a certain time, wither and shut up, and the plant becomes incapable of fructification. The fertile drone-laying workers, are always in my opinion, physically incapable of being impregnated.

There is something analagous to these wonders, in the aphides or green lice which infest our rose bushes and other plants. We have the most undoubted evidence that a fecundated female gives birth to other females, and they in turn to others, all of which, without impregnation, are able to bring forth young, until at length, after a number of generations, perfect males and females are produced, and the series starts anew!

However strange it may appear, or even improbable, that an unimpregnated egg can give birth to a living being, or that the sex can be dependent on impregnation, we are not at liberty to reject facts, because we cannot comprehend the reasons of them. He who allows himself to be guilty of such folly, if he seeks to maintain his consistency, will be plunged, sooner or later, into the dreary gulf of atheism. Common sense, philosophy and religion alike teach us to receive all undoubted facts. both in the natural and spiritual world, with becoming reverence; assured that however mysterious they may appear to us, they are all most beautifully harmonious and consistent in the sight of Him whose "understanding is infinite."

The unequaled facilities for easy and accurate observation, furnished by the Movable Comb Hive, have seemed to render it peculiarly incumbent on me, to do all in my power to clear up the difficulties in this intricate and yet highly important branch of Apiarian knowledge. All the leading facts

in the breeding of bees ought to be as well known to the bee keeper, as the same class of facts in the rearing of his domestic animals. A few crude and hasty notions, but half understood and half digested, will answer only for the old fashioned bee keeper, who deals in the brimstone matches. He who expects to conduct bee keeping on a safe and profitable system, must learn that on this, as on all other subjects, "knowledge is power." *

The extraordinary fertility of the Queen bee has already been noticed. The process of laying has been well described by the Rev. W. Dunbar, a Scotch Apiarian.

"When the Queen is about to lay, she puts her head into a cell, and remains in that position for a second or two, to ascertain its fitness for the deposit which she is about to make. She then withdraws her head, and curving her body downwards,† inserts the lower part of it into the cell: in a few seconds she turns half round upon herself and withdraws, leaving an egg behind her. When she lays a considerable number, she does it equally on each side of the comb, those on the one side being as exactly opposite to those on the other as the relative position of the cells will admit. The effect of this is to produce the utmost possible concentration and economy of heat for developing the various changes of the brood!"

Here as at every step in the economy of the bee, our minds are filled with admiration as we witness the perfect

* "If it were possible," said an able German Apiarian, in 1846, "to ascertain the reproductive process of bees with as much certainty as that of our domestic animals, bee culture might unquestionably be pursued with positive assurance of profit; and it would then assume a high rank among the various branches of rural economy."

† In this way she is sure to deposit the egg in the cell she has selected.

adaptation of means to ends. Who can blame the warmest enthusiasm of the Apiarian in view of a sagacity which seems scarcely inferior to that of man?

"The eggs of bees," I quote from the admirable treatise of Bevan, "are of a lengthened oval shape, with a slight curvature, and of a bluish white color: being besmeared at the time of laying, with a glutinous substance, they adhere to the bases of the cells, and remain unchanged in figure or situation for three or four days; they are then hatched, the bottom of each cell presenting to view a small white worm. On its growing so as to touch the opposite angle of the cell, it coils itself up, to use the language of Swammerdam, like a dog when going to sleep; and floats in a whitish transparent fluid, which is deposited in the cells by the nursing-bees, and by which it is probably nourished; it becomes gradually enlarged in its dimensions, till the two extremities touch one another and form a ring. In this state it is called a larva or worm. So nicely do the bees calculate the quantity of food which will be required, that none remains in the cell when it is transformed to a nymph. It is the opinion of many eminent naturalists that farina does not constitute the sole food of the larva, but that it consists of a mixture of farina, honey and water, partly digested in the stomachs of the nursing-bees."

"The larva having derived its support, in the manner above described, for four, five or six days, according to the season," (the development being retarded in cool weather, and badly protected hives,) "continues to increase during that period, till it occupies the whole breadth and nearly the length of the cell. The nursing bees now seal over the cell, with a light brown cover, externally more or less convex, (the cap of a drone cell is more convex than that of a worker,) and thus differing from that of a honey cell which

which is paler and somewhat concave." The cap of the brood cell appears to be made of a mixture of bee-bread and wax; it is not air tight as it would be if made of wax alone; but appears, under the microscope, to be full of fine holes through which the inclosed insect can have air for all necessary purposes. From its texture and shape it is easily thrust off by the bee when mature, whereas, if it consisted wholly of wax, the insect would either perish for lack of air, or be unable to force its way into the world. Both the material and shape of the lids which seal up the honey cells are different, because an entirely different object was aimed at; they are of pure wax to make them air tight, and thus prevent the honey from souring or candying in the cells; and are slightly concave or hollowed inwards, to give them greater strength to resist the pressure of their contents.

To return to Bevan. "The larva is no sooner perfectly inclosed than it begins to line the cell by spinning round itself, after the manner of the silk worm, a whitish silky film or cocoon, by which it is encased, as it were, in a pod. When it has undergone this change, it has usually borne the name of *nymph* or *pupa*. It has now attained its full growth, and the large amount of nutriment which it has taken serves as a store for developing the perfect insect."

"The *working bee nymph* spins its cocoon in thirty-six hours. After passing about three days in this state of preparation for a new existence, it gradually undergoes so great a change as not to wear a vestige of its previous form."

"When it has reached the twenty-first day of its existence, counting from the time the egg is laid, it comes forth a perfect winged insect. The cocoon is left behind, and forms a closely attached and exact lining to the cell in which it was spun; by this means the breeding cells become smaller and their partitions stronger, the oftener they change

their tenants; and may become so much diminished in size as not to admit of the perfect development of full sized bees."

"Such are the respective stages of the working bee: those of the royal bee are as follows: she passes three days in the egg and is five a worm; the workers then close her cell, and she immediately begins spinning her cocoon, which occupies her twenty-four hours. On the tenth and eleventh days and a part of the twelfth, as if exhausted by her labor, she remains in complete repose. Then she passes four days and a part of the fifth as a nymph. It is on the sixteenth day therefore that the perfect state of Queen is attained."

"The drone passes three days in the egg, six and a half as a worm, and changes into a perfect insect on the twenty-fourth or twenty-fifth day after the egg is laid."

"The developement of each species likewise proceeds more slowly when the colonies are weak or the air cool. Dr. Hunter has observed that the eggs, worms and nymphs all require a heat above 70° of Fahrenheit for their evolution." The bee keeper, therefore, in all his operations, should remember that brood comb must never be exposed to so low a temperature as to become chilled: the effect is as disastrous as when the eggs of a setting hen are left, for too long a time, by the careless mother. The brood combs are never safe when taken for any considerable time from the bees, unless the temperature is fully up to summer heat.

"Both drones and workers on emerging from the cell are, at first gray, soft and comparatively helpless, so that some time elapses before they take wing."

"The workers and drones spin *complete cocoons*, or inclose themselves on every side, while the royal larvæ construct only *imperfect cocoons*, open behind, and enveloping only

the head, thorax, and first ring of the abdomen; and Huber concludes, without any hesitation, that the final cause of this is, that they may be exposed to the mortal sting of the first hatched Queen, whose instinct leads her instantly to seek the destruction of those who would soon become her rivals."

"If the royal larvæ spun complete cocoons, the stings of the Queens seeking to destroy their rivals might be so entangled in their meshes that they could not be disengaged. 'Such,' says Huber, 'is the instinctive enmity of young Queens to each other, that I have seen one of them, immediately on its emergence from the cell, rush to those of its sisters, and tear to pieces even the imperfect larvæ. Hitherto philosophers have claimed our admiration of nature for her care in preserving and multiplying the species. But from these facts we must now admire her precautions in exposing certain individuals to a mortal hazard.'"

The cocoon of the royal larvæ is very much stronger and coarser than that spun by the drone or worker, its texture considerably resembling that of the silk worm's. The young Queen does not ordinarily come forth from her cell until she is quite mature; and as its great size gives her abundant room to exercise her wings, she is usually capable of flying as soon as she quits it. While still in her cell she makes the fluttering and piping noises with which every observant bee keeper is so well acquainted.

When the eggs of the Queen are fully developed, like those of the domestic hen, they must be extruded; but some Apiarians have supposed that she can regulate their development so that few or many are produced, according to the necessities of the colony. That this, to a certain extent, is true, seems highly probable; for if a Queen is taken from a feeble colony, her abdomen seldom appears greatly distended; and yet, if put in a strong one, she speedily becomes very

prolific. Mr. Wagner says, "I conceive that she has the power of regulating or repressing the development of her eggs, so that *gradually* she can diminish the number maturing, and finally cease laying and remain inactive, as long as circumstances require. The old Queen appears to qualify herself for accompanying a first swarm,* by repressing the development of eggs, and as this is done at the most genial season of the year, it does not seem to be the result of atmospheric influence."

It is certain that when the weather is unfavorable, or the colony too feeble to maintain sufficient heat, a smaller number of eggs are matured, just as unfavorable circumstances diminish the number of eggs laid by the hen; and when the weather is very cold, laying usually ceases altogether in weak colonies. In the latitude of Philadelphia, I opened a strong stock, on the 5th day of February, and found an abundance of eggs and brood, although the Winter had been very severe, and the temperature of the preceding month quite low. The Fall of 1852 was warm, and eggs and brood were found in a hive examined on the 21st of October. Strong stocks in well protected hives, even in cold climates, usually contain some brood, every month in the year.

It is highly interesting to see how the supernumerary eggs of the Queen are disposed of. When the number of workers is too small to take charge of all her eggs, or when there is a deficiency of bee bread to nourish the young, or when, for any reason, she does not judge best to deposit them in the cells, she stands upon a comb, and simply extrudes them from her oviduct, and the workers devour them as fast as they are laid! This I have repeatedly witnessed in my observing hives, and admired the sagacity of the Queen in

* Huber had noticed the reduced size of the Queen before swarming, but attributed it evidently to a wrong cause.

economizing her necessary work after this fashion, instead of laboriously depositing the eggs in cells where they are not wanted. What a difference between her wise management, and the stupidity of a hen obstinately persisting to set upon addled eggs or pieces of chalk, and often upon nothing at all.

The workers eat up also the eggs which are dropped, or deposited out of place by the Queen; in this way, nothing goes to waste, even a tiny egg being turned to some account.

It is difficult for one who has carefully watched the habits of bees, to speak of his little favorites otherwise than as possessing an intelligence almost, if not quite, akin to reason; and I have sometime queried, whether the workers who are so fond of a tit-bit in the shape of a new laid egg, ever experience a struggle between their appetite and the claims of duty, and if it does not cost them some self denial to refrain from making a breakfast on a fresh laid egg.

It is well known to every breeder of poultry, that the fertility of a hen decreases with age, until at length, she becomes entirely barren; it is equally certain that the fertility of the Queen bee ordinarily diminishes after she has entered upon her third year. She sometimes ceases to lay worker eggs, a considerable time before she dies of old age; the contents of her spermatheca becoming exhausted, the eggs can no longer be impregnated, and must therefore produce drones.

The Queen bee usually dies of old age, some time in her fourth year, although some have been known to live much longer. It is highly important to the bee keeper who would receive the largest returns from his bees, to be able, as in my hives, easily to remove her, when she has passed the period of her greatest fertility.

Before proceeding farther in the natural history of the

Queen bee, I shall describe more particularly, the other inmates of the hive.

The Drones or Male Bees.

The drones are, unquestionably, the male bees; dissection proving that they have the appropriate organs of generation. They are much larger and stouter than either the Queen or workers; although their bodies are not quite so long as that of the Queen. They have no sting with which to defend themselves; no proboscis suitable for gathering honey from the flowers, no baskets on their thighs for holding bee-bread, and no pouches on their abdomens for secreting wax. They are therefore, physically disqualified for work, even if they were ever so well disposed to it. Their proper office is to impregnate the young Queens, and they are usually destroyed by the bees, soon after this is completed.

Dr. Evans, the author of a beautiful poem on bees, thus appropriately describes them :—

> "Their short proboscis sips
> No luscious nectar from the wild thyme's lips,
> From the lime's leaf no amber drops they steal,
> Nor bear their grooveless thighs the foodful meal:
> On other's toils in pamper'd leisure thrive
> The lazy fathers of the industrious hive."

The drones begin to make their appearance in April or May; earlier or later, according to climate and the forwardness of the season, and strength of the stock. In colonies which are too weak to swarm, none, as a general rule, are reared, for in such hives, as no young Queens are raised, they would be only useless consumers.

The number of drones in a hive is often very great, amounting, not merely to hundreds, but sometimes to thou-

sands. It seems, at first, very difficult to understand why there should be so many, especially since it has been ascertained, that a single one will impregnate a Queen for life. But as intercourse always takes place high in the air, the young Queens are obliged to leave the hive for this purpose; and it is exceedingly important to their safety, that they should be sure of finding one, without being compelled to make frequent excursions. Being larger than a worker, and less active on the wing, they are more exposed to be caught by birds, or blown down and destroyed by sudden gusts of wind.

In a large Apiary, a few drones in each hive, or the number usually found in one, might be amply sufficient. But it must be borne in mind, that under these circumstances, bees are not in a state of nature, when a colony living in a forest, often had no neighbors, for miles. A good stock, even in our climate, sometimes sends out three or more swarms, and in the tropical climates, of which the bee is probably a native, they increase with astonishing rapidity.* All the new swarms, except the first, are led off by a young Queen, and as she is never impregnated, until after she has been established as the head of a separate family, it is important that they should all be accompanied by a goodly number of drones; and this renders it necessary that a large number should be produced in the parent hive.

As this necessity no longer exists when the bee is domesticated, the production of so many drones should be discouraged. Traps have been invented to destroy them, but it is much better to save the bees the labor and expense of rearing such a host of useless consumers. This can readily be done, when we have the control of the combs. The drone comb may be taken out, to have its place supplied

* At Sydney, in Australia, a single colony is stated to have multiplied to 300 in three years.

with worker cells, and thus the over production of drones may easily be prevented.

Some bee keepers will object to this mode of management as interfering with nature; but they should remember that the bee is not in a state of nature, and that the same objection might, with equal force, be urged against killing off the supernumerary males of our domestic animals.

If at the time a new swarm is building their combs, the honey harvest is very abundant, the bees will frequently construct an unusual amount of drone combs, in which they then store honey alone. In a state of nature, where the bees, in the hollow of a tree or cleft of a rock, have an abundance of room, this excess of drone comb will, another season, be used for the same purpose, and new worker comb made to meet the enlarged wants of the colony: but in hives of a limited capacity, this cannot be done, and in precisely this way, many stocks are so crowded with drones, as to be of little value to their owner.

In July or August, or soon after the swarming season is over, the bees usually expel the drones from the hive. They sometimes sting them, or gnaw the roots of their wings, so that when driven from the hive, they cannot return. If not treated in either of these summary ways, they are so persecuted and starved, that they soon perish. At such times they often retreat from the comb, keeping by themselves in large numbers upon the sides or bottom-board of the hive. The hatred of the bees extends even to the young which are still unhatched, which are mercilessly pulled from the cells, and destroyed with the rest. How wonderful that instinct which teaches the bees that there is no longer any occasion for the services of the drones, and which impels them to destroy those members of the colony, which, a short time before, they reared with such devoted attention!

THE PRODUCTION OF SO MANY DRONES NECESSARY, IN A STATE OF NATURE, TO PREVENT DEGENERACY FROM "IN AND IN BREEDING."

I have never been able, by the reasons previously assigned, fully to account for the necessity of such a large number of drones. I have repeatedly queried, why impregnation might not as well be effected *in the hive*, as on the wing, in the open air. Two very obvious and important advantages would have resulted from such an arrangement. 1st. A few dozen drones would have sufficed for the wants of any colony, even if, (as in tropical climates,) it swarmed half a dozen times or oftener, in the same season. 2d. The young Queens would not have been exposed to the risks they now incur, in leaving the hive for fecundation.

For a long time, I was unable to show how the existing arrangement is best; although I never doubted that there must be a satisfactory reason, for this seeming imperfection. To suppose otherwise, would be highly unphilosophical, since we constantly see, as the circle of our knowledge enlarges, many mysteries in nature, hitherto inexplicable, fully cleared up.

Let me here ask if the disposition which many students of nature cherish to reject some of the doctrines of revealed religion, is not equally unphilosophical. Neither our ignorance of all the facts necessary to their full elucidation, nor our inability to harmonize these facts in their mutual relations and dependencies, will justify us in rejecting any truth which God has seen fit to reveal, either in the book of nature, or in His holy word. The man who would substitute his own speculations for the divine teachings, has embarked, without rudder or chart, pilot or compass, on an uncertain ocean of theory and conjecture; unless he turns his prow

from its fatal course, no Sun of Righteousness will ever brighten for him the dreary expanse of waters; storms and whirlwinds will thicken in gloom, on his "voyage of life," and no favoring gales will ever waft his shattered bark to a peaceful haven.

The thoughtful reader will require no apology for the moralizing strain of many of my remarks, nor blame a clergyman, if sometimes forgetting to speak as the mere naturalist, he endeavors to find,

> "Tongues in trees, books in running brooks,
> *Sermons* in '*bees*,' and 'GOD' in every thing."

To return to the point from which I have digressed; a new attempt to account for the existence of so many drones. If a farmer persists in what is called "breeding in and in," that is, from the same stock, without changing the blood, it is well known that ultimate degeneracy is the inevitable consequence. This law extends, as far as we know, to all animal life, and even man is not exempt from its influence. Have we any reason to suppose that the bee is an exception? or that degeneracy would not ensue, unless some provision were made to counteract the tendency to in and in breeding? If fecundation had taken place in the hive, the Queen bee must have been impregnated by drones from a common parent, and the same result must have taken place in each successive generation, until the whole species would eventually have "run out." By the present arrangement, the young Queens when they leave the hive, often find the air swarming with drones, many of which belong to other colonies, and thus by crossing the breed, a provision is constantly made to prevent deterioration.

Experience has proved not only that it is unnecessary to impregnation that there should be drones in the colony of the young Queen, but that this may be effected even when there

are none except at a considerable distance. Intercourse takes place very high in the air, (perhaps that less risk may be incurred from birds,) and this conduces more to the continual crossing of stocks.

I am strongly persuaded that the decay of many flourishing stocks, even when managed with great care, may be attributed to the fact that they have become enfeebled by "close breeding," and are thus unable to resist injurious influences which were comparatively harmless, when the bees were in a state of high physical vigor. In the chapter on Artificial Swarming, I shall explain how bees may be easily crossed, when a cultivator has too few colonies, or is too remote from other Apiaries, to depend upon its being naturally effected.

The Workers, or Common Bees.

The number of workers in a hive varies very much. A good swarm ought to contain at least 20,000; and in large hives, strong colonies which are not reduced by swarming, frequently number two or three times as many, during the height of the breeding season. We have well-authenticated instances of stocks even much more populous than this. The Polish hives will hold several bushels, and yet we are informed by Mr. Dobrogost Chylinski, that they swarm regularly, and that the swarms are so powerful that "they resemble a little cloud in the air."

The workers, (as already stated,) are all females whose ovaries are too imperfectly developed to admit of their laying eggs. For a long time, being regarded as neither males nor females, they were called Neuters; but more careful microscopic examinations enable us to detect the rudiments

of their ovaries, and thus determine their sex. The accuracy of these examinations has been verified by the well-known facts respecting *fertile workers.*

Riem, a German Apiarian, first discovered that workers sometimes lay eggs. Huber, in the course of his investigations on this subject, ascertained that such workers were raised in hives that had lost their Queen, and in the vicinity of the royal cells in which young Queens were rearing. He conjectured that they received *accidentally*, a small portion of the peculiar food of these infant Queens, and he thus accounted for their reproductive organs being more developed than those of other workers. Workers reared in such hives, are in close proximity to the young Queens, and it is possible that some of the royal jelly may be accidentally dropped into their cells.

In the Summer of 1854, I examined a brood comb which had been given to a Queenless colony. It contained eleven sealed Queens. A number of cells were capped with a round covering, as though they contained drones. On opening several of them, I found some containing drone, and others worker nymphs. The latter seemed a little more sugar-loaf, in shape, than the common workers, and their cocoons were of a coarser texture than usual. I believe that they were fertile workers. I had noticed, for several years, in hives raising artificial Queens, the same kind of cells, and at first thought that they all contained drones. I am now inclined to believe that bees, when rearing Queens artificially, frequently give a portion of the royal jelly to brood which, for some reason, they do not proceed to develope, as full grown Queens. It is a well known fact that they often begin many more Queen cells, than they choose to complete. The kind of eggs laid by these fertile workers, has already been noticed. Huber states that they prefer

large cells in which to deposit their eggs, and resort to small ones only when unable to find those of greater diameter. In one hive, in my Apiary, which contained a fertile worker, there was only a small piece of drone comb, and this was entirely filled with eggs, some of the cells containing three or four! Such workers are seldom tolerated in hives containing a fertile, healthy Queen, though instances of this kind have been known to occur.

The worker is much smaller than either the Queen or the drone.* She is furnished with a tongue or proboscis, of the most curious and complicated structure, which, when not in use, is nicely folded up under her body; with this, she licks or brushes up the honey, which is thence conveyed to the honeg-bag. This receptacle is not larger than a very small pea, and so perfectly transparent, as to appear, when filled, of the same color with its contents; it is properly the first stomach, and is surrounded by muscles which enable the bee to compress it, and empty its contents through her proboscis into the cells.

The hinder legs of the worker are furnished with a spoon-shaped hollow, or basket, to receive the pollen or bee bread which she gathers from the flowers.

Every worker is armed with a formidable sting, and when provoked, makes instant and effectual use of her natural weapon. When subjected to a microscopic examination, it exhibits a very curious and complicated mechanism. "It is moved† by muscles which, though invisible to the eye, are yet strong enough to force the sting, to the depth of one-twelfth of an inch, through the thick skin of a man's hand. At its

* This work being intended chiefly for practical purposes, I have thought best to use, as little as possible, the technical terms and minute anatomical descriptions of the scientific entomologist.

† Bevan.

root are situated two glands by which the poison is secreted: these glands uniting in one duct, eject the venomous liquid along the groove, formed by the junction of the two piercers. There are four barbs on the outside of each piercer: when the insect is prepared to sting, one of these piercers, having its point a little longer than the other, first darts into the flesh, and being fixed by its foremost beard, the other strikes in also, and they alternately penetrate deeper and deeper, till they acquire a firm hold of the flesh with their barbed hooks, and then follows the sheath, conveying the poison into the wound. The action of the sting, says Paley, affords an example of the union of *chemistry* and mechanism; of chemistry in respect to the *venom*, which can produce such powerful effects; of mechanism as the sting is a compound instrument. The machinery would have been comparatively useles had it not been for the chemical process, by which in the insect's body *honey* is converted into *poison;* and on the other hand, the poison would have been ineffectual, without an instrument to wound, and a syringe to inject it."

"Upon examining the edge of a very keen razor by the microscope, it appears as broad as the back of a pretty thick knife, rough, uneven, and full of notches and furrows, and so far from anything like sharpness, that an instrument, as blunt as this seemed to be, would not serve even to cleave wood. An exceedingly small needle being also examined, it resembled a rough iron bar out of a smith's forge. The sting of a bee viewed through the same instrument, showed everywhere a polish amazingly beautiful, without the least flaw, blemish, or inequality, and ended in a point too fine to be discerned."

As the extremity of the sting is barbed like an arrow, the bee can seldom withdraw it, if the substance into which she darts it, is at all tenacious. In losing her sting she parts

with a portion of her intestines, and of necessity, soon perishes.

The loss of their sting being always fatal, they pay dearly for the exercise of their patriotic instincts; but they always seem ready, (except when gorged with honey they may be said to have taken "a drop too much,") to die in defence of their home and treasures; or as the poet has expressed it, they

> "Deem life itself to vengeance well resign'd,
> Die on the wound, and leave their sting behind."

Hornets, wasps and other stinging insects are able to withdraw their stings from the wound. I have never seen any attempt to account for the exception in the case of the honey bee. But as the Creator intended the bee for the use of man, has He not given it this peculiarity, to make it less formidable, and therefore more completely subject to human control? Without a sting, it would have stood no chance of defending its tempting sweets against a host of greedy depredators; but if it could sting a number of times, it would be much more difficult to bring it into a state of thorough domestication. A quiver full of arrows in the hand of a skillful marksman, is far more to be dreaded than a single shaft.*

The defence of the colony against enemies, the construction of the cells, and the storing of them with honey and bee-bread, the rearing of the young, in short, the whole

* Since the publication of the first edition of this treatise, during a visit to the Mexican Frontier, I had an opportunity of studying the habits of the honey hornet, of that region. Its nest, in shape and material, is considerably like that of our common hornet, and some of them contain many pounds of delicious honey. This insect, which in those regions is so serviceable to man, like the honey bee, is unable to withdraw its sting from the wound! It has also a Queen, and lives in a colony state during the whole year.

work of the hive, the laying of eggs excepted, is carried on by the industrious little workers.

There may be *gentlemen* of leisure in the commonwealth of bees, but most assuredly there are no such *ladies*, whether of high or low degree. The Queen herself, has her full share of duties, for it must be admitted, that the royal office is no sinecure, when the mother who fills it, must daily superintend the proper deposition of several thousand eggs.

Age of Bees.

The Queen bee, (as already stated,) will live four, and sometimes, though very rarely, five or more years. As the life of the drones is usually cut short by violence, it is not easy to ascertain its precise limit. Bevan estimates it not to exceed four months. The workers are supposed by him, to live six or seven months. Their age depends, however, very much upon their greater or less exposure to injurious influences and severe labors. Those reared in the Spring and early part of Summer, and on whom the heaviest labors of the hive necessarily devolve, do not appear to live more than two or three months, while those which are bred at the close of Summer, and early in Autumn, being able to spend a large part of their time in repose, attain a much greater age. It is very evident that "the bee," (to use the words of a quaint old writer,) "is a Summer bird," and that with the exception of the Queen, none live to be a year old.*

Notched and ragged wings, instead of gray hairs and wrinkled faces, are the signs of old age in the bee, and in-

* If an Italian Queen be given, in the working season, to a colony of common bees, the great mass of the latter will disappear in about three months. This is a new, and perfectly conclusive proof, of the short limit of a worker's life.

dicate that its season of toil will soon be over. They appear to die rather suddenly, and often spend their last days, and sometimes even their last hours, in useful labors. Place yourself before a hive, and see the indefatigable energy of these industrious veterans, toiling along with their heavy burdens, side by side with their more youthful compeers, and then say if you can, that you have done work enough, and that you will surrender yourself to slothful indulgence, while the ability for useful labor still remains. Let the cheerful hum of their busy old age inspire you with better resolutions, and teach you how much nobler it is to meet death in the path of duty, striving still, as you "have opportunity," to "do good unto all men."

The age which individual members of the community may attain, must not be confounded with that of the colony. Bees have been known to occupy the same domicile for a great number of years. I have seen flourishing colonies which were twenty years old; the Abbe Della Rocca speaks of some over forty years old; and Stoche says, that he saw a colony, which he was assured had subsisted forty-six years, swarming annually once! Such cases have led to the erroneous opinion that bees are a long-lived race. But this, as Dr Evans has observed, is just as wise as if a stranger, contemplating a populous city, and personally unacquainted with its inhabitants, should on paying it a second visit, many years after, and finding it equally populous, imagine that it was peopled by the same individuals, not one of whom might then be living.

> "Like leaves on trees, the race of bees is found,
> Now green in youth, now withering on the ground;
> Another race the Spring or Fall supplies,
> They droop successive, and successive rise."

The cocoons spun by the larvæ, are never removed by

the bees; they adhere so closely to the sides of the cells, that the knowing bee understands that the labor of removal would cost far more than it would be worth. In course of time, the breeding cells become too small for the proper development of the young. In some cases, the bees must take down and reconstruct the old combs, for if they did not, the young issuing from them would always be dwarfs; whereas I once compared with other bees, those of a colony more than fifteen years old, and found no difference in their size. That they do not usually renew the old combs, must be admitted, as the young from very old hives are frequently under the average size. On this account, it is very desirable to be able, occasionally, to remove the old combs, that their place may be supplied with new ones.

It is a great mistake, however, to imagine that the brood combs ought to be changed every year. In my hives, if it were desirable, they might be easily changed several times in a year; but once in five or six years is often enough: oftener than this requires a needless consumption of honey to replace them, besides being for other reasons undesirable, as the bees are always in Winter, much colder in new comb than in old. Inventors of hives have been too often, most emphatically, "men of one idea:" and that one, instead of being a well established and important fact in the physiology of the bee, has frequently, (like the necessity for a yearly change of the brood combs,) been merely a conceit of some visionary projector. This might be harmless enough, were no effort made to impose such miserable crudities upon an ignorant public, either in the shape of a patented hive, or worse still, of an *unpatented* hive, the pretended *right* to use which, is *fraudulently* sold to the cheated purchaser! *

* Hives which have never been patented, are extensively sold as patent articles, by men, who for years, have been liable to prosecution,

For want of correct knowledge with regard to the age of bees, huge "bee palaces," and large closets in garrets or attics, have been constructed, and their proprietors have vainly imagined that the bees would fill them, however spacious; for they can see no reason why a colony should not continue to increase indefinitely, until at length it numbers its inhabitants by millions or billions! As the bees can never at one time equal, still less exceed, the number which the Queen is capable of producing in a season, these spacious dwellings have always an abundance of "spare rooms." It seems strange that men can be thus deceived, when often in their own Apiary, they have healthy stocks which have not swarmed for a year or more, and which yet in the Spring are no more populous than those which have regularly parted with vigorous colonies.

It is certain that the Creator, has wisely set a limit to the increase of numbers in a single colony; and I shall venture to assign what appears to me to have been one reason for His so doing. Suppose that he had given to the bee, a length of life as great as that of the horse or the cow, or had made each Queen capable of laying daily, some hundreds of thou-

for obtaining money under false pretences. Others are disposed of, on the ground that the patent is still pending, when no application for a patent has ever been made, or has long ago been rejected. Often the patented part of a hive, being a worthless conceit, is carefully concealed, while much ingenuity is displayed, in exhibiting those features in the hive, which any one has a right to use; and yet which the vender, sometimes by implication, and sometimes by direct assertion, leads the purchaser to believe, are essential features in the patent.

No one should ever purchase a "patent hive," until he ascertains at least two things: 1st, that there is really a patent on the invention; and 2d, that the part patented is, in his opinion, worth the money demanded for the right to use it.

sands of eggs, or had given several hundred Queens to each hive, then from the very nature of the case, a colony must have gone on increasing, until it became a scourge rather than a benefit to man. In the warm climates of which the bee is a native, they would have established themselves in some cavern or capacious cleft in the rocks, and would soon have become so powerful, as to bid defiance to all attempts to appropriate the avails of their labors.

It has already been stated, that none, except the mother wasps and hornets, survive the Winter. If these insects had been able, like the bee, to commence the season, with the accumulated strength of a large colony, long before its close, they would have proved an intolerable nuisance. If, on the contrary, the Queen bee had been compelled, solitary and alone, to lay the foundations of a new commonwealth, the honey-harvest would have disappeared long before she became the parent of a numerous family.

In the laws which regulate the increase of bees, as well as in all other parts of their economy, we see the plainest proofs, that the insect was formed for the special service of the human race.

The Process of Rearing the Queen more Particularly Described.

In the early part of the season, if the population of a hive becomes very numerous, the bees usually make preparations for swarming. A number of royal cells are commenced, being usually placed upon those edges of the combs which are not attached to the sides of the hive. These cells somewhat resemble a small ground-nut or pea-nut, and are about an inch deep, and one-third of an inch in diameter: being very thick, they require a large quantity of material for

their construction. They are seldom seen, after the swarming season, in a perfect state, as the bees nibble them away when the Queen has hatched, leaving only their remains, in the shape of a very small acorn-cup. On examining the Queen cells while they are in progress, one of the first things which excites our notice, is the very unusual amount of attention bestowed upon them by the workers. There is scarcely a second in which a bee is not peeping into them, and just as fast as one is satisfied, another pops in its head, to examine, if not to report progress. The importance of their inmates to the bee-community, might easily be inferred from their being the center of so much attraction.

While the other cells open sideways, the Queen cells always hang with their mouth *downwards*. Much speculation has arisen as to the reason for this deviation: some have conjectured that their peculiar position exerts an influence upon the development of the royal larvæ; while others, having ascertained that no injurious effect was produced by turning them upwards, or placing them in any other position, have considered this deviation as among the inscrutable mysteries of the bee-hive. So it always seemed to me, until more careful reflection enabled me to solve the problem. The Queen cells open downwards, simply *to save room!* The distance between the parallel ranges of comb is usually so small, that the bees could not have made the royal cells to open sideways, without sacrificing the opposite cells. In order to economize space, to the utmost, they put them on the unoccupied edges of the comb, as the only place where there is always plenty of room, for such very large cells.

The number of royal cells in a hive, varies greatly; sometimes there are only two or three, ordinarily there are five or six, and I have occasionally seen more than a dozen. They are not all commenced at once, for the bees do not intend that all the young Queens shall arrive at maturity, at

the same time. I do not consider it as fully settled, how the eggs are deposited in these cells. In some few instances, I have known the bees to transfer the eggs from common to Queen cells, and this may be their general method of procedure. I shall hazard the conjecture, that the Queen deposits her eggs, in a crowded state of the hive, in cells on the edges of the comb, and that some of these are afterwards enlarged, and changed into royal cells by the workers. Such is the instinctive hatred of the Queen to her own kind, that it does not seem to me probable, that she is intrusted with even the initiatory steps for securing a race of successors. That the eggs from which the young Queens are produced, are of the same kind with those producing workers, has been repeatedly demonstrated.

Royal Jelly.

The young Queens are supplied with a much larger quantity of food than is allotted to the other larvæ, so that they seem almost to float in a thick bed of jelly, a portion of which is usually left unconsumed at the base of the cells, after the insects have arrived at maturity. It is different from the food of the other larvæ, has a slightly acid taste, and when fresh, resembles starch, when old, a light quince jelly.

I submitted a portion of the royal jelly for analysis, to Dr. Charles M. Wetherell, of Philadelphia; a very interesting account of his examination may be found in the proceedings of the Philadelphia Academy of Natural Sciences for July, 1852. He speaks of the substance as "truly a bread-containing, albuminous compound." I hope to obtain from this able chemist, an analysis of the food of the young drones and workers. A comparison of its elements with those of the royal jelly, may throw some light on subjects as yet involved in obscurity.

The effects produced upon the larvæ by this peculiar food and method of treatment, are so very remarkable, that it is not strange that they should be rejected as idle whims, by nearly all, except those who have either been eye-witnesses to them, or have been well acquainted with the character and opportunities for accurate observation, of those on whose testimony they have received them. They are not only in themselves most marvelously strange, but on the face of them, so entirely opposed to all common analogies, and so very improbable, that many men when asked to believe them, feel almost as though an insult were offered to their common sense. The most important of these effects, I shall briefly enumerate.

1st. The peculiar mode in which the worm designed to be reared as a Queen, is treated, causes it to arrive at maturity, almost one-third earlier than if it had been bred a worker. And yet, as it is to be much more fully developed, according to ordinary analogy, it should have had a *slower growth.*

2d. Its organs of reproduction are completely developed, so that it is capable of fulfilling the office of a mother.

3d. Its size, shape and color are all greatly changed. Its lower jaws are shorter, its head rounder, its abdomen without the receptacles for secreting wax, and its legs have neither brushes nor baskets, while its sting is more curved, and one-third longer than that of a worker.

4th. Its *instincts* are entirely changed. Reared as a worker, it would have been ready to thrust out its sting at the least provocation; whereas now, it may be pulled limb from limb, without attempting to sting. As a worker it would have treated a Queen with the greatest consideration; whereas now, if brought into contact with another Queen, it rushes forthwith to mortal combat with it rival. As a worker, it would frequently have left the hive, either for

labor or exercise: as a Queen, it never leaves the hive, after impregnation, except to accompany a new swarm.

5th. The term of its life is remarkably lengthened. As a worker, it would not have lived more than six or seven months; as a Queen it may live seven or eight times as long! All these wonders rest on the impregnable basis of complete demonstration, and instead of being witnessed only by a select few, may now, by the use of my hive, be familiar sights to any bee keeper, who prefers to acquaint himself with facts, rather than to cavil and sneer at the labors of others.*

* Having already spoken of Swammerdam, I shall give from the celebrated Dr. Boerhaave's memoir of this wonderful naturalist, a brief extract which should put to the blush, if any thing can, the arrogance of those superficial observers, who are too wise in their own conceit, to avail themselves of the knowledge of others.

"This treatise on Bees proved so fatiguing a performance, that Swammerdam never afterwards recovered even the appearance of his former health and vigor. He was almost continually engaged by day in making observations, and as constantly engaged by night in recording them by drawings and suitable explanations."

"This being Summer work, his daily labor began at six in the morning, when the sun afforded him light enough to survey such minute objects; and from that hour till twelve, he continued without interruption, all the while exposed in the open air to the scorching heat of the sun, bareheaded for fear of intercepting his sight, and his head in a manner dissolving into sweat under the irresistible ardors of that powerful luminary. And if he desisted at noon, it was only because the strength of his eyes was too much weakened, by the extraordinary afflux of light, and the use of microscopes, to continue any longer upon such small objects, though as discernable in the afternoon, as they had been in the forenoon."

"Our author, the better to accomplish his vast, unlimited views, often wished for a year of perpetual heat and light to perfect his inquiries, with a polar night to reap all the advantages of them, by proper drawings and descriptions."

When provision has been made, in the manner described, for a new race of Queens, the old mother, (See Chap. on Swarming,) always departs with the first swarm, before her successors have arrived at maturity.

Artificial Rearing of Queens.

The distress of the bees when they lose their Queen, has already been described. If they have the means of supplying her loss, they soon calm down, and commence the necessary steps for rearing another. The process of rearing Queens artificially, to meet some special emergency, is even more wonderful than the natural one already described. Its success depends on the bees having worker-eggs, or worms not more than three days old*; the bees nibble away the partitions of two cells adjoining a third, so as to make one large cell out of the three. They destroy the eggs or worms in two of these cells, while they place before the occupant of the third, the usual food of the young Queens, and build out its cell, so as to give it ample space for development. They seldom confine themselves to the attempt to rear a single Queen, but to guard against failure, start a considerable number, although the work on all except a few, is often soon discontinued.

In twelve† or fourteen days, they are in possession of a new Queen, precisely similar to one reared in the natural way; while the eggs which were laid at the same time in the adjoining cells, and which have been developed in the usual way, are nearly a week longer in coming to maturity.

The beautiful representation of comb which I here present

* Some Apiarians believe that the worms may be older.

† I once had two Queens hatched in eleven days after the old Queen was removed.

to my readers, was taken, with some alterations, from "Cotton's My Bee Book," to which I am also indebted for the group of bees in the title page.* The dimensions of the cells are considerably reduced: the larger ones, on the right hand of the plate, towards the bottom, are of drone size. One of the royal cells on the right contains an unhatched Queen, from the other which is open at the base, the Queen has emerged. The Queen cell on the left which is open at the side, is one from which a young Queen has been violently extracted; the other is in an unfinished state. On the face of the comb is a Queen cell just begun, of the kind constructed when Queens are reared artificially. The natural Queen cells are almost always on the edges of the comb, and the artificial ones, (those built to meet some unexpected emergency,) on the face.

I will give in this connection a description of a highly interesting experiment:

A large hive standing at a distance from any other colony, was removed in the morning of a pleasant day, to a new place, and another hive containing only empty comb, was put upon its stand. Thousands of workers which were out in the fields, or which left the old hive after its removal, returned to the familiar spot. It was affecting to witness their grief and despair: they flew in restless circles about the place where once stood their happy home, entered and left the new hive continually, expressing, in various ways, their lamentations over so cruel a bereavement. Towards evening, they ceased to take wing, and roamed in restless platoons, in and out of the hive, and over its surface, acting all the time, as though in search of some lost treasure. I now

* Instead of the original motto, "God save the Queen and all the Royal Family," I have substituted one which seems to me to be much more in accordance with nature and truth.

gave them a small piece of brood comb, containing worker eggs and worms. What followed the introduction of this brood comb, took place much quicker than it can be described. The bees which first touched it, raised a peculiar note, and in a moment, the comb was covered with a dense mass; their restless motions and mournful noises ceased, and a cheerful hum at once proclaimed their delight! Despair gave place to hope, as they recognized in this small piece of comb, the means of their deliverance. Imagine a large building filled with thousands of persons, tearing their hair, beating their breasts, and by piteous cries, as well as frantic gestures, giving vent to their despair; if some one should enter this house of mourning, and by a single word, cause all these demonstrations of agony to give place to smiles and congratulations, the change would not be more instantaneous and wonderful, than that produced when the bees received the brood comb!

The Orientals call the honey bee, Deborah, "She that speaketh." Would that this little insect might speak, and in words more eloquent than any of man's device, to those who allow themselves to reject the doctrines of revealed religion, because, as they assert, they are, on their face so utterly improbable, that they labor under an *a priori* objection quite strong enough to be fatal to their credibility. Do not nearly all the steps in the development of a Queen from a worker-egg, labor under precisely the same objection? and have they not, for this very reason, always been regarded by great numbers of bee keepers, as unworthy of belief? If the favorite argument of infidels will not stand the test when applied to the wonders of the bee-hive, can it be regarded as entitled to any serious weight, when employed in framing objections against religious truths, and arrogantly taking to task the infinite Jehovah, for what He has been pleased to

do or to teach? Give me the same latitude claimed by such objectors, and I can easily prove that a man is under no obligation to receive as true, any of the wonders in the economy of the bee-hive, even although he is himself an intelligent eye-witness that they are all substantial verities.

I shall quote, in this connection, from Huish, an English Apiarian, whose objections to the discoveries of Huber, so forcibly resemble many which are urged against the doctrines of revealed religion.

"If an individual, with the view of acquiring some knowledge of the natural history of the bee, or of its management, consult the works of Bagster, Bevan, or any of the periodicals which casually treat upon the subject, will he not rise from the study of them with his mind surcharged with falsities and mystification? Will he not discover through the whole of them a servile acquiescence in the opinions and discoveries of one man, however at variance they may be with truth or probability; and if he enter upon the discussion with his mind free from prejudice, will he not experience that an outrage has been committed upon his reason, in calling upon him to give assent to positions and principles which at best are merely assumed, but to which he is called upon dogmatically to subscribe his acquiescence as the indubitable results of experience, skill and ability? The editors of the works above alluded to, should boldly and indignantly have declared, that from their own experience in the natural economy of the insect, they were able to pronounce the circumstances as related by Huber to be directly *impossible*, and the whole of them based on fiction and imposition."

Let the reader change only a few words in this extract: for "the natural history of the bee, or its management," let him write, "the subject of revealed religion;" for, "the works of Bagster, Bevan," &c., let him put, "the works of

Moses, Paul," &c.; for, "their own experience in the natural economy of the insect," let him substitute, "their own experience in the nature of man;" and for, "circumstances as related by Huber," let him insert, "as related by Luke or John," and it will sound almost precisely like a passage from some infidel author.

CHAPTER IV.

Comb.

WAX is a natural secretion of the bees; it may be called *their oil or fat.* If they are gorged with honey or any liquid sweet, and remain quietly clustered together, it is formed in small wax pouches on their abdomen, and comes out in the shape of very delicate scales. Soon after a swarm is hived, the bottom board will often be covered with these scales. The bees seem to aid its liberation from their bodies, by violently shaking themselves, as they stand upon the combs.

"Thus, filtered through yon flutterer's folded mail,
Clings the cooled wax, and hardens to a scale.
Swift, at the well known call, the ready train,
(For not a buz boon Nature breathes in vain,)
Spring to each falling flake, and bear along
Their glossy burdens to the builder throng.
These with sharp sickle or with sharper tooth,
Pare each excrescence, and each angle smooth,
Till now, in finish'd pride, two radiant rows
Of snow white cells one mutual base disclose.
Six shining panels gird each polish'd round,
The door's fine rim, with waxen fillet bound.
While walls so thin, with sister walls combined,
Weak in themselves, a sure dependence find."

EVANS.

Huber was the first to demonstrate that wax is a natural secretion of the bee, when fed on honey or any saccharine substance. Most Apiarians before his time, supposed that it was made from pollen or bee-bread, either in a crude or digested state. He confined a new swarm of bees in a hive placed in a dark and cool room, and on examining them, at the end of five days, found several beautiful white combs in their tenement: these were taken from them, and they were again confined and supplied with honey and water, and a second time new combs were constructed. Seven times in succession their combs were removed, and were in each instance replaced, the bees being all the time prevented from ranging the fields, to supply themselves with bee-bread. By subsequent experiments he proved that sugar answered the same end with honey. He then confined a swarm, giving them no honey, but an abundance of fruit and pollen. They subsisted on the fruit, but refused to touch the pollen; and no combs were constructed, nor any wax scales formed in their pouches.

Notwithstanding the extreme caution and unwearied patience of Huber, in conducting these experiments on the secretion of wax, later observations seem to show, that he had not discovered the *whole* truth on this important subject. He has demonstrated, to be sure, that bees can construct comb from honey or sugar, without the aid of pollen, and that they cannot make it from pollen, without the honey or sugar: but he has not proved that when *permanently* deprived of pollen they can continue to work in wax, or if they can, that the pollen does not assist in its elaboration.

A portion of pollen is always found in the stomach of a wax-producing worker, and bees appear never to build comb so rapidly, as when they have free access to this article. It must, therefore, either furnish some of the elements of

wax, or in some way aid the bee in producing it. Further investigations must yet be made, and colonies confined with honey and pollen, as well as honey alone, before we can arrive at perfectly accurate results. Confident assertions are easily made, requiring only a little breath or a few drops of ink; and the men who deal most in them, have often the profoundest contempt for observation and experiment. To establish even a simple truth, on the solid foundation of demonstrated facts, often requires severe and protracted toil.

A high temperature is necessary for comb-building, in order that the wax may be soft enough to be moulded into shape. The very process of its secretion aids in furnishing the heat which is required to work it. This is an interesting fact, but one which seems never before to have been noticed.

Honey and sugar are each found to contain by weight, about eight pounds of oxygen to one of carbon and hydrogen. When converted into wax, the proportions are remarkably changed; the wax containing only one pound of oxygen to more than sixteen of hydrogen and carbon. Now as oxygen is the grand supporter of animal heat, the consumption of so large a quantity helps to produce the extraordinary heat which always accompanies comb-building, and which is necessary to keep the wax in the soft and plastic state requisite to enable the bees to mould it into such exquisitely delicate and beautiful forms.* Who can fail to admire the wisdom of the Creator in this beautiful intance of adaptation?

The most careful experiments have clearly established the fact, that from thirteen to twenty pounds of honey are required to make a single pound of wax. If any think this incredible, let them bear in mind that wax is an animal oil

* According to Dr. Donhoff, the thickness of the sides of a cell, in a new comb, is only the one hundred and eightieth part of an inch!

secreted chiefly from honey, and then consider how much corn or hay they must feed to their stock, in order to have them gain a single pound of fat.

Many Apiarians are entirely ignorant of the great value of empty comb. Suppose the honey to be worth only fifteen cents per pound, and the comb when rendered into wax, to be worth thirty cents, the bee-master who melts a pound of comb, loses largely by the operation, even without estimating the time which the bees have consumed in building the comb. Unfortunately, in the ordinary hives, but little use can be made of empty comb, unless it is new, and can be put into the surplus honey-boxes; but by the use of bars or movable frames, every piece of good worker-comb may be given to the bees, to aid them in their labors.

Comb, when taken from the bees, is with difficulty preserved from the bee-moth. If it contains only a few of the eggs of this destroyer, these, when exposed to summer heat, will soon produce a progeny sufficient to devour it. The comb, if attached to my frames, may be suspended in a box or empty hive, and thoroughly smoked with sulphur; this will kill any *worms* which it may contain. When the weather is warm enough to hatch the eggs of the moth, this process must be repeated, as the sulphur does not seem always to destroy the vitality of the *eggs*. The combs may then be kept in a tight box or hive, with perfect safety.

Combs containing bee-bread, are of great value, and if given to young colonies, which in Spring are frequently destitute of this article, they will materially assist them in early breeding.

A strong stock of bees, in the height of the honey harvest, will fill empty combs with wonderful rapidity. I lay it down, therefore, as one of my first principles in bee culture, that good comb should never be melted, but carefully pre-

served and given to the bees. When new, it may be easily attached to the frames, or the honey-receptacles, by dipping the edge into melted wax, and pressing it gently until it stiffens: if old or the pieces large and full of bee-bread, it will be best to dip them into a mixture of melted wax and rosin, which will secure a firmer adhesion. When comb is put into tumblers or other small vessels, the bees will begin to work upon it sooner, if it is simply crowded in, so as to be held in place by being supported against the sides. It would seem as though, disgusted with such unworkmanlike proceedings, they could not rest until they have endeavored to "make a good job of it."

Bees seem to fancy "a good start in life," about as well as their more intelligent owners, and are greatly encouraged in filling all receptacles in which a portion of empty comb is placed. To this use all suitable drone comb should be put, as soon as removed from the main hive.

Artificial honey combs, made of porcelain, have recently been used for feeding bees. No one, to my knowledge, has ever attempted to imitate the delicate mechanism of the bee so closely, as to construct artificial combs for the ordinary uses of the hive; although for a long time I have entertained the idea as very desirable, and yet as barely possible. If store combs could be made of gutta percha, when emptied of their contents they might be returned to the hive, again to be filled by the bees.

While writing this treatise, it has occurred to me that bees might be induced to use old wax for the construction of their combs. If very fine parings are given to them, it seems to me very probable that they would use them, just as they do the scales which are formed in their wax pouches. Let strong colonies be deprived of some of their combs, after the honey harvest is over, and supplied abundantly with

these parings of wax. Whether " nature abhors a vacuum," or not, bees certainly do, when it occurs among the combs of their main hive. They will not consume the honey stored up for winter use to replace the combs taken from them ; they can gather none from the flowers ; and I have strong hopes that necessity will with bees as well as men, prove the mother of invention, and lead them to use the wax, as readily as they do the substitutes offered them for pollen.

If this conjecture should be verified by actual results, it would promote the cheap and rapid multiplication of colonies, besides enabling the bees to amass unusual quantities of honey. A pound of bees wax might then be made to store up nearly twenty of honey, and the gain to the bee-keeper would be the great difference in price between the pound of wax, and the honey which bees consume in making the same weight of comb. Strong stocks might thus during the dull season, when no honey can be procured, be profitably employed in building spare comb, to be used in strengthening feeble stocks, and for a great variety of purposes. Give me the means of cheaply obtaining large quantities of comb, and I have almost found the philosopher's stone in bee-keeping.*

The building of comb is carried on with the greatest activity by night, while the honey is gathered by day.† Thus no time is lost. When the weather is so forbidding as to prevent the bees from going abroad, the combs are very rapidly constructed, the labor being carried on both by day and by night. On the return of a fair day, the bees gather

* I have ascertained that bees will use fine shavings of wax to build new comb; but further investigations are needed, to make the discovery of practical advantage to the great mass of bee-keepers.

† I have known bees to gather honey from the tulip tree, on very clear moonlight nights.

unusual quantities of honey, as they have plenty of room for its storage. Thus it often happens, that by their wise economy of time, they actually lose nothing, even if confined, for several days, to their hive.

"How doth the little busy bee, improve each *shining* hour!"

The poet might with equal truth have described her, as improving the gloomy days, and the dark nights, in her useful labors.

It is an interesting fact, which I do not remember ever to have seen noticed, that honey-gathering, and comb-building, go on simultaneously; so that when one stops, the other ceases also. I have repeatedly observed, that as soon as the honey harvest fails, the bees intermit their labors in building new comb, even although large portions of their hive are unfilled. If they should use their stores to enlarge their combs, they would incur the risk of perishing in the Winter, by starvation. When honey no longer abounds in the fields, it is wisely ordered, that they should not consume their hoarded treasures, in expectation of supplies which may never come. Could any safer rule have been given them? And were honey-gathering our business, should not we, with all our boasted reason, be obliged to adopt the very same course?

Wax being a bad conductor, when warmed by the animal heat of the bees can more easily be worked, than if it parted with its heat too readily. By this property, the combs serve also to keep the bees warm, and there is not so much risk of the honey candying in the cells, or the combs cracking with frost. If wax was a good conductor of heat, the combs would often be icy cold, moisture would condense and freeze upon them, and they would fail to answer all the ends for which they are intended.

The size of the cells, in which workers are reared, never

varies: the same may substantially be said of the drone cells which are very considerably larger; the cells in which honey is stored, often vary exceedingly in depth, while in diameter, they are of all sizes from that of the worker cells to that of the drones. As five worker, or four drone cells will measure about one linear inch, a piece of comb an inch square, will contain twenty-five worker and sixteen drone cells, on each side.

The cells of the bees are found to answer perfectly all the most subtle conditions of a very intricate mathematical problem. Let it be required to find what shape a given quantity of matter must take, in order to have *the greatest capacity and strength*, requiring at the same time, *the least space and labor* in its construction. This problem, when solved by the most refined mathematical processes, gives the hexagonal or six-sided cell of the honey bee, with its three four sided figures at the base!

The shape of these figures cannot be altered, ever so little, except for the worse. Besides possessing the desirable qualities already described, they answer as nurseries for rearing the young, and as small air-tight vessels to preserve the honey from souring or candying. Every prudent housewife who puts up her preserves in tumblers, or small glass jars, and carefully pastes them over, to keep out the air, will understand the value of such an arrangement.

"There are only three possible figures of the cells," says Dr. Reid, "which can make them all equal and similar, without any useless spaces between them. These are the equilateral triangle, the square, and the regular hexagon. It is well known to mathematicians that there is not a fourth way possible, in which a plane may be cut into little spaces that shall be equal, similar and regular, without leaving any interstices."

An equilateral triangle would have made an uncomfortable tenement for an insect with a round body; and a square cell would not have been much better. At first sight a circle would seem to be the best shape for the development of the larvæ: but such a figure would have caused a needless sacrifice of space, materials and strength; while the honey which now adheres so admirably to the many angles and corners of the six-sided cell, would have been much more liable to run out. I will venture to assign a new reason for the hexagonal form. The body of the immature insect as it undergoes its changes, is charged with a super-abundance of moisture which passes off through the reticulated cover which the bees build over its cell: a hexagon while it approaches so nearly the shape of a circle as not to incommode the young bee, furnishes in its six corners the necessary vacancies for its more thorough ventilation!

So invariably uniform in size, as well as perfect in other respects, are the cells in which the workers are bred, that some mathematicians have proposed their adoption as the best unit for measures of capacity to serve for universal use.

Can we believe that in the construction of their cells, these little insects unite so many requisites, either by chance, or because they are profoundly versed in the most intricate mathematics? Are we not compelled to acknowledge that the mathematics must be referred to the Creator, and not to his puny creature? To an intelligent and candid mind, a piece of honey comb is a complete demonstration that there is a "GREAT FIRST CAUSE:" for on no other supposition can we account for a shape so complicated, and yet the only one which can possibly unite so many desirable requirements.

"On books deep poring, ye pale sons of toil,
Who waste in studious trance the midnight oil,
Say, can ye emulate with all your rules,
Drawn or from Grecian or from Gothic schools,

This artless frame? Instinct her simple guide,
A heaven-taught Insect baffles all your pride.
Not all yon marshall'd orbs, that ride so high,
Proclaim more loud a present Deity,
Than the nice symmetry of these small cells,
Where on each angle genuine science dwells."

EVANS.

CHAPTER V.

Propolis, or "Bee-Glue."

THIS substance is obtained by the bees from the resinous buds and limbs of trees; the different varieties of poplar yield a rich supply. When first gathered, it is usually of a bright golden color, and so exceedingly sticky, that the bees never deposit it in cells, but apply it at once to the purposes for which it has been gathered. I have sometimes caught them as they were bringing in a load, and found it adhering very firmly to their legs.

"Huber planted in Spring some branches of the wild poplar, before the leaves were developed, and placed them in pots near his Apiary; the bees alighted on them, separated the folds of the large buds with their forceps, extracted the varnish in threads, and loaded with it, first one thigh and then the other; for they convey it like pollen, transferring it by the first pair of legs to the second, by which it is lodged in the hollow of the third."

The smell of the propolis is often like that of the resin from the poplar, and chemical analysis proves the identity of the two substances. It is frequently gathered from the

alder, horse-chestnut, birch, and willow ; and as some think, from pines and other trees of the fir kind. Bees will enter shops where varnishing is being carried on, attracted, evidently by the smell ; and in the vicinity of Matamoras, Mexico, where propolis seems to be scarce, I found a colony using green paint, and another pitch from the rigging of vessels ! Bevan mentions the fact of their carrying off a composition of wax and turpentine, from trees to which it had been applied. Dr. Evans says that he has seen them collect the balsamic varnish which coats the young blossom buds of the hollyhock, and has known them rest at least ten minutes on the same bud, moulding the balsam with their fore feet, and transferring it to the hinder legs, as described by Huber.

> " With merry hum the Willow's copse they scale,
> The Fir's dark pyramid, or Poplar pale,
> Scoop from the Alder's leaf its oozy flood,
> Or strip the Chestnut's resin-coated bud,
> Skim the light tear that tips Narcissus' ray,
> Or round the hollyhock's hoar fragrance play.
> Soon temper'd to their will through eve's low beam,
> And link'd in airy bands the viscous stream,
> They waft their nut-brown loads exulting home,
> That form a fret-work for the future comb ;
> Caulk every chink where rushing winds may roar,
> And seal their circling ramparts to the floor."
>
> EVANS.

A mixture of wax and propolis being much more adhesive than wax alone, serves admirably to strengthen the attachments of the combs to the top and sides of the hive. If the combs, as soon as they are built, are not filled with honey or brood, they are beautifully varnished with a most delicate coating of propolis, which adds exceedingly to their strength : but as this natural varnish impairs their snowy whiteness, they ought not to be left in the surplus honey receptacles, accessible to the bees, except when they are actively engaged in storing them with honey.

The bees make a very liberal use of this substance to fill up all the crevices about their premises: and as the natural summer heat of the hive keeps it soft, the bee moth selects it as a proper place of deposit for her eggs. For this reason, hives should be made of sound lumber, entirely free from cracks. The corners, which the bees always fill with propolis, may have a melted mixture run into them, three parts of rosin, and one of bees-wax; this remaining hard during the hottest weather, bids defiance to the moth.

As the bees find it difficult to gather the propolis, and equally so to remove from their thighs and work so sticky a material, it is important to save them all unnecessary labor in amassing it. To men, time is *money;* to bees, it is *honey;* and all the arrangements of the hive should be such as to economize it to the very utmost.

Propolis is sometimes put to a very curious use by the bees. "A snail* having crept into one of M. Reaumur's hives early in the morning, after crawling about for some time, adhered by means of its own slime to one of the glass panes. The bees having discovered the snail, surrounded it and formed a border of propolis round the verge of its shell, and fastened it so securely to the glass that it became immovable."

> "Forever closed the impenetrable door,
> It naught avails that in its torpid veins
> Year after year, life's loitering spark remains."
>
> EVANS.

"Maraldi, another eminent Apiarian, states that a snail without a shell having entered one of his hives, the bees, as soon as they observed it, stung it to death; after which, being unable to dislodge it, they covered it all over with an impervious coat of propolis."

* Bevan.

"For soon in fearless ire, their wonder lost,
Spring fiercely from the comb the indignant host,
Lay the pierced monster breathless on the ground,
And clap in joy their victor pinions round:
While all in vain concurrent numbers strive,
To heave the slime-girt giant from the hive —
Sure not alone by force instinctive swayed,
But blest with reason's soul directing aid,
Alike in man or bee, they haste to pour,
Thick hard'ning as it falls, the flaky shower;
Embalmed in shroud of glue the mummy lies,
No worms invade, no foul miasmas rise."

EVANS.

"In these instances who can withhold his admiration of the ingenuity and judgment of the bees? *In the first case* a troublesome creature gained admission to the hive, which, from its unwieldiness, they could not remove, and which, from the impenetrability of its shell, they could not destroy: here then their only resource was to deprive it of locomotion, and to obviate putrefaction; both which objects they accomplished most skillfully and securely; and as is usual with these sagacious creatures, at the least possible expense of labor and materials. They applied their cement where alone it was required, round the verge of the shell. *In the latter case*, to obviate the evil of decay, by the total exclusion of air, they were obliged to be more lavish in the use of their embalming material, and to case over the "slime-girt giant" so as to guard themselves from his noisome smell. What means more effectual could human wisdom have devised under similar circumstances?"

A large volume would not suffice to set forth all the *superstitions* connected with bees. While on the subject of Propolis, I will refer to one which is very common, and has often made a deep impression upon many minds. When any member of a family dies, the bees are believed to be aware of what has happened, and the hives are by some

dressed in mourning, to pacify their sorrowing occupants! Some persons imagine that if this is not done, the bees will never afterwards prosper, while others assert, that they often take their loss so much to heart, as to alight upon the coffin whenever it is exposed! An intelligent clergyman on reading the sheets of this work, stated to me that he had always refused to credit this latter fact, until present at a funeral where the bees gathered in such large numbers upon the coffin, as soon as it was brought out from the house, as to excite considerable alarm. Some years after this occurrence, being engaged in varnishing a table, and finding that the bees came and lit upon it, he was convinced that the love of varnish, (see p. 87,) instead of sorrow or respect for the dead, was the occasion of their gathering round the coffin! How many superstitions in which even intelligent persons firmly confide, might if all the facts were known, be as easily explained.

CHAPTER VI.

Pollen, or "Bee-Bread."

This substance is gathered by the bees from the flowers, or blossoms, and is indispensable to the nourishment of their young, as repeated experiments have proved that no brood can be raised without it. It is rich in what chemists call nitrogenous substances, which are not contained in honey, and which furnish ample nourishment for the development of the growing bee. Dr. Hunter dissected some immature

bees, and found their stomachs to contain farina, but not a particle of honey.

We are indebted to Huber for the discovery that pollen is the principal food of the young bees. As large supplies are often found in hives whose inmates have starved to death, it was evident that it could not, without honey, support the mature bees. It was this fact which led the old observers to conclude that it was gathered for the purpose of building comb. After Huber had demonstrated that wax can be secreted from an entirely different substance, he was soon led to conjecture that the bee-bread must be used for the nourishment of the embryo bees. By rigid experiments he proved the truth of this supposition. Bees were confined to their hive without any pollen, after being supplied with honey, eggs and larvæ. In a short time the young all perished. A fresh supply of brood was given to them, with an ample allowance of pollen, and the development of the larvæ then proceeded in the natural way.

In the backward Spring of 1852, I had an excellent opportunity of testing the value of this substance. In one of my hives, was an artificial swarm of the previous year. The hive was well protected, being double, and the situation warm. I opened it on the 5th of February, and although the weather, until within a week of that time, had been unusually cold, many of the cells were filled with brood. On the 23d, the combs being again examined, contained neither eggs, brood, nor bee-bread. The bees were then supplied with pollen from another hive: the next day, a large number of eggs were found in the cells. When this supply was exhausted, laying ceased, and was resumed when more was furnished them. During the time of these experiments, the weather was so unpromising, that the bees were unable to go out even for water, and were supplied at home with this important article.

Dzierzon is of opinion that bees are able to furnish food for their young, without the presence of pollen in the hive; although he admits that they can do this only for a short time, and at a great expense of vital energy; just as the strength of an animal nursing its young is rapidly reduced, when for want of proper food, the very substance of its own body is converted into milk. My experiments do not corroborate this theory, but tend to confirm the views of Huber, that pollen is absolutely necessary to the development of brood.

Gundelach says, that if a colony with a fertile Queen be put into an empty hive and set in the dark, and then supplied with honey, comb will be rapidly built, and the cells filled with eggs. The eggs in due time will be hatched, but the worms will all die within twenty-four hours.

Some Apiarians think that pollen is used by the bees when they are engaged in comb-building; and that unless they are well supplied with it, they cannot rapidly secrete wax, without very severely taxing their strength. I once attached but little weight to this conjecture, but further observations have convinced me of its truth: for if bees are supplied with an abundance of pollen and honey, they will produce wax much faster than when supplied with honey alone. That the full grown bees make some use of pollen in connection with honey, for their own nourishment, I believe also to be highly probable.

Bees prefer to gather *fresh* bee-bread, even when there are large accumulations of old stores in the cells. Hence, the great importance of being able, by the control of the combs, to make the surplus of old colonies supply the deficiency of young ones.

If honey and pollen can both be obtained from the same flower, then a load of each will be secured by the industrious insect. Of this, any one may be convinced, who will dis-

sect a few pollen gatherers at the time when honey is plenty: he will generally find their honey-bags full.

The mode of gathering is very interesting. The body of the bee appears, to the naked eye, to be covered with fine hairs: when she alights on a flower, the farina adheres to these. With her legs, she brushes it from her body, and packs it in two hollows or *baskets*, one on each of her thighs: these baskets are surrounded by stouter hairs which hold the load in its place.

When the bee returns with pollen, she often makes a singular dancing or vibratory motion, to attract the attention of the other bees, who nibble away from her thighs what they want for immediate use; the rest she stores away for future need, by inserting her body in a cell and brushing it off from her legs; it is then carefully packed down, and often sealed over with wax. Pollen is very seldom deposited in any except worker cells.

When from the dryness of the air, or any other cause, the pollen cannot be readily gathered in balls, the bee will often roll herself in the farina, and return, thus dusted over, to her hive.

It has been observed that a bee, in gathering pollen, almost always confines herself to the kind of flower on which she begins, even when that is not so abundant as some others; thus a ball of this substance taken from her thigh, is found to be of a uniform color throughout: the load of one will be yellow, another red, and a third brown; the color varying according to that of the plant from which the supply was obtained. It is probable that the pollen of different kinds of flowers would not pack so well together. As they carry on their bodies the pollen or fertilizing substance, they aid most powerfully in the impregnation of plants!

He must be blind indeed, who does not see, at every step

in the natural history of the honey-bee, the plainest proofs of the wisdom of its Creator, or who can resist the impression that this insect was made for the especial service and instruction of man. At first the importance of its products, when honey was almost the only natural sweet, attracted most powerfully his attention to its curious habits; and now, since the cultivation of the sugar cane has diminished the relative value of its luscious sweets, the more accurate knowledge which has been obtained of its instincts, is awakening an ever increasing enthusiasm in its cultivation.

Virgil in the fourth book of his Georgics, which is entirely devoted to bees, speaks of them as having received a direct emanation from the Divine Intelligence. And many modern Apiarians are disposed to rank the bee for sagacity, as almost next in the scale of creation to man.

Though the importance of pollen in nourshing the brood, has long been known, it is only of late that any successful attempts have been made to furnish a *substitute.* The bees, in Dzierzon's Apiary, were observed by him, to bring rye meal to their hives from a neighboring mill, early in Spring, before they could procure any pollen from natural supplies. It is now a common practice on the continent of Europe, where bee keping is extensively carried on, to supply the bees early in the season, with this article. Shallow troughs are set in front of the Apiaries, filled about two inches deep, with *finely ground, dry, unbolted rye meal.* Thousands of bees, when the weather is favorable, resort eagerly to them, roll themselves in the meal, and return heavily laden to their hives. In fine, mild weather, they labor at this work with astonishing industry; and seem decidedly to prefer the meal to the *old* pollen stored in their combs. By this means, the bees are induced to commence breeding early, and rapidly recruit their numbers. The feeding is continued till the

bees cease to carry away the meal; that is, until the blossoms furnish a preferable article. The average consumption of each colony is about two pounds.

Mr. F. Sontag, a German Apiarian, says that in the Spring of 1853, he fed one of his colonies with rye meal, placed in the hive, in an old comb, and that he continued the supply until they could procure fresh pollen abroad. This colony produced four strong swarms that Spring, while an adjoining stock not supplied with the meal, produced only one, and that was weak.

Another German bee-keeper says he has used wheat flour with very good results. The bees *forsook some honey* which had been set out for them, and engaged actively in carrying in the flour, which was placed about twenty paces in front of their hives.

The construction of my hives, permits the flour to be easily placed where the bees can take it, without being compelled to waste their time in going out for it, or suffer from the want of it, when the weather confines them at home.

The discovery of this substitute, removes a serious obstacle to the successful culture of bees. In many districts, there is a great abundance of honey for a few weeks in the season; and almost any number of colonies, which are strong when the honey-harvest commences, will lay up, in a good season, sufficient stores for themselves, and a large surplus for their owners. In many of these districts, however, the supply of pollen is often so insufficient, that, in Spring, the new colonies of the previous year, are found destitute of this article; and unless the season is early, and the weather unusually favorable, the production of brood is most seriously checked, and the colony becomes strong too late to avail itself, to the best advantage, of the superabundant harvest of honey.

While the honey bee is regarded by the best informed

horticulturists, as one of their friends, a strong prejudice has been excited against it, by many fruit-growers in this country; and in some communities, a man who keeps bees is considered as bad a neighbor, as one who sends out his poultry to riot in the gardens of others. I have repeatedly heard even the warmest friends of the "busy bee," lament its propensity to banquet on their beautiful peaches and pears, and choicest grapes and plums.

In a conversation with a very intelligent gentleman, I once assigned three reasons, which to me seemed perfectly conclusive, that the bees could not, of themselves, inflict any very extensive injury upon his grapes. 1st, that as the Creator appeared to have intended both the honey-bee and fruit for the comfort of man, it was difficult to conceive how he could have made the one to be the natural enemy of the other. 2d, that as the supplies of honey from the flowers had entirely failed, the season (1854) being exceedingly dry, if the bees had been able to help themselves to his sound grapes, they would, from the many hives near him, in a few days have entirely devoured the fruit of his vines. 3d, that the jaws of the bee being adapted only to the delicate manipulation of wax, were too feeble to enable it to puncture the skin of even the most delicate grapes.

In reply to these arguments, I was invited to go to the grape vines, and behold the depredators in the very act. The result justified my anticipations. Many bees were indeed seen banqueting on the grapes; but on closer observation, not one was found to be doing any mischief to the *sound* fruit. The bruised grapes on the vines, those lying on the ground, and the moist stems from which grapes had recently been plucked, were covered with bees: while others which were observed to alight upon bunches, after finding by careful inspection that they were sound, left them with evident dis-

appointment. Multitudes, however, of the wasp and hornet tribes were seen helping themselves to the very best of the fruit. As these insects do not secrete wax, they are furnished with powerful saw-like jaws, to enable them to cut off the woody fibre out of which they build their combs: with these they can easily puncture the skin of the toughest fruits.

After the mischief is once begun by other insects, or wherever a speck of rot, or a crack is seen, the honey bee hastens to help itself, on the principle of "gathering up the fragments that nothing may be lost." In this way, they undoubtedly do some mischief; but before war is declared against them, let every fruit-grower ask himself the question, if on the whole they are not far more useful than injurious. In genial seasons, when all the circumstances are favorable, the fruit will often set abundantly, even if no bees are kept in its vicinity: but many Springs are so cool and windy, that those only whose trees are all murmuring with the pleasant hum of bees, can expect a good crop.

If those horticulturists who have learned to regard the bee as their enemy, could succeed in exterminating the whole race, they would act with as much wisdom, as though they could banish from their inhospitable premises, every insectivorous bird which ventures to help itself to a small portion of the abundance it has aided in producing. If in the early Spring, judicious efforts were made to entrap the mother wasps and hornets, which alone survive the Winter, an effectual blow would be struck at some of the worst pests of the orchard and garden. In Europe, those engaged extensively in the cultivation of fruit, are in the habit of paying a premium, in the Spring, on all the wasps and hornets destroyed in their vicinity.

CHAPTER VII.

On the Advantages which ought to be found in a Good Hive.

In this Chapter, I shall enumerate certain very desirable, if not necessary qualities of a good hive. Having neither the taste nor the time for the invidious work of disparaging other hives, I prefer inviting the attention of bee-keepers to the importance of these requisites; some of which, I believe, are contained in no hive but my own. Let them be most carefully examined, and if found to commend themselves to the enlightened judgment of cultivators, they will serve to test the comparative merits of the various kinds of hives in common use.

1. A good hive should give the Apiarian the perfect control of all the combs; so that any of them may be easily taken out, without cutting them, or enraging the bees.

This advantage is fully possessed by no hive, except my own; although it forms the very foundation of the most profitable system of bee culture; for unless the combs are at the entire command of the Apiarian, he can have no effectual control over his bees, but must be almost entirely dependent upon all their caprices.

2. It should permit all necessary operations to be performed without hurting or killing a single bee.

Most hives are so constructed that it is impossible to use them, without at times injuring or destroying some of the bees. The mere destruction of a few bees, would not, except on the score of humanity, be of much consequence, if it did not very materially increase the difficulty of managing them. Bees remember injuries done to any of their number, for some time, and generally find an opportunity to avenge them.

3. It should afford suitable protection against extremes of heat and cold, sudden changes of temperature, and the injurious effects of dampness.

In Winter, the interior of the hive should be dry, and in Summer, the bees should not be forced to work to disadvantage in a pent and almost suffocating heat.

4. It should allow everything to be done that is necessary in the most extensive management of bees, without incurring any serious risk of exciting their anger.

5. Not a single unnecessary step or motion ought to be required of a single bee.

The honey harvest, in most locations, is of short continuance; and all the arrangements of the hive should facilitate, to the utmost, the work of the busy gatherers. Very tall hives, therefore, and all such as compel them to travel with their heavy burdens through densely crowded combs, are very objectionable. The bees in my hive, instead of forcing their way through thick clusters, can easily pass into the surplus honey boxes, not only from any comb in the hive, but without traveling over the combs at all.

6. It should afford suitable facilities for inspecting, at all times, the condition of the bees.

If the Apiarian wishes to make a thorough examination of any colony, in a few minutes, all the combs may be taken out and carefully inspected. In this way, its exact condition may always be easily ascertained, and nothing left, as in the common hives, to mere conjecture. This is an advantage, the importance of which it would be difficult to over estimate.

7. While the hive is of a size adapted to the natural instincts of the bee, it should be capable of being readily adjusted to the wants of small colonies.

By means of a movable partition, my hive can, in a few moments, be adapted to the wants of any colony however small, and can, with equal facility, be enlarged from time to time, or at once restored to its full dimensions.

8. It should allow the combs to be removed without any jarring.

Bees manifest the utmost aversion to any sudden jar, as such a motion loosens or detatches their combs. However firmly fastened the frames may be in my hive, they can all be loosened in a few moments, without injuring or exciting the bees.

9. It should allow every good piece of comb to be given to the bees, instead of being melted into wax.

10. The construction of the hive should induce the bees to build their combs with great regularity.

A hive which contains a large proportion of irregular comb, can seldom be expected to prosper. Such comb is often suitable only for storing honey, or raising drones. This is one reason why so many colonies never flourish.

11. It should furnish the means of procuring comb to induce the bees more readily to take possession of the surplus honey receptacles.

12. It should allow the removal of drone combs from the hive, to prevent the breeding of too many drones.

13. It should enable the Apiarian, in case too many drones have been raised, to trap and destroy them, early in the season.

This is effected, in my hives, by the simple adjustment of the blocks which regulate the entrance.

14. It should enable the Apiarian, when the combs become too old, to remove them, and supply their place with new ones.

No hive can, in this respect, equal one from which, in a few

moments, any comb can be removed, and the part which is too old, be cut off. The upper part of a comb, which is generally used for storing honey, will last without renewal for many years.

15. It ought to furnish the greatest possible security against the ravages of the Bee-Moth.

Neither before nor after it is occupied, ought there to be any cracks or crevices in the interior. All such places will be filled by the bees with propolis or bee-glue ; a substance, which, being always soft in the summer heat of the hive, forms a most congenial place of deposit for the eggs of the moth.

16. It should furnish some place accessible to the Apiarian, where the bee-moth can be tempted to deposit her eggs, and the worms, when full grown, to wind themselves in their cocoons.

17. It should enable the Apiarian, if the bee-moth ever gains the upper hand of the bees, to remove the combs, and expell the worms.

18. The bottom board should be permanently attached to the hive ; for if this is not done, it will be inconvenient to move the hive when bees are in it, and next to impossible to prevent the depredations of moths and worms.

Sooner or later, there will be crevices between the bottom board and sides of the hive, through which the moths will gain admission, and under which the worms, when fully grown, will retreat to spin their webs, and to be changed into moths, to enter in their turn, and lay their eggs. Movable bottom boards are a great nuisance in the Apiary, and the construction of my hive, which enables me entirely to dispense with them, will furnish a very great protection against the bee-moth. There is no place where they can get in, except at the entrance for the bees, and this may be

contracted or enlarged, to suit the strength of the colony; and from its peculiar shape, the bees are enabled to defend it against intruders, with the greatest advantage. If any prefer, however, to use movable bottom boards, the construction of my hive can be varied to suit their notions.

19. The bottom board should slant towards the entrance, to assist the bees in carrying out the dead, and other useless substances; to aid them in defending themselves against robbers; to carry off all moisture; and to prevent the rain and snow from beating into the hive.

20. The bottom board should be so constructed that it may easily be cleared of dead bees in cold weather, when the bees are unable to attend to this business themselves.

If suffered to remain, they often become mouldy, and injure the health of the colony. If the bees drag them out, as they will do, when the weather moderates, they often fall with them on the snow, and are so chilled that they never rise again; for a bee generally retains its hold in flying away with the dead, until both fall to the ground.

21. No part of the interior of the hive should be below the level of the place of exit.

If this principle is violated, the bees must, at great disadvantage, drag their dead, and all the refuse of the hive, *up hill.* Such hives will often have their bottom boards covered with small pieces of comb, bee-bread, and other impurities, in which the moth delights to lay her eggs; and which furnish her progeny with a most congenial nourishment, until they are able to get access to the combs.

22. It should afford facilities lor feeding the bees both in warm and cold weather.

In this respect, my hive has very unusual advantages. In warm weather, sixty colonies may, in less than an hour, be fed a quart each, and yet no feeder be used, and no risk incurred from robbing bees.

23. It should permit the easy hiving of a swarm, without injuring any of the bees, or risking the destruction of the Queen.

24. It should admit of the safe transportation of the bees to any distance whatever.

The permanent bottom board, the firm attachment of the combs, each to a separate frame, and the facility with which, in my hive, any amount of air can be given to the bees when shut up, most admirably adapt it to this purpose.

25. It should furnish the bees with air, when for any purpose, the entrance must be entirely shut.

26. A good hive should furnish facilities for enlarging, contracting, and closing the entrance, so as to protect the bees against robbers, and the bee-moth; and when the entrance is altered, the bees ought not to lose valuable time in searching for it, as they must do in most hives.

27. It should give the bees the means of ventilating their hives, without enlarging the entrance too much, so as to expose them to moths and robbers.

28. It should furnish facilities for admitting at once, a large body of air; so that in Winter, or early Spring, when the weather is at any time unusually mild, the bees may be tempted to fly out and discharge their fæces.

If such a free admission of air cannot be given to hives which are thoroughly protected against the cold, the bees may lose a favorable opportunity of emptying themselves; and thus be more exposed than they otherwise would, to suffer from diseases resulting from too long confinement. A very free admission of air is also desirable when the weather is exceedingly hot.

29. It should enable the Apiarian to remove the excess of bee-bread from old stocks.

By means of my movable frames, the excess of old colo-

nies may be made to supply the deficiency of young ones, to the mutual benefit of both.

30. It should enable the Apiarian, when he has removed the combs from a common hive, to place them with the bees, brood, honey and bee-bread, in the improved hive, so that the bees may be able to attach them in their natural positions.

31. It should permit the safe and easy dislodgement of the bees from the hive.

This requisite is especially important, when it becomes necessary to break up some of the weak stocks, to join them to others.

32. It should allow the heat and odor of the main hive as well as the bees themselves, to pass in the freest manner, to the surplus honey receptacles.

In this respect, all the hives with which I am acquainted, are more or less deficient: the bees are forced to work in receptacles difficult of access, and in which, they find it impossible, in cool nights, to keep up the animal heat necessary for comb-building. Bees cannot, in such hives, work to advantage in glass tumblers, or other small vessels. One of the most important arrangements of my hive, is that by which the heat ascends into all the receptacles for storing honey, as naturally and almost as easily as the warmest air ascends to the top of a heated room.

33. It should permit the surplus honey to be taken away, in the most convenient, beautiful and salable forms, at any time, and without any risk of annoyance from the bees.

In my hives, it may be made on frames, in tumblers, glass boxes, wooden boxes small or large, earthen jars, flower-pots, in short, in any kind of receptacle which may suit the fancy or convenience of the bee-keeper. Or all these may be dispensed with, and the honey taken from the interior of the main hive, by removing the frames with loaded combs, and supplying their place with empty ones.

34. It should admit of the easy removal of good honey from the main hive, that its place may be supplied by the bees with an inferior article.

In districts where buckwheat is raised, the bees will rapidly fill any vacancies made by removing the choice honey from the hive.

35. It should allow, when quantity not quality is the object, the largest amount of honey to be gathered; so that the surplus of strong conlonies may, in the Fall, be given to those which have not a sufficient supply.

By surmounting my hive with a box of the same dimensions, and transferring the combs to this box, the bees, when they commence building, will descend and fill the lower frames, gradually using the upper box, as the brood is hatched out, for storing honey. In this way, the largest possible yield of honey may be secured, as bees prefer to continue their work below, rather than above the main hive, and will very seldom swarm, when allowed ample and seasonable room in this direction. The combs in the upper box, containing a large amount of bee-bread, and being of a size adapted to the breeding of workers, will be all the better for aiding weak colonies.

36. It should compel, when desired, the force of the colony to be mainly directed to raising young bees; so that brood may be on hand to form new colonies, and strengthen feeble stocks.

37. It ought, while well protected from the weather, to be so constructed, that in warm, sunny days in early Spring, the influence of the sun may be allowed to penetrate and warm up the hive, so as to encourage early breeding.

38. The hive should be equally well adapted to be used as a swarmer, or non-swarmer.

In my hives, bees may be allowed, if their owner chooses,

to swarm just as they do in common hives, and be managed in the usual way. Even on this plan, the great protection against the weather which it affords, and the command over all the combs, will be found to afford unusual advantages.

Non-swarming hives managed in the ordinary way are liable, in spite of all precautions, to swarm very unexpectedly, and if not closely watched, the swarm is lost, and with it often the whole profit of that season. In my hives, the entrance can be so regulated that the Queen cannot leave, and a swarm will not depart without her.

39. It should enable the Apiarian to prevent a new swarm from forsaking its hive.

This vexatious occurrence can always be prevented, by adjusting the entrance, for a few days, so that the Queen cannot leave the hive.

40. It should enable the Apiarian, if he allows his bees to swarm, and wishes to secure surplus honey, to prevent them from throwing more than one swarm in the season.

Second and third swarms must be returned to the old stock, if the largest quantities of surplus honey are to be realized. It is troublesome to watch them, deprive them of their Queens, and restore them to the parent hive. They often issue with new Queens, again and again; and waste, in this way, both their own time, and that of their keeper. "An ounce of prevention is worth a pound of cure." In my hives, all the Queen cells except one, in a colony which swarms, may be cut out, and thus after-swarming be easily and effectually prevented. When the old stock is left with but one Queen, she runs no risk of being killed or crippled in a contest with rivals. By such contests, a colony is often left without a Queen, or in possession of one which is too much maimed to be of any service.

41. A good hive should enable the Apiarian, if he relies

on natural swarming, and wishes to multiply his colonies as fast as possible, to make vigorous stocks of all his small after-swarms.

Such swarms contain a young Queen, and if they can be judiciously strengthened, usually make the best stock hives. If hived in a common hive, and left to themselves, they seldom thrive, unless they issued very early, or the season was unusually favorable. They generally desert their hives, or perish in the Winter. If they are small, they cannot be made powerful, even by the most generous feeding. There are too few bees to build comb, and take care of the eggs which a healthy Queen can lay; and when fed, they are apt to fill with honey, the cells in which young bees ought to be raised; thus making the kindness of their owner serve only to hasten their destruction. My hives enable me to supply all such swarms at once with combs containing bee-bread, honey and brood almost mature. They are thus made strong, and flourish as well, nay, often better than the first swarms which have an old Queen, whose fertility is generally not so great as that of a young one.

42. It should enable the Apiarian to multiply his colonies with a certainty and rapidity which are entirely out of the question, if he depends upon natural swarming.

43. It should enable the Apiarian to supply destitute colonies with the means of obtaining a new Queen.

Every Apiarian would for this reason, if for no other, find it to his advantage to possess, at least, one such hive.

44. It should enable him to catch the Queen, for any purpose; especially to remove an old one whose fertility is impaired by age, that her place may be supplied with a young one.

45. While a good hive is adapted to the wants of those who desire to enter upon bee-keeping on a large scale, or at

least to manage their colonies on the most improved plans, it ought to be suited to the wants of those who from timidity, ignorance or any other reason, are indisposed to manage them except in the common way.

46. It should enable a single individual to superintend the colonies of many different persons.

Many would like to keep bees, if they could have them taken care of, by those who would undertake their management, just as a gardener does the gardens and grounds of his employers. No person can agree to do this with the common hives. If the bees are allowed to swarm, he may be called in a dozen different directions, and if any accident, such as the loss of a Queen, happens to the colonies of his customers, he can apply no remedy. If the bees are in non-swarming hives, he cannot multiply the stocks when this is desired.

On my plan, gentlemen who desire it, may have the pleasure of witnessing the industry and sagacity of this wonderful insect, and of gratifying their palates with its delicious stores, harvested on their own premises, without incurring either trouble, or risk of annoyance.

47. All the joints of the hive should be water tight, and there should be no doors or slides which are liable to shrink, swell, or get out of order.

The importance of this will be sufficiently obvious to any one who has had the ordinary share of vexatious experience in the use of such fixtures.

48. It should enable the bee-keeper entirely to dispense with sheds, and costly Apiaries; as each hive when properly placed, should alike defy, heat or cold, rain or snow.

49. It should allow the contents of a hive, bees, combs and all, to be taken out; so that any necessary repairs may be made.

This may be done, with my hives, in a few minutes. "A stitch in time saves nine." Hives which can be thoroughly overhauled and repaired, from time to time, if properly attended to, will last for generations.

50. The hive and fixtures should present a neat and attractive appearance, and should admit, when desired, of being made highly ornamental.

51. The hives ought not to be liable to be blown down in high winds.

In very windy situations, my hives may be made so low that it would require almost a hurricane to upset them.

52. It should enable an Apiarian who lives in the neighborhood of human pilferers, to lock up the precious contents of his hives, in some cheap, simple and convenient way.

As my bottom boards are not movable, when a hive is locked up, the contents can only be reached by carrying it bodily away.

53. A good hive should be protected against the destructive ravages of mice in Winter.

It seems almost incredible that so puny an animal should dare to invade a hive of bees; and yet not unfrequently they slip in when the bees are compelled by the cold to retreat from the entrance. Having once found admission, they build themselves a nest in their comfortable abode, eat up the honey and such bees as are too much chilled to make any resistance; and fill the premises with such an abominable stench, that on the arrival of warm weather, the bees often in a body abandon their desecrated home. As soon as the cold weather approaches, all my hives may have their entrances so contracted that a mouse cannot gain admission.

54. A good hive should have its alighting board constructed so as to shelter the bees against wind and wet, and thus

facilitate to the utmost their entrance when they come home with their heavy burdens.

If this precaution is neglected, much valuable time and many lives may be sacrificed, as the colony cannot be encouraged to use to the best advantage the unpromising days which so often occur in the working season.

I have succeeded in arranging my alighting board in such a manner that the bees are sheltered against wind and wet, and are able to enter the hive with the least possible loss of time.

55. It should possess all these requsites without being too costly for common bee-keepers, or too complicated to be constructed by any who can handle simple tools: and they should be so combined that the result is a simple hive, which any one can manage who has ordinary intelligence on the subject of bees.

I suppose that the very natural conclusion from reading this long list of desirables, would be that no single hive can combine them all, without being exceedingly complicated and expensive. On the contrary, the simplicity and cheapness with which my hive secures all these results, is one of its most striking peculiarities, the attainment of which has cost me more study than all the other points besides. As far as the bees are concerned, they can work in this hive with even greater facility than in the simple old-fashioned box, as the frames are left rough by the saw, and thus give an admirable support to the bees when building their combs; and they can enter the spare honey boxes, with even more ease than if they were merely continuations of the main hive.

There are a few desirables to which my hive makes not the slightest pretensions! It promises no splendid results to those who purchase it, and yet are too ignorant, or too careless to be entrusted with the management of bees. In bee-

keeping, as in other things, a man must first understand his business, and then proceed on the good old maxim, that "the hand of the diligent maketh rich."

It possesses no talismanic influence by which it can convert a bad situation for honey, into a good one; or give the Apiarian an abundant harvest whether the season is productive or otherwise.

It cannot enable the cultivator rapidly to multiply his stocks, and yet in the same season, to secure surplus honey from his bees. As well might the breeder of poultry pretend that in the same year and from the same stock, he can both raise the greatest number of chickens, and sell the largest number of eggs.

Worse than all, it cannot furnish the many advantages enumerated, and yet be made in as little time, or quite as cheap as a hive which proves, in the end, to be a very dear bargain!

I have not constructed my hive in accordance with crude theories, or mere conjectures, and then insisted that the bees must flourish in such a fanciful contrivance; but I have studied, for many years, most carefully, the nature of the honey-bee; and have diligently compared my observations with those of writers and practical cultivators, who have spent their lives in extending the sphere of Apiarian knowledge; and as the result, have endeavored to adapt my invention to the actual habits and wants of the bee; and to remedy the many difficulties with which I have found its successful culture to be beset. And more than this, I have actually tested its merits, by experiments long continued and on a large scale, so that I might not deceive both myself and others, and add another to the many useless contrivances which have deluded and disgusted a too credulous public. I would, however, most earnestly repudiate all claims to

having devised a "perfect bee hive." Perfection can belong only to the works of the great Creator, to whose omniscient eye, all causes and effects with all their relations were present, when he spake, and from nothing formed the Universe and all its stupendous wonders. For man to stamp upon any of his own works, the label of perfection, is to show both his folly and presumption.

It must be confessed that the culture of bees is at a very low ebb in our country, when thousands can be induced to purchase hives which are in most glaring opposition not only to the true principles of Apiarian knowledge, but often, to the plainest dictates of simple common sense. Such have been the losses and disappointments of deluded purchasers, that it is no wonder that they turn from everything offered in the shape of a patent bee-hive, as a miserable humbug, if not a most barefaced cheat.

I do not hesitate to say, that those old-fashioned bee-keepers who have most steadily refused to meddle with any novelties, and who have used hives of the very simplest construction, or at least such as are only one remove from the old straw hive, or wooden box, have, as a general thing, realized by far the largest profits in the management of bees. They have lost neither time, money nor bees, in the vain hope of obtaining any unusual results from hives, which, in the very nature of the case, can secure nothing really in advance of what can be accomplished by a simple box hive with an upper chamber.

A hive of the simplest possible construction, is only a close imitation of the abode of bees in a state of nature; being a mere hollow receptacle in which they are protected from the weather, and where they can lay up their stores.

An improved hive is one which contains, in addition, a separate apartment in which the bees can be induced to lay

up the surplus portion of their stores, for the use of their owner. All the various hives in common use, are only modifications of this latter hive, and, as a general rule, they are bad, exactly in proportion as they depart from it. Not one of them offers any remedy for the loss of the Queen, or indeed for most of the casualties to which bees are exposed: they form no reliable basis for any new system of management; and hence the cultivation of bees, is substantially where it was, fifty years ago, and the Apiarian as entirely dependent as ever, upon all the whims and caprices of an insect which, more than any of his domestic animals, may be made completely subject to his control.

No hive which does not furnish a thorough control over every comb, can be considered as any substantial advance on the simple improved or chamber hive. Of all such hives, the one which with the least expense, gives the greatest amount of protection, and the readiest access to the spare honey boxes, is the best.

Having thus enumerated the tests to which all hives ought to be subjected, and by which they should stand or fall, I submit them to the candid examination of practical, common sense bee-keepers, who having the largest experience in the management of bees, are most conversant with the evils of the present system; and are therefore best fitted to apply them to an invention, which, if I may be pardoned for using the enthusiastic language of an experienced Apiarian on examining its practical workings, "introduces, not simply an *improvement*, but a *complete revolution* in bee-keeping."

CHAPTER VIII.

Protection against extremes of Heat and Cold, sudden and severe changes of Temperature, and Dampness in the Hives.

I specially invite a careful perusal of this chapter, as the subject, though of the very first importance in the management of bees, is one to which but little attention has been given by the majority of cultivators.

In our climate of great and sudden extremes, many colonies are annually injured or destroyed by undue exposure to heat or cold. In Summer, thin hives are often exposed to the direct heat of the sun, so that the combs melt, and the bees are drowned in their own sweets. Even if they escape utter ruin, they cannot work to advantage in the almost suffocating heat of their hives.

But in those places where the Winters are long and severe, it is much more difficult to protect the bees from the cold than from the heat. Bees are not, as some suppose, in a dormant, or torpid condition in Winter. The wasp, hornet, and other insects which do not, like the honey-bee, live in families in the Winter, lay up no stores for cold weather, and are so organized as to be able to endure in a torpid state, a very low temperature; so low that it would be certain death to a bee, which when frozen, is as surely killed as a frozen man.

As soon as the temperature of the hives falls too low for their comfort, the bees gather themselves into a more compact body, to preserve to the utmost, their animal heat; and if the cold becomes so great that this will not suffice, they keep up an incessant, tremulous motion, accompanied by a loud humming noise; in other words, they take active exer-

cise in order to keep warm! If a thermometer is pushed up among them, it will indicate a high temperature, even when the external atmosphere is many degrees below zero. When bees are unable to maintain the necessary amount of animal heat, an occurrence which is very common with small colonies in badly protected hives, then, as a matter of course, they quickly perish.

Extreme cold, when of long continuance, very frequently, in thin hives, destroys colonies strong both in bees and honey. The inside of such hives, is often filled with frost, and the bees, after eating all the food in the combs in which they are clustered, are unable to enter the frosty ones, and thus starve in the midst of plenty. The unskilfull bee-keeper who finds an abundance of honey in the hives, cannot conjecture the cause of their death.

Bees will very seldom desert the combs containing brood, and hence when the honey in them is consumed, they will not, in a body, transfer themselves to other combs, but choose rather to die upon their young. This is a calamity which rarely occurs, in well protected hives.

If the cold merely destroyed feeble colonies, or strong ones only now and then, it would not be so formidable an enemy; but every year, it causes some of the most flourishing stocks to perish by starvation. The extra quantity of food which they are compelled to eat, in order to keep up the heat in their miserable hives, is often the turning point with them, between life and death. They starve, when with proper protection, they would have had food enough and to spare.

But some one may say, "What possible difference can the kind of hives in which bees are kept, make in the quantity of food which they will consume?" To this I would reply that we cannot move a finger, or wink even an eye-lid without some waste of muscle, however small; for it is a

well-ascertained law in our animal economy, that all *muscular exertion* is attended with a corresponding *waste* of muscular fibre. Now this waste must be supplied by the consumption of food, and it would be quite as unreasonable to expect constant heat from a stove without fresh supplies of fuel, as incessant muscular activity from an insect, without a supply of food proportioned to that activity. If then we can contrive any plan to keep our bees in almost perfect quiet during the Winter, we may be certain that they will need much less food than when they are constantly excited.

In the cold Winter of 1851–2, I kept two swarms in a perfectly dry and dark cellar, where the temperature was remarkably uniform, seldom varying two degrees from 50° of Fahrenheit; and found that the bees ate very little honey. The hives were of glass, and the bees, when examined from time to time, were found clustered in almost death-like repose. If these bees had been exposed in thin hives, in the open air, they would, whenever the sun shone upon them, or the atmosphere was unusually warm, have been roused to injurious activity, and the same would have been the case, when the cold was severe: exposed to sudden changes and severe cold, they would have been in almost perpetual motion, and must have been compelled to consume a largely increased allowance of food. In this way, many colonies are annually starved to death, which if they had been better protected, would have survived to gladden their owner with an abundant harvest. This protection, as a general thing, cannot be given to them in a cellar, which is rarely dry enough to prevent the combs from moulding, and the bees from becoming diseased.

Bees never, unless diseased, discharge their fæces in the hive; and the want of suitable protection, by exciting undue activity, and compelling them to eat more freely, causes

their bodies to be greatly distended with accumulated fæces. On the return of mild weather, bees in this condition being often too feeble to fly, crawl from their hives, and miserably perish.

Insufficient protection is also exceedingly injurious, by causing the *moisture* to settle upon the cold top and sides of the interior of the hive, from whence it drips upon the bees. In this way, many of their number are chilled and destroyed, and often the whole colony infected with dysentery. Not unfrequently, large portions of the comb are covered with mould, and the hive rendered very offensive.

This dampness which causes what may be called a *rot* among the bees, is one of the worst enemies with which the Apiarian in a cold climate, has to contend, as it weakens or destroys many of his best colonies. No extreme of cold ever experienced in latitudes where bees flourish, can destroy a strong colony well supplied with honey, except indirectly, by confining them to empty combs. They will survive our coldest winters, in thin hives raised on blocks to give a freer admission of air, or even in suspended hives, without any bottom-board at all. Indeed, in cold weather, a *very free* admission of air is necessary in thin hives, to prevent the otherwise ruinous effects of frozen moisture; and hence the common remark that bees require even more air in Winter than in Summer.

When bees, in unsuitable hives, are exposed to all the variations of the external atmosphere, they are frequently tempted to fly abroad if the weather becomes unseasonably warm, and multitudes are lost on the *snow*, at a season when few are bred to replenish their number, and when the loss is most injurious to the colony.

From these remarks, it will be obvious to the intelligent cultivator, that protection against extremes of heat and cold,

is a point of the *very first importance;* and yet this is the very point, which in proportion to its importance, has been most overlooked. We have discarded, and very wisely, the straw hives of our ancestors; but such hives, with all their faults, were comparatively warm in Winter, and cool in Summer. We have undertaken to keep bees, where the cold of Winter and the heat of Summer are alike intense, and where sudden and severe changes are often fatal to the brood; and yet we blindly persist in expecting success under circumstances in which any marked success is well nigh impossible.

That our country is eminently favorable to the production of honey, cannot be doubted. Many of our forests abound with colonies which are not only able to protect themselves against all their enemies, the dreaded bee-moth not excepted, but which often amass prodigious quantities of honey. Nor are such colonies found merely in *new* countries. They exist frequently in the very neighborhood of cultivators whose hives are weak and impoverished, and who impute to a decay of the honey resources of the country, the inevitable consequences of their own irrational system of management. It will not be without profit, to consider briefly under what circumstances these wild colonies flourish, and how they are protected against sudden and extreme changes of temperature.

Snugly housed in the hollow of a tree, whose thickness and decayed interior are such admirable materials for excluding atmospheric changes, the bees in Winter are in a state of almost absolute repose. The entrance to their abode is generally very small in proportion to the space within; and let the weather out of doors vary as it may, the inside temperature is very uniform. These natural hives are dry, because the moisture finds no cold or icy top, or sides, on

which to condense, and from which it must drip upon the bees, destroying their lives, or enfeebling their health, by filling the interior of their dwelling with mould and dampness. As they are very quiet, they eat but little, and hence their bodies are not distended and diseased by accumulated fæces. Often they do not stir from their hollows, from November until March or April; and yet they come forth in the Spring, strong in numbers, and vigorous in health. If at any time in the Winter season, the warmth is so great as to penetrate their comfortable abodes, and to tempt them to fly, when they venture out, they find a balmy atmosphere in which they may disport with impunity. In the Summer, they are protected from the heat, not merely by the thickness of the hollow tree, but by the leafy shade of overarching branches, and the refreshing coolness of a forest home.

The Russian and Polish bee-keepers, living in a climate whose winters are much more severe than our own, are among the largest and most successful cultivators of bees, many of them numbering their colonies by hundreds, and some even by thousands! They have, with great practical sagacity, imitated as closely as possible, the conditions under which bees are found to flourish so admirably in a state of nature. We are informed by a Polish writer, that his countrymen make their hives of the best plank, and never less than an inch and a half in thickness. The shape is that of an old-fashioned churn, and the hive is covered on the outside, halfway down, with twisted rope cordage, to give it greater protection against extremes of heat and cold. The hives are placed in a dry situation, directly upon the hard earth, which is first covered with an inch or two of clean, dry sand. Chips are then heaped up all around them, and covered with earth banked up in a sloping direction, to carry off the rain. The entrance is at some distance above the

bottom, and is a triangle whose sides are only one inch long. In the Winter season, this entrance is contracted so that only one bee can pass at a time. Such a hive, with us, as it does not furnish the honey in convenient, beautiful and salable forms, would not meet the demands of our cultivators. Still, there are some very important lessons to be learned from it, by all who keep bees in regions of cold Winters, and hot Summers. It shows the importance which some of the largest Apiarians in the world, attach to protection; practical, common sense men, whose heads have not been turned, as some would express it, by modern theories and fanciful inventions. They cultivate their bees almost in a state of nature, and their experience on what we would term a gigantic scale, ought to convince even the most incredulous, of the folly of pretending to keep bees, in the miserably thin and unprotected hives to which we have been accustomed.

But how, it will be asked, can bees live in Winter, in a hive so closely shut up as the Polish hive? They do live in such hives, and prosper, just as they do in hollow trees, with only one small entrance. It is well known that bees have flourished when their hives were buried in Winter, and under circumstances in which but a very small amount of air could possibly gain admission to them. Bees, when kept in a *dry* place, in properly protected hives and in a state of almost perfect repose, need only a small supply of air; and the objection that those cultivators among us, who shut up their colonies very closely in Winter, are almost sure to lose them, is of no weight; because the majority of our hives are so deficient in protection, that if they are too closely shut up, "the breath of the bees," condensing and freezing upon the inside, and afterwards thawing, causes the combs to mould, and the bees to become diseased; just as many substances mould and perish when kept in a close, damp cellar.

We are now prepared to discuss the question of protection in its relations to the construction of hives. We have seen how it is furnished to the bees in the Polish hives, and in the decayed hollows of trees. If the Apiarian chooses, he can imitate this plan by constructing his hives of very thick plank; but such hives would be clumsy, and with us, expensive. Or he may much more effectually reach the same end, by making his hives double, so as to enclose an air space all around, which may be filled with charcoal, saw dust, or any good non-conductor, to enable the bees to preserve with the least waste, their animal heat. Hives may be constructed in this way, which without great expense, may be much better protected than if they were made of the thickest plank.

The manner in which I make my hives, not only protects the bees against extremes of heat and cold, but it guards them very effectually, against the injurious and often fatal effects of condensed moisture. By means of my movable frames, the combs are prevented from being attached to the sides, top or bottom of the hive; they are in fact, suspended in the air. If now the dampness can be prevented from condensing any where, *over* the bees, so that it may not drip upon the combs, and if it can be easily discharged from the hive wherever it may collect, it cannot, under any circumstances, seriously annoy them. Such are the arrangements in my hives, that the little moisture which forms in them, is deposited on the sides in preference to any other part of the interior; just as it is upon the colder walls or windows, rather than the ceiling of a room. But as the combs are kept away from the sides, this moisture cannot annoy the bees, but must fall upon the bottom-board, from whence it can be easily discharged from the hive. Wherever glass is used in the construction of my hives, I prefer to set the

panes *double*, with a dead air space between them; the extra cost will be amply repaid by the additional protection given to the bees.

There is one disadvantage to which all well protected hives of the ordinary construction, are exposed. In the Spring of the year, it is exceedingly desirable that the warmth of the sun should penetrate the hives, to encourage the bees in early breeding; but the very arrangement which protects them from cold, often interferes with this. A bee-hive is thus like a cellar, warm in Winter, and cool in Summer; but often unpleasantly cool in the early Spring, when the atmosphere out of doors is warm and delightful. In my hive, this difficulty is easily remedied. In the Spring, as soon as the bees begin to fly, on warm, sun-shiny days, the upper part of the outside case may, for a few hours, be removed, so that the heat of the sun can penetrate to every part of the hive.

It is a serious objection to most covered Apiaries, that they do not permit the hives to receive the genial heat of the sun at a period of the year when instead of injuring the bees, it exerts a most powerful influence in developing their brood. This is one among many reasons why I have discarded them, and why I prefer to construct my hives in such a manner that they need no extra covering, but stand, in the early part of the season, exposed to the full influence of the sun. I have known strong colonies which have survived the Winter in thin hives, to increase rapidly and swarm early, because of the stimulating effect of the sun; while others, deprived of this influence, in dark bee houses and well protected hives, have sometimes disappointed the hopes of their owners. Enclosed Apiaries are at best but nuisances: they soon become lurking-places for spiders and moths; and after all the expense wasted on their construction, afford but little protection against extreme cold.

I have been thus particular on the subject of protection, in order to convince every bee keeper who exercises common sense, that thin hives ought to be given up, if either pleasure or profit is sought from his bees. Such hives an enlightened Apiarian could not be persuaded to purchase, and he would consider them too expensive in their waste of honey and bees, to be worth accepting, even as a gift. Many strong colonies which are lodged in badly protected hives, often consume in extra food, in a single hard Winter, more than enough to pay the difference between the first cost of a good hive over a bad one. In the severe Winter of 1851–2, many cultivators lost nearly all their stocks, and a large part of those which survived, were too much weakened to be able to swarm. And yet these same miserable hives, after accomplishing the work of destruction on one generation of bees, are reserved to perform the same office for another. And this some call economy!

I am well aware of the question which many of my readers have for some time been ready to ask me. Can you make one of your well protected hives as cheaply as we construct our common box hives? I would remind such questioners, that it is hardly possible to build a well protected house as cheaply as a barn.

If, however, my hives are not built of doubled materials, they can be made for less money than most patent hives, and yet afford much greater protection; as the combs touch neither the top, bottom nor sides of the hive. I recommend, however, for all latitudes north of Philadelphia, a construction, which although somewhat more costly at first, is yet much cheaper in the end.

Such is the passion of the American people for cheapness in the first cost of an article, even at the evident expense of dearness in the end, that many, I doubt not, will continue to

lodge their bees in thin hives, in spite of their conviction of the folly of so doing; just as many of our shrewdest Yankees build thin, wooden houses, in the cold climate of New England, or plaster their stone or brick ones directly on the wall, when the extra cost of fuel to warm them, far exceeds the interest on the additional expense which would be necessary to give them the requisite protection; to say nothing of the doctors' bills, and fatal diseases which can be traced often to the dreary barns or damp vaults which they build, and call houses!

In the first edition of this work, I recommended placing the hives over a trench, dug in the ground, from which, by means of ventilators in the bottom-boards, they could obtain a supply of cool air in Summers and warm air in Winter. This trench I called a Protector. Subsequent experiments have, however, fully convinced me that it is not adapted to secure the ends proposed. In most situations it will be damp in Winter, while at the same time, the extra protection furnished is not sufficient to justify the expense.

CHAPTER IX.

Ventilation of the Hive.

If a populous hive is examined on a warm Summer day, a considerable number of bees will be found standing on the alighting board, with their heads turned towards the entrance, the extremity of their bodies slightly elevated, and their wings in such rapid motion that they are almost as indistinct

as the spokes of a wheel, in swift rotation on its axis. A brisk current of air may be felt proceeding from the hive, and if a small piece of down be suspended by a thread, it will be blown out from one part of the entrance, and drawn in at another. What are these bees expecting to accomplish, that they appear so deeply absorbed in their fanning occupation, while busy numbers are constantly crowding in and out of the hive? and what is the meaning of this double current of air? To Huber, we owe the first satisfactory explanation of these curious phenomena. The bees plying their rapid wings in such a singular attitude, are performing the important business of *ventilating* the hive; and this double current is composed of pure air rushing in at one part, to supply the place of the foul air forced out at another. By a series of the most careful and beautiful experiments, Huber ascertained that the air of a crowded hive is almost, if not quite, as pure as the atmosphere by which it is surrounded. Now, as the entrance to such a hive, is often, (more especially in a state of nature,) very small, the interior air cannot be renewed without resort to some artificial means. If a lamp is put into a close vessel with only one small orifice, it will soon exhaust all the oxygen, and go out. If another small orifice is made, the same result will follow; but if by some device a current of air is drawn out from one opening, an equal current will force its way into the other, and the lamp will burn until the oil is exhausted.

It is precisely on this principle of maintaining a double current by *artificial means*, that the bees ventilate their crowded habitations. A body of active ventilators stands inside of the hive, as well as outside, all with their heads turned towards the entrance, and by the rapid fanning of their wings, a current of air is blown briskly out of the hive, and an equal current drawn in. This important office is one

which requires great physical exertion on the part of those to whom it is entrusted; and if their proceedings are carefully watched, it will be found that the exhausted ventilators, are, from time to time, relieved by fresh detachments. If the interior of the hive will admit of inspection, in very hot weather, large numbers of these ventilators will be found in regular files, in various parts of the hive, all busily engaged in their laborious employment. If the entrance at any time is contracted, a speedy accession will be made to the numbers, both inside and outside; and if it is closed entirely, the heat of the hive will quickly increase, the whole colony will commence a rapid vibration of their wings, and in a few moments will drop lifeless from the combs, for want of air.

It has been proved by careful experiments, that pure air is necessary not only for the respiration of the mature bees, but that without it, neither the eggs can be hatched, nor the larvæ developed. A fine netting of air-vessels covers the eggs; and the cells of the larvæ are sealed over with a covering which is full of air holes. In Winter, as has been stated in the Chapter on Protection, bees, if kept in the dark, and neither too warm nor too cold, are almost dormant, and seem to require but a small allowance of air; but even under such circumstances, they cannot live entirely without air; and if they are excited by being exposed to atmospheric changes, or by being disturbed, a very loud humming may be heard in the interior of their hives, and they need quite as much air as in warm weather.

If at any time, by moving their hives, or in any other way, bees are greatly disturbed, it will be unsafe to confine them, especially in warm weather, unless a very free admission of air is given to them, and even then, the air ought to be admitted above, as well as below the mass of bees, or the ventilators may become clogged with dead bees, and the

swarm may perish. Under close confinement, the bees become excessively heated, and the combs are often melted down. When bees are confined to a close atmosphere, especially if dampness is added to its injurious influences, they are sure to become diseased; and large numbers, if not the whole colony, perish from dysentery. Is it not under circumstances precisely similar, that cholera and dysentery prove most fatal to human beings? How often do the filthy, damp and unventilated abodes of the abject poor, become perfect lazar-houses to their wretched inmates?

I examined, last Summer, the bees of a new swarm which had been suffocated for want of air, and found their bodies distended with a yellow and noisome substance, just as though they had perished from dysentery. A few were still alive, and instead of honey, their bodies were filled with this same disgusting fluid; though the bees had not been shut up, more than two hours.

In a medical point of view, I consider these facts as highly interesting; showing as they do, under what circumstances, and how speedily, diseases may be produced.

In very hot weather, if thin hives are exposed to the sun's rays, the bees are excessively annoyed by the intense heat, and have recourse to the most powerful ventilation, not merely to keep the air of the hive pure, but to carry off, as much as possible, its internal warmth. They often leave the interior of the hive, almost in a body, and in thick masses, cluster on the outside, not simply to escape the close heat within, but to guard their combs against the danger of being dissolved. At such times they are particularly careful not to cluster on the combs containing sealed honey; for as most of these combs have not been lined with the cocoons of the larvæ, they are, for this reason, as well as on account of the extra amount of wax used for their covers, much more liable to be melted, than the breeding cells.

Apiarians have often noticed the fact, that as a general thing, the bees leave the honey cells almost entirely bare, as soon as they have sealed them over; but it seems to have escaped their observation, that in hot weather, there is often an absolute necessity for such a course. In cool weather, on the contrary, the bees may often be found clustered among the sealed honey-combs, because there is then no danger of their melting down.

Few things in the range of their wonderful instincts, are so well fitted to impress the mind with their admirable sagacity, as the truly scientific device, by which these wise little insects ventilate their dwellings. I was on the point of saying that it was almost like human reason, when the painful and mortifying reflection presented itself to my mind that in respect to ventilation, the bee is immensely in advance of the great mass of those who consider themselves as rational beings. It has, to be sure, no ability to make an elaborate analysis of the chemical constituents of the atmosphere, and to decide how large a proportion of oxygen is essential to the support of life, and how rapidly the process of breathing converts this important element into a deadly poison. It has not, like Liebig, been able to demonstrate that God has set the animal and vegetable world, the one over against the other; so that the carbonic acid produced by the breathing of the one, furnishes the aliment of the other; which, in turn, gives out its oxygen for the support of animal life; and that, in this wonderful manner, God has provided that the atmosphere shall, through all ages, be as pure as when it first came from His creating hand. But shame upon us! that with all our intelligence, the most of us live as though pure air was of little or no importance; while the bee ventilates with a scientific precision and thoroughness, that puts to the blush our criminal neglect.

To this it may be replied that ventilation in our case, cannot be had, without considerable expense. Can it be had for nothing, by the industrious bees? Those busy insects, which are so indefatigably plying their wings, are not engaged in idle amusement; nor might they, as some would-be utilitarian may imagine, be better employed in gathering honey, or in superintending some other department in the economy of the hive. They are at great expense of time and labor, supplying the rest of the colony with pure air, so conducive in every way, to their health and prosperity.

I trust that I shall be permitted to digress, for a short time, from bees to men, and that the remarks which I shall offer on the subject of ventilation in human dwellings, may make a deeper impression, in connection with the wise arrangements of the bee, than they would, if presented in the shape of a mere scientific discussion; and that some who have been in the habit of considering all air, except in the particular of temperature, as about alike, may be thoroughly convinced of their mistake.

Recent statistics prove that consumption and its kindred diseases are most fearfully on the increase, in the Northern, and more especially in the New England States; and that the general mortality of Massachusetts exceeds that of almost nny other state in the Union. In these States, the tendency of increasing attention to manufacturing and mechanical pursuits, is to compel a larger and larger proportion of the population to lead an in-door life, and breat he an atmosphere more or less vitiated, and thus unfit for the full development of vigorous health. The importance of pure air can hardly be over-estimated; indeed, the quality of the air we breathe, seems to exert an influence much more powerful, and hardly less direct, than the mere quality of our food. Those who, by active exercise in the open air, keep their

lungs saturated as it were, with the pure element, can eat almost anything with impunity; while those who breathe the sorry apology for air which is to be found in so many habitations, although they may live upon the most nutritious diet, and avoid the least excess, are incessantly troubled with head-ache, dyspepsia, and various mental as well as physical sufferings. Well may such persons, as they witness the healthy forms and happy faces of so many of the hardy sons of toil, exclaim with the old Latin poet,

"Oh dura messorum illia!"

It is with the human family very much as it is with the vegetable kingdom. Take a plant or tree, and shut it out from the pure air and the invigorating light, and though you may supply it with an abundance of water, and the very soil, which by the strictest chemical analysis, is found to contain all the elements that are essential to its vigorous growth, it will still be a puny thing, ready to droop, if exposed to a summer's sun, or to be prostrated by the first visitation of a winter's blast. Compare, now, this wretched abortion, with an oak or maple which has grown upon the comparatively sterile mountain pasture, and whose branches, in Summer, are the pleasant resort of the happy songsters, while, under its mighty shade, the panting herds drink in a refreshing coolness. In Winter it laughs at the mighty storms, which wildly toss its giant branches in the air, and which serve only to exercise the limbs of the sturdy tree, whose roots deep intertwined among its native rocks, enable it to bid defiance to anything short of a whirlwind or tornado.

To a population, who, for more than two-thirds of the year, are compelled to breathe an atmosphere heated by artificial means, the question how can this air be made, at a moderate expense, to resemble, as far as possible, the purest

ether of the skies is, (alas! that I should rather say ought to be,) a question of the utmost interest. When open fires were used, there was no lack of pure air, whatever else might have been deficient. A capacious chimney carried up through its insatiable throat, immense volumes of air, to be replaced by the pure element, whistling in glee, through every crack, crevice and keyhole. Now the house-builder and stove-maker with but few exceptions* seem to have joined hands in waging a most effectual warfare against the unwelcome intruder. By labor-saving machinery, they contrive to make the one, the joints of his wood-work, and the other, those of his iron-work, tighter and tighter, and if it were possible for them to accomplish fully their manifest design, they would be able to furnish rooms almost as fatal to life as "the black hole of Calcutta." But in spite of all that they can do, the materials will shrink, and no fuel has yet been found, which will burn without any air, so that sufficient ventilation is kept up, to prevent such deadly occurrences. Still they are tolerably successful in keeping out the unfriendly element; and by the use of huge cooking-stoves with towering ovens, and other salamander contrivances, the little air that can find its way in, is almost as thoroughly cooked, as are the various delicacies destined for the table.

On reading an account of a run-away slave, who was for a considerable time, closely boxed up, a gentleman remarked that if the poor fellow had only known that a renewal of the air was necessary to the support of life, he could not have lived there an hour without suffocation; I have frequently thought that if the occupants of the rooms I have been de-

* The beautiful open or Franklin stoves, manufactured by Messrs. Jagger, Treadwell & Perry, of Albany, deserve the highest commendation: they economize fuel as well as life and health.

scribing, could only know as much, they would be in almost similar danger.

Bad air, one would think, is bad enough: but when it is heated and dried to an excessive degree, all its original vileness is stimulated to greater activity, and thus made doubly injurious by this new element of evil. Not only our private houses, but our churches and school-rooms, our rail-road cars, and all our places of public assemblage, are, to a most lamentable degree, either unprovided with any means of ventilation, or, to a great extent, supplied with those which are so deficient that they

> "Keep the word of promise to our ear,
> And break it to our hope."

That ultimate degeneracy must surely follow such entire disregard of the laws of health, cannot be doubted; and those who imagine that the physical stamina of a people can be undermined, and yet that their intellectual, moral and religious health will suffer no eclipse or decay, know very little of the intimate connection between body and mind, which the Creator has seen fit to establish.

The men may, to a certain extent, resist the injurious influences of foul air; as their employments usually compel them to live much more out of doors: but alas, alas! for the poor women! In the very land where women are treated with more universal deference and respect than in any other, and where they so well deserve it, there often, no provision is made to furnish them with that great element of health, cheerfulness and beauty, heaven's pure, fresh air.

In Southern climes, where doors and windows may be safely kept open for a large part of the year, pure air is cheap enough, and can be obtained without any special effort: but in Northern latitudes, where heated air must be

used for nearly three-quarters of the year, the neglect of ventilation is fast causing the health and beauty of our women to disappear. The pallid cheek, or the hectic flush, the angular form and distorted spine, the debilitated appearance of a large portion of our females, which to a stranger, would seem to indicate that they were just recovering from a long illness, all these indications of the lamentable absence of physical health, to say nothing of the anxious, care-worn faces and premature wrinkles, proclaim in sorrowful voices, our violation of God's physical laws, and the dreadful penalty with which He visits our transgressions.

Our people must, and I have no doubt that eventually they will be most thoroughly aroused to the necessity of a vital reform on this important subject. Open stoves, and cheerful grates and fire-places will again be in vogue with the mass of the people, unless some better mode of warming shall be devised, which, at less expense, shall make still more ample provision for the constant introduction of fresh air. Houses will be constructed, which, although more expensive in the first cost, will be far cheaper in the end, and by requiring a much smaller quantity of fuel to warm the air, will enable us to enjoy the luxury of breathing air which may be duly tempered, and yet be pure and invigorating. Air-tight and all other *lung-tight* stoves will be exploded, as economizing in fuel only when they allow the smallest possible change of air, and thus squandering health and endangering life.

The laws very wisely forbid the erection of wooden buildings in large cities, and in various ways prescribe such regulations for the construction of edifices as are deemed to be essential to the public welfare; and the time cannot, I trust, be very far distant, when at least all public buildings erected for the accommodation of large numbers, will be required by law, to furnish a supply of fresh air, in some reasonable

degree adequate to the necessities of those who are to occupy them.

The man who shall succeed in convincing the mass of the people, of the truth of the views thus imperfectly presented, and whose inventive mind shall devise a cheap and efficacious way of furnishing a copious supply of pure air for our dwellings and public buildings, our steamboats and railroad cars, will be even more of a benefactor than a Jenner, or a Watt, a Fulton, or a Morse.*

To return from this lengthy and yet I trust not unprofitable digression.

In the ventilation of my hive, I have endeavored, as far as possible, to meet all the necessities of the bees, under the varying circumstances to which they are exposed, in our uncertain climate, whose severe extremes of temperature impress most forcibly upon the bee-keeper, the maxim of the Mantuan Bard,

"Utraque vis pariter apibus metuenda."

* An able article on the subject of ventilation, may be found in the Nov. number of the Horticulturist, for 1850, from the pen of the lamented Downing. It seems to have been written shortly after his return from Europe, and when he must have been most deeply impressed by the woful contrast, in point of physical health between the women of America and Europe. While he speaks in just and therefore glowing terms of the virtues of our countrywomen, he says: "But in the *signs of physical health* and all that constitutes the outward aspect of the men and women of the United States, our countrymen and especially countrywomen, compare most unfavorably with all but the absolutely starving classes on the other side of the Atlantic." Close stoves he has most appropriately styled "little demons," and impure air "the favorite poison of America." His article concludes as follows:

"Pale countrymen and countrywomen, rouse yourselves! Consider that God has given us an atmosphere of pure health-giving air forty-five miles high, and *ventilate your houses.*"

" Extremes of heat or cold, alike are hurtful to the bees." In order to make artificial ventilation of any use to the great majority of bee-keepers, it must be simple, and not as in Nutt's hive, and many other labored contrivances, so complicated as to require almost as constant supervision as a hot-bed or a green-house.

In the Chapter on the Requisites of a good hive, I have spoken of the importance of furnishing ventilation, independently of the entrance. By such an arrangement, I am able to improve upon the method which the bees are compelled to adopt in a state of nature. As they have no means of admitting air, and at the same time, of effectually excluding all intruders, they are obliged in very hot weather, and in a very crowded state of their dwellings, to employ a larger force in the laborious business of ventilation, than would otherwise be necessary. By the use of my blocks, I can keep the entrance so small, that only a single bee can go in at once, or I can, if circumstances require, entirely close it, and yet the bees need not suffer for the want of air. In all ordinary cases, the ventilators will admit a sufficient supply, and the bees can, at any time, easily increase their efficiency by their own direct agency, while yet they will, at no time, admit so strong a current of chilly air, as to endanger the life of the brood.

As respects ventilation from above, as well as from below, so as to allow a free current of air to pass through the hive, I am decidedly opposed to it, in cool and windy weather, when such a current often compels the bees to retire from the brood, which are thus destroyed by a fatal chill. In thin hives, ventilation from above may be desirable in Winter, to carry off the superfluous moisture, but in properly constructed hives, there is, as has already been remarked, little or no dampness to be carried off. The construction of my hives

will allow, if at all desirable, of ventilation from above; and I always make use of it, when the bees are to be shut up for any length of time, in order to be moved; as in this case, there is risk that ventilation from below may be clogged by dead bees, and the colony suffocated. As the entrance of the hive, may in a moment, be enlarged to any desirable extent, without in the least perplexing the bees, any quantity of air may be admitted, which the necessities of the bees, under any possible circumstances, may require. It may be made full eighteen inches in length, but as a general rule, in Summer, in a large colony, it need not exceed six inches; while during the rest of the year, two or three inches will suffice.

CHAPTER X.

Natural Swarming, and Hiving of Swarms.

THE swarming of bees has been justly regarded as one of the most beautiful sights in the whole compass of rural economy. Although, for reasons which will hereafter be assigned, I prefer to rely chiefly on artificial means for the multiplication of colonies, I should be very unwilling to pass a season without participating, to some extent, in the pleasing excitement of natural swarming.

"Up mounts the chief, and to the cheated eye
Ten thousand shuttles dart along the sky;
As swift through æther rise the rushing swarms,
Gay dancing to the beam their sun-bright forms;
And each thin form, still ling'ring on the sight,
Trails, as it shoots, a line of silver light.
High pois'd on buoyant wing, the thoughtful queen,
In gaze attentive, views the varied scene,

And soon her far-fetch'd ken discerns below
The light laburnum lift her polish'd brow,
Wave her green leafy ringlets o'er the glade,
And seem to beckon to her friendly shade.
Swift as the falcon's sweep, the monarch bends
Her flight abrupt; the following host descends.
Round the fine twig, like cluster'd grapes, they close
In thickening wreaths, and court a short repose."

EVANS.

The swarming of bees, by making provision for the constant multiplication of colonies, was undoubtedly intended both to guard the insect against the possibility of extinction, and to make its labors in the highest degree useful to man. The laws of reproduction in those insects which do not live in regular colonies, are such as to secure an ample increase of numbers. The same is true in the case of hornets, wasps and humble bees which live in colonies only during the warm weather. In the Fall of the year, all the males perish, while the impregnated females retreat into winter quarters and remain dormant, until the warm weather restores them to activity, and each one becomes the mother of a new family.

The honey bee differs from all these insects, in being compelled, by the laws of its physical organization, to live in communities, during the entire year. The balmy breezes of Spring will quickly thaw out the frozen veins of a torpid wasp; but the bee is incapable of enduring even a moderate degree of cold: a temperature as low as 50° speedily chills it, and it would be quite as easy to recall to life the stiffened corpses in the charnel houses of the Convent of the Great St. Bernard, as to restore to animation, a frozen bee. In cool weather, they must therefore associate in large numbers, in order to maintain the heat necessary to their preservation; and the formation of new colonies, after the manner of wasps and hornets, is clearly impossible. If the young

Queens left the parent stock in Summer, and were able, like the mother-wasps, to lay the foundations of a new colony, they could not maintain the warmth requisite for the development of their young, even if they were able, without any baskets on their thighs, to gather bee-bread for their support. If all these difficulties were surmounted, they would still be unable to amass any treasures for our use, or even to lay up the stores requisite for their own preservation.

How admirably are all these difficulties obviated by the present arrangement! Their domicile is well supplied with all the materials for the rearing of brood, and long before any of the insects which depend upon the heat of the sun, are able to commence breeding, the bees have added thousands in the full vigor of youth to their already numerous population. They are thus able to send off in season, colonies sufficiently powerful to take advantage of the honey-harvest, and provision the new hive against the approach of Winter. From these considerations, it is very evident that swarming, so far from being, as some Apiarians have considered it, a forced or unnatural event, is one, which in a state of nature, could not possibly be dispensed with.

Let us now inquire under what circumstances it ordinarily takes place.

The time when swarms may be expected, depends of course, upon climate, season, and the strength of the stocks. In the Northern and Middle States, they seldom swarm before the latter part of May; and June may be considered as the great swarming month. The importance of having powerful swarms early in the season, will be discussed in another place.

In the Spring, as soon as a hive well filled* with comb

* As a general rule, bees, in our Northern and Middle States, seldom swarm unless the hive is filled with comb; in Southern lati-

and bees, becomes too much crowded to accommodate its teeming population, the bees begin the necessary preparations for emigration. A number of royal cells are commenced about the time that the drones make their appearance; and by the time the young Queens arrive at maturity, drones are usually found in great abundance. The first swarm is invariably led off by the old Queen, unless she has previously died from accident or disease, in which case, it is accompanied by one of the young Queens reared to supply her loss. The old mother leaves soon after the royal cells are sealed over, unless delayed by unfavorable weather. There are no signs from which the Apiarian can, with certainty, predict the issue of a first swarm. I devoted annually, much attention to this point, vainly hoping to discover some infallible indications of first swarming; until taught by further reflection that, from the very nature of the case, there can be no such indications. The bees, from an unfavorable state of the weather, or the failure of the blossoms to yield an abundant supply of honey, often change their minds, and refuse to swarm, even after all their preparations have been completed. Nay more, they sometimes send out no new colonies that season, when a sudden change of weather has interrupted them on the very day when they were intending to emigrate, and after they had taken a full supply of honey for their journey.

If on a fair, warm day in the swarming season, but few bees leave a strong hive, while other colonies are busily at work, we may, unless the weather suddenly prove unfavorable, look with great confidence for a swarm. As the old Queens, which accompany the first swarm, are heavy with

tudes, however, the swarming instinct seems to be much more powerful. In Matamoras and Brownsville, on the Rio Grande, I saw many colonies issue from hives only partially filled with comb.

eggs, and fly with considerable difficulty, they are shy of venturing out, except on fair, still days. If the weather is very sultry, a swarm will sometimes issue as early as seven o'clock in the morning; but from 10 to 2, is the usual time, and the majority of swarms come off from 11 to 1. Occasionally, a swarm will venture out as late as 5 P. M. An old Queen is seldom guilty of such a piece of indiscretion.

I have in repeated instances witnessed the whole process of swarming, in my observing hives. On the day fixed for their departure, the Queen appears to be very restless, and instead of depositing her eggs in the cells, she travels over the combs, and communicates her agitation to the whole colony. The emigrating bees fill themselves with honey, some time before their departure: in one instance, I noticed them laying 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, with their heads turned always to the hive, occasionally flying in and out, as though impatient for the important event to take place. At length, a very violent agitation commences in the hive: the bees appear almost frantic, whirling around in a circle, which continually enlarges, like the circles 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 rush impetuously to the entrance, and pour forth in one steady stream. Not a bee looks behind, but each one pushes straight ahead, as though flying "for dear life," or urged on by some invisible power, in its headlong career. The Queen often does not come out, until a large number have left, and is frequently so heavy, from the large number of eggs in her ovaries, that she falls to the ground, incapable of rising with the colony into the air.

The bees are very soon aware of her absence, and a most

interesting scene may now be witnessed. A diligent search is immediately made for their missing mother; the swarm scatters in all directions, and I have frequently seen the leaves of the adjoining trees and bushes, almost as thickly covered with the anxious explorers, as they are with drops of rain after a copious shower. If she cannot be found, they return to the old hive, though occasionally they attempt to enter some other hive, or join themselves to another swarm if any is still unhived.

The ringing of bells, and beating of kettles and frying-pans, is one of the good old ways more honored by the breach than the observance; it may answer a very good purpose in amusing the children, but I believe that as far as the bees are concerned, it is all time thrown away; and that it is not a whit more efficatious than the custom practiced by some savage tribes, who, when the sun is eclipsed, imagining that it has been swallowed by an enormous dragon, resort to the most frightful noises, to compel his snakeship to disgorge their favorite luminary. If a swarm has selected a new home previous to their departure, no amount of *noise* will ever compel them to alight, but as soon as all the bees which compose the emigrating colony have left the hive, they fly in a direct course, or "bee-line," to the chosen spot. I have noticed that when bees are much neglected by those who pretend to take care of them, such unceremonious leave-taking is quite common; on the contrary, when proper attention is bestowed upon them, it seldom occurs.

It can seldom if ever occur to those who manage their bees according to my system; as I shall show in the Chapter on Artificial Swarming. If the Apiarian perceives that his swarm instead of clustering begins to rise higher and higher in the air, and evidently means to depart, not a moment is to be lost: instead of empty noises, he must resort

to means much more effective to stay their vagrant propensities. Handfulls of dirt cast into the air, or water thrown among them, will often so disorganize them as to compel them to alight. Of all devices for stopping them, the most original one that I have ever heard of, is to flash the sun's rays among them, by the use of a looking glass! I have never had occasion to try it, but the anonymous writer who recommends it, says that he never knew it to fail. If they are forcibly prevented from eloping, then special care must be taken or they will be almost sure, soon after hiving, to leave for their selected home. The Queen should be caught and confined for several days in a way which will be subsequently described. The same caution must be exercised, when new swarms abandon their hive. If the Queen cannot be caught, and there is reason to dread desertion, the bees may be carried into the cellar, and confined in total darkness, until towards sun-set of the third day after they swarmed, being supplied in the mean time with water and honey to build their combs.

By the use of my hives it is always very easy to prevent a colony from abandoning its new home; as the entrance may be so regulated by the beveled edge of the blocks which control it, that while a loaded worker can just pass, the Queen will be unable to leave. If a piece of comb containing *unsealed* worker brood is put into the new hive, a swarm will scarcely ever forsake it.

It may generally be ascertained soon after hiving a swarm, whether it intends to remain or not. If, on applying the ear against the side of the hive, a sound as of gnawing or rubbing, be heard, the bees are preparing to commence comb building, and will usually remain.

If a colony decides to go, they look upon the hive in which they are put, as only a temporary stopping place, and

seldom trouble themselves to build any comb in it. If the hive is so constructed as to permit inspection, I can tell by a glance whether bees are disgusted with their new residence, and mean before long to forsake it. They not only refuse to work with that energy so characteristic of a new swarm, but they have a peculiar look which to the experienced eye at once proclaims the fact that they are most unwilling tenants. Their very attitude, hanging as they do with a sort of dogged or supercilious air, as though they hated even so much as to touch their detested abode, is equivalent to an open proclamation that they mean to be off. My numerous experiments in attempting from the moment of hiving, to make the bees work in observing hives exposed to the full light of day, instead of keeping them as I now do, in darkness for several days, have made me quite familiar with all their graceless, do-nothing proceedings before their departure.

Bees sometimes abandon their hives very early in the Spring, or late in the Summer or Fall. They exhibit all the appearance of natural swarming; but they leave, not because the population is crowded, but because it is either so small, or the hive so destitute of supplies, that they are discouraged, or driven to desperation. I once knew a colony to leave the hive under such circumstances, on a spring-like day in December! They seem to have a presentiment that they must perish if they stay, and instead of awaiting the sure approach of famine, they sally out to see if something cannot be done to better their condition.

At first sight, it seems strange that so provident an insect should not always select a suitable domicile before venturing on so important a step as to abandon the old home. Often before they are safely housed again, they are exposed to powerful winds and drenching rains, which beat down and destroy many of their number.

I solve this problem in the economy of the bee, in the same manner that I have solved so many others, by considering in what way, this arrangement conduces to the advantage of man.

The honey-bee would have been of comparatively little service to him, if instead of tarrying until he had sufficient time to establish them in a hive in which to labor for him, their instinct impelled them to decamp, without any delay, from the restraints of domestication. In this, as in many other things, we see that what on a superficial view, appeared to be a very obvious imperfection, proves, on closer examination, to be a special contrivance to answer important ends.

To return to our new swarm. The Queen sometimes alights first, and sometimes joins the cluster after it has commenced forming. It is not usual for the bees to cluster, unless the Queen is with them; and when they do, and yet afterwards disperse, it is frequently the case that the Queen, after first rising with them, has been lost by falling into some spot where she is unnoticed by the bees. In two instances, I performed the following interesting experiment.

Perceiving a hive in the very act of swarming, I contracted the entrance so as to secure the Queen when she made her appearance. In each case, at least one-third of the bees came out, before the Queen presented herself to join them. When I perceived that the swarm had given up their search for her, and were beginning to return to the parent hive, I placed her, with her wings clipped, on the limb of a small evergreen tree: she crawled to the very top of the limb, as if for the express purpose of making herself as conspicuous as possible. A few bees noticed her, and instead of alighting, darted rapidly away; in a few seconds, the whole colony were apprised of her presence, flew in a dense cloud

to the spot, and commenced quietly clustering around her. I have often noticed the surprising rapidity with which swarms communicate with each other, while on the wing. Telegraphic signals are hardly more instantaneous.

That bees send out scouts to seek a suitable abode, can admit of no serious question. Swarms have been traced to their new home, either in their flight directly from their hive, or from the place where they have clustered; and it is evident, that in such instances, they have pursued the most direct course. Now this precision of flight to such a "*terra incognita*," as an unknown home, would plainly be impossible, if some of their number had not previously selected the spot, so as to be competent to act as guides to the rest. The sight of bees for distant objects, is wonderfully acute, and after rising to a sufficient elevation, they can see the prominent objects in the vicinity of their intended abode, even although they may be several miles distant. Whether the bees send out their scouts *before* or *after* swarming, may admit of more question. In cases where the colony flies without alighting, to its new home, they are unquestionably dispatched before swarming. If this were their usual course, then we should naturally expect all the colonies to take the same speedy departure. Or if, for the convenience of the Queen or any other members of the colony, over fatigued by the excitement of swarming, or for any other reason, they should see fit to cluster, then we should expect that only a transient tarrying would be allowed. Instead of this, they often remain until the next day, and instances of a more protracted delay are not unfrequent. The cases which occur, of bees stopping in their flight, and clustering again on any convenient object, are not inconsistent with this view of the subject; for if the weather is hot, and the sun shines directly upon them, they will often leave before they have found a

suitable habitation; and even when they are on the way to their new home, the Queen being heavy with eggs, and unaccustomed to fly, is sometimes from weariness, compelled to alight, and her colony clusters around her. Queens, under such circumstances, sometimes seem unwilling to entrust themselves again to their wings, and the poor bees attempt to lay the foundations of their colony, on fence-rails, hay-stacks, or other most unsuitable places.

I have been informed by Mr. Henry M. Zollickoffer of Philadelphia, a very intelligent and reliable observer, that he knew a swarm to settle on a willow tree in that city, in a lot owned by the Pennsylvania Hospital; it remained there for some time, and the boys pelted it with stones, to get possession of its comb and honey.

Mr. Wagner says, that he once knew a swarm of bees to lodge under the lowermost limb of an isolated oak tree, in a corn field. It was not discovered until the corn was harvested, in September. Those who found it, mistook it for a recent swarm, and in brushing it down to hive it, broke away three pieces of comb, each about eight inches square!

The absolute necessity for scouts or explorers, is evident from all the facts in the case, unless we admit that bees have the faculty of flying in an air-line to a hollow tree, or some suitable abode which they have never seen, though they cannot find their hive, if, in their absence, it is moved only a few rods from its former position.

These obvious considerations are abundantly confirmed, by the repeated instances in which a few bees have been noticed, prying very inquisitively into a hole in a hollow tree or the cornice of a building, and have been followed before long, by a whole colony. The importance of these remarks will be more obvious, when I come to discuss the proper mode of hiving bees.

Having described the common method of procedure pursued by the new swarm, when left to their natural instincts, it is time to return to the parent stock from which they emigrated.

In witnessing the immense number which have abandoned it, we might naturally suppose that it must be almost entirely depopulated. It is sometimes asserted that as bees swarm in the pleasantest part of the day, the population is replenished by the return of large numbers of workers that were absent in the fields; this, however, can seldom be the case, as it is rare for many bees to be absent from the hive at the time of swarming.

To those who limit the fertility of the Queen to two hundred, or at most to four hundred eggs per day, the rapid replenishing of the hive after swarming, must ever be a problem incapable of solution; but to those who have ocular demonstration that she can lay from one to three thousand eggs a day, it is no mystery at all. A sufficient number of bees to carry on the domestic operations of the hive, is always left behind; and as the old Queen departs only when the population of the hive is super-abundant, and when thousands of young bees are hatching daily, and often thirty thousand or more, are rapidly maturing, in a short time the hive is almost as populous as it was before swarming. Those who assert that the new colony is composed of young bees which have been forced to emigrate by the older ones, have certainly failed to use their eyes to much advantage, or they would have seen, in hiving a new swarm, that it is composed of both young and old; some, having wings ragged from hard work, while others are evidently quite young. After the tumult of swarming is entirely over, not a bee that did not participate in it, seeks afterwards to join the new colony, and not one that did, seeks to return. What determines some to go, and others to stay, we have no certain means of knowing.

How wonderfully abiding the impression made upon an insect, which in a moment causes it to lose all its strong affection for the old home in which it was bred, and which it has entered, perhaps hundreds of times; so that when established in another hive, though only a few feet distant, it seldom pays the slightest attention to its former abode! Often, when the hive into which the new swarm is put, is not removed from the place where the bees were hived, until some have gone to the fields, on their return, they fly for hours, in ceaseless circles about the spot where the missing hive stood. I have known them to continue the vain search for their companions until they have, at length, dropped down from utter exhaustion, and perished in close proximity to their old homes!

It has been already stated that the old Queen, if the weather is favorable, generally leaves about the time that the young Queens are sealed over, to be changed into nymphs. In about a week, one of these Queens hatches, and the question must now be decided whether any more colonies are to be sent out that season, or not. If the hive is well filled with bees, and the season in all respects promising, this question is generally decided in the affirmative; although colonies often refuse to swarm more than once, when they are very strong, and when we can assign no reason for such a course; and they sometimes swarm repeatedly, to the utter ruin of both the old stock, and the after-swarms.

If the bees decide not to swarm again, the first hatched Queen is allowed to have her own way. She rushes immediately to the cells of her sisters, and stings them to death. From some observations that I have made, I am inclined to think that the other bees aid her in this murderous transaction; they certainly tear open the cradles of the slaugh-

tered innocents, and remove them from the cells. Their dead bodies may often be found on the ground in front of the hive.

When a Queen has emerged in the natural way from her cell, the bees usually nibble away the now useless abode, until only a small acorn cup remains; but when by violence she has met with an untimely end, they take down entirely the whole of the cell. By counting these acorn-cups, it can be ascertained how many young Queens have hatched in a hive.

Before the Queens emerge from their cells, a fluttering sound is frequently heard, which is caused by the rapid motion of their wings, and which must not be confounded with the piping notes which will soon be described. If the bees of the parent stock decide to swarm again, the first hatched Queen is prevented from killing the others. A strong guard is kept over their cells, and as often as she approaches them with murderous intent, she is bitten, or otherwise rudely treated, and given to understand by the most uncourtier-like demonstrations, that she cannot, in all things, do just as she pleases.

When thus repulsed, like men and women who cannot have their own way, she is highly offended and utters an angry sound, given forth in a quick succession of notes, and which sounds not unlike the rapid utterance of the words, "peep, peep." I have frequently, by holding a Queen in the closed hand, caused her to make a similar noise. To this angry note, one or more of the Queens still unhatched, will respond, in a somewhat hoarser key, just as chicken-cocks, by crowing, bid defiance to each other. These sounds are entirely unlike the usual steady hum of the bees, and when heard, are the almost infallible indications that a second swarm will soon issue. They are occasionally so

loud that they may be heard at some distance from the hive. About a week after first swarming, the Apiarian should, early in the morning or at evening, when the bees are still, place his ear against the hive, and he will, if the Queens are piping, readily recognize their peculiar sounds. If their notes are not heard, at the very latest, sixteen days after the departure of the first swarm, by which time the young Queens are mature, even if the first colony left as soon as the construction of royal cells was commenced, it is an infallible indication that the first hatched Queen is without rivals in the hive, and that swarming, in that stock, is over for the season.

The second swarm usually issues on the second or third day after this sound is heard: although I have known them to delay coming out, until the fifth day, in consequence of a very unfavorable state of the weather. Occasionally, the weather is so unfavorable, that the bees permit the oldest Queen to kill the others, and refuse to swarm again. This is a rare occurrence, as the young Queens, unlike the old ones, do not appear to be very particular about the weather, and sometimes venture out, not merely when it is cloudy, but even when rain is falling. On this account, if a very close watch is not kept, they are often lost. As piping ordinarily commences about a week after first swarming, the second swarm generally issues nine days after the first. It has been known to issue as early as the third day after the first, and as late as the seventeenth. Such cases, however, are of rare occurrence.

It frequently happens in the agitation of swarming, that several of the young Queens emerge from their cells at the same time, and accompany the colony: when this is the case, the bees often alight in two or more separate clusters.

The following remarkable instance came under my observation, in 1854. A second swarm deserted its abode the *second* day after being hived, and lit upon a tree. Before securing them, I first examined the abandoned hive, and found *five* young Queens lying dead on the bottom-board. The bees were then returned to the hive, and the next morning, two more dead Queens were found, making seven in all. As the colony afterwards prospered, *eight* Queens, at least, must have left the parent stock, in the same season!

Young Queens not having their ovaries burdened with eggs, are much more quick on the wing, than old ones, and fly frequently much farther from the parent stock, before they alight; though I never knew a second swarm to depart to the woods without clustering at all. After the departure of a second swarm, the oldest of the remaining Queens leaves her cell; and if another swarm is to be sent forth, piping will still be heard, and so before the issue of each swarm after the first. Piping will sometimes be heard for a short time after the issue of the second swarm, even in cases where the bees do not intend to swarm again. I once had five stocks issue from one swarm, and they all came out in about two weeks. In warm latitudes more than twice this number of swarms have been known to issue in one season from a single stock. The third swarm commonly makes its appearance on the second or third day after the second swarm, and the others, at intervals of about a day.

In after swarming it sometimes occurs that the Queen, after having appeared on the alighting-board, re-enters the hive, either from alarm or some other cause. If she does so once, she will be apt to repeat it again and again, and the swarm in each instance, will return to the mother hive, greatly to the annoyance of the Apiarian.

After-swarms, or casts, (these names are given to all

swarms after the first,) reduce very seriously the strength of the parent stock; for after the departure of the old Queen, no more eggs are deposited in the cells, until all swarming is over. It is a very wise arrangement that the second swarm does not ordinarily issue until all the eggs left by the first Queen are hatched, and the young fed and mostly sealed over, so as to require no further care. The departure of the second swarm earlier than this, would leave too few laborers to attend to the wants of the young bees. As it is, if the weather after swarming, suddenly becomes chilly, and the hives are thin and admit too much air, the bees are too much reduced in numbers, to maintain the heat requisite for the proper development of the brood, and numbers are destroyed.

In the Chapter on Artificial Swarming, I shall discuss the effect of too frequent swarming, on the profits of the Apiary. If the bee-keeper desires to have no casts, he can, by the use of my hives, very easily, prevent their issue. A few days after the first swarm is hived, the parent stock may be opened, and all the Queen cells except one removed. How much better this is, than to attempt to return the after-swarms to the parent hive, can only be appreciated by one who has thoroughly tried both plans. If the Apiarian desires the most rapid multiplication of colonies possible, where natural swarming is relied on, full directions will be furnished in the sequel, for building up all after-swarms, however small, into vigorous stocks.

It will be remembered that both the parent stock from which the swarm issues, and all the colonies except the first, have a young Queen. These Queens never leave the hive for impregnation, until after they have been established as the acknowledged heads of independent families. They generally go out for this purpose, the first pleasant day, after

they are thus acknowledged, early in the afternoon, at which hour the drones are flying in the greatest numbers. On first leaving their hive, they always fly with their heads turned towards it, and enter and depart often several times before they finally soar up into the air. Such precautions on the part of a young Queen, are highly necessary that she may not mistake her own hive on her return, and lose her life by attempting to enter that of another colony. Mistakes of this kind are frequently made when the hives stand near, and closely resemble each other, and are fatal, not only to the Queen, but to her whole colony. In the new hive there is no brood at all, and in the old one it is too far advanced towards maturity to answer for raising new Queens. How such calamities are to be prevented, or remedied, I shall show in the Chapter on the Loss of the Queen.

When a young Queen leaves the hive for the purpose above mentioned, the bees, on missing her, are often filled with alarm, and rush from the hive, just as though they were intending to swarm. Their agitation soon calms down, if she returns to them in safety. I shall give, through the medium of the Latin tongue, some statements which are important only to the scientific naturalist, and entomologist.

Post coitum fucus statim perit. Penis ejectio, ut ego comperi, lenem compressionem fuci ventris, consequitur; et fucus extemplo similis fulmine tacto, moritur. Dominus Huber sæpe videbat fuci organum post congressum, in corpore feminæ hæsisse. Vidi semel tam firme inhærens, ut nisi disruptione reginæ ventris, non possim divellere.

The Queen commences laying eggs, about two days after impregnation, and for the first season, lays almost entirely the eggs of workers; no males being needed in colonies which will throw no swarm till another season. It is seldom until after she has commenced replenishing the cells with eggs

that she is treated with any special attention by the bees; although if deprived of her before this time, they show, by their despair, that they thoroughly comprehended her vast importance to their welfare.

A first swarm will sometimes swarm again, about a month after it is hived; but this, in Northern climates, is a rare occurrence. In Texas, I have known even second swarms to do the same; and many colonies swarm there in September and October. In the Northern and Middle States, swarming is usually all over, in three or four weeks after it commences. Inexperienced bee-keepers, ignorant of this fact, often watch their Apiaries, long after the swarming season has passed.

I shall now give such practical directions for the easy hiving of swarms, as will, I trust, greatly facilitate the whole operation, not merely to the novice, but even to many experienced bee-keepers; and I shall try to make these directions sufficiently minute, to guide those who having never seen a swarm hived, are very apt to imagine that the process must be a formidable one, instead of being, as it usually is to those who are fond of bees, a most delightful entertainment. Experience in this, as in other things, will speedily give the requisite skill and confidence; and the cry of "the bees are swarming," will soon be hailed with greater pleasure than an invitation to the most sumptuous banquet.

The hives for the new swarms should be in readiness before the swarming season begins, and painted long enough beforehand, to have the paint most thoroughly dried. The smell of fresh paint is well known to be exceedingly injurious to human beings, and is such an abomination to the bees, that they will often desert a new hive sooner than put up with it. If the hives cannot be painted in ample season, then such paints should be preferred as contain no white

lead, and they should be mixed so as to dry as quickly as possible. Thin hives ought never to stand in the sun, and then, when heated to an insufferable degree, be used for a new swarm. Bees often refuse to enter such hives at all, and at best, are very slow in taking possession of them. It should be borne in mind, that bees, when they swarm, are greatly excited, and unnaturally heated. The temperature of the hive, at the moment of swarming, rises very suddenly, and many of the bees are often drenched with such a profuse perspiration that they are unable to take wing and join the departing colony. The attempt to make bees enter a heated hive, in a blazing sun, is as irrational as it would be to try to force a panting crowd of human beings into the suffocating atmosphere of a close garret. If bees are put in hives through which the heat of the sun can penetrate, the process should be accomplished in the shade, or the hive covered with a sheet, or shaded with leafy boughs.

If a hive with movable frames is used, the Apiarian can use all his good worker-comb, by attaching it firmly to the frames, with melted wax or resin. Such, however, is the shape of these frames, that the bees will, without any guide combs, build their combs with great regularity. This result has only been obtained by me after years of careful and laborious experiment.

Drone combs should never be attached to the frames as a guide, unless it is desired to have the bees follow the pattern, and build large ranges of drone comb, to breed a vast horde of useless consumers. Such comb, if white, may be used to great advantage in the surplus honey-boxes; if old and discolored, it should be melted for wax. Every piece of good worker-comb, if large enough to be attached to a frame, should be used both for its intrinsic value, and because bees are so wonderfully pleased when they find such

unexpected treasures in a hive, that they will seldom desert it. A new swarm has been known to take possession of an old hive without any occupants, but well stored with comb. Though dozens of empty hives may be in the Apiary, they very seldom, unless under such circumstances, enter a hive, of their own accord. It might seem as though an instinct impelling them to do so, would have been a most admirable one, and so doubtless, it may seem to some that it would have been much better, if the earth had brought forth spontaneously all things requisite for the support of man and beast, without any necessity for the sweat of the brow.

The first and last frames in my hive, are placed three-eighths of an inch from the ends, and the others just five-eighths of an inch apart. When the tops of my frames are an inch wide, they are placed only half an inch apart. When first put in, the rabbets on which they rest should be smeared with flour paste, to keep them in their places, until they are fastened with propolis, by the bees. The rubbing of hives with various kinds of herbs or washes, has always seemed to me, useless, and often positively injurious. There ought always to be some small trees near the hives, on which the swarms can cluster, and from which they can be easily gathered. If there are none, limbs of trees about six feet high, (evergreens are best,) may be fastened into the ground, a few rods in front of the hives, and will answer a very good temporary purpose. It will inspire the inexperienced Apiarian with much greater confidence, to remember that almost all the bees in a swarm, have filled themselves with honey, before leaving the parent stock, and are therefore in a very peaceable mood. If he is at all timid, or liable, as some are, to suffer severely from the sting of a single bee, he should, by all means, furnish himself with the protection of a bee-dress. (See Bee-Dress.)

When the bees have quietly clustered around their Queen, preparations should be made to hive them without any unnecessary delay. The headlong haste of some Apiarians, which, by throwing them into a profuse perspiration, renders them very liable to be stung, is altogether unnecessary. The very fact that the bees have clustered, after leaving the parent stock, is almost equivalent to a certainty that they will not leave, for at least one or two hours. All convenient despatch should be used, however, lest other colonies issue before the first one is hived, and attempt to add themselves, as they frequently do, to the first swarm. The proper course to be pursued, in such a case, will be subsequently explained. If my hives are used, the entrance on the whole front must be opened, so that the bees may have every chance to enter as rapidly as possible; and a sheet must be securely fastened to the alighting-board, to keep the bees from being separated from each other or soiled by dirt, for a bee thoroughly covered with dust or dirt, is almost sure to perish. If the common hives are used, they must be propped up on the sheet, so as to give the bees a free admission. When the bees alight where they can be easily reached from the ground, the limb on which they have clustered, should, with one hand, be shaken, so that they may gently fall into a basket held under them, by the other. If the basket is sufficiently open to admit the air freely, and not so open as to allow the bees to get through the sides, it will answer all the better. The bees should now be gently shaken, or poured out, on the sheet, in front of their new home. If they seem at all reluctant to enter, take up a few of them in a large spoon, and shake them close to the entrance. As they go in, they will fan with their wings, and raise a peculiar note, which communicates to their companions, the joyful news that they have found a home; and in a short

time, the whole swarm will enter, without injury to a single bee. When bees are once shaken down on the sheet, the great mass of them are very unwilling to take wing again; for they are loaded with honey, and like heavily armed troops, they desire to march slowly and sedately to the place of encampment. If the sheet hangs in folds, or is not stretched out, so as to present an uninterrupted surface, they are often greatly confused, and take a long time to find the entrance to the hive. If it is desired to have them enter sooner than they are sometimes inclined to do, they may be gently separated, with a feather, or leafy twig, when they gather in bunches on the sheet; or better still, they may be gently "spooned up" and emptied out before the entrance of the hive. If they cluster in the portico of my hive, they should be treated in the same way.

On first shaking them down into the basket, some will again take wing, and others will be left on the tree, but if the Queen has been secured, they will speedily form a line of communication with those on the sheet, and enter the hive with them. It sometimes happens that the Queen is left on the tree: in this case, the bees will either refuse to enter the hive, or if they go in, will speedily come out, and all take wing again, to join their Queen. This happens much more frequently in the case of after-swarms, whose young Queens, instead of exhibiting the gravity of the old matron, are apt to be constantly flying about and frisking in the air. When the bees forsake the hive and cluster again on the tree, the process of hiving must be repeated.

If the Apiarian has a pair of sharp pruning-shears, and the limb on which the bees have clustered, is of no value, and so small, that it can be cut without jarring them off, this may be done, and the bees carried on it and then shaken off on the sheet.

If the bees settle too high to be easily reached, the basket should be fastened to a pole, and raised directly under the swarm; a quick motion of the basket will cause the mass of the bees to fall into it, when it may be carried to the hive, and the bees poured out from it on the sheet.

If the bees light on the trunk of a tree, or any thing from which they cannot easily be gathered in a basket, place a leafy bough over them, (it may be fastened with a gimlet,) and if they do not mount it of their own accord, a little smoke will compel them to do so. If the place is inaccessible, and this is about the worst case that occurs, they will enter a basket well shaded by cotton cloth fastened around it, and elevated so as to rest with its open top sideways to the mass of the bees. When small trees, or limbs fastened into the ground, are placed near the hives, and there are no large trees near, there will seldom be found any difficulty in hiving swarms.

If two swarms light together, I advise that they should be put into one hive, and abundant room at once given them, for storing surplus honey. This can always be readily done in my hives. Large quantities of honey are generally obtained from such stocks, if the season is favorable, and they have issued early. If it is desired to separate them, place in each of the hives which is to receive them, a comb containing brood and eggs, from which, in case of necessity, a new Queen may be raised. Shake a portion of the bees in front of each hive, sprinkling them thoroughly, both before and after they are shaken out from the basket, so that they will not take wing to unite again. If possible, secure the Queens, so that one may be given to each hive. If this cannot be done, the hives should be examined the next day, and if the two Queens entered the same hive, one will have killed the other, and the queenless hive will be found building

royal cells. It should be supplied with a sealed Queen nearly mature, taken from another hive, not only to save time, but to prevent them from filling their hive with comb unfit for the rearing of workers. (See Artificial Swarming.) Of course, this cannot be done with the common hives, and if the Apiarian does not succeed in getting a Queen for each hive, the queenless one will refuse to stay, and go back to the old stock.

The old-fashioned way of hiving bees, by mounting trees, cutting and lowering down large limbs, (often to the injury of valuable trees,) and placing the hive over the bees, frequently crushing large numbers, and endangering the life of the Queen, should be entirely abandoned. A swarm may be hived in the proper way with far less risk and trouble, and in much less time. In large Apiaries managed on the swarming plan, where a number of swarms come out on the same day, and there is constant danger of their mixing,* the speedy hiving of swarms is an object of great importance. If the new hive does not stand where it is to remain

*Dr. Scudamore, an English physician who has written a small tract on the formation of artificial swarms, says that he once knew "as many as ten swarms go forth at once, and settle and mingle together, forming literally a monster meeting!" Instances are on record of a much larger number of swarms clustering together. A venerable clergyman, in Western Massachusetts, related to me the following remarkable occurrence. In the Apiary of one of his parishioners, five swarms lit in one mass. As there was no hive which would hold them, a very large box was roughly nailed together, and the bees were hived in it. They were taken up by sulphur in the Fall, when it was perfectly evident that the five swarms had occupied the same box as independent colonies. Four of them had commenced their works, each one near a corner, and the fifth one in the middle, and there was a distinct interval separating the works of the different colonies. In Cotton's "My Bee Book," there is a cut illustrating a hive in which two colonies had built in the same manner.

for the season, it should be removed to its permanent stand as soon as the bees have entered; for if allowed to remain to be removed in the evening, or early next morning, the scouts which have left the cluster, in search of a hollow tree, will find the bees when they return, and will often entice them from the hive. There is the greater danger of this, if the bees remain on the tree, a considerable time before they are hived. I have invariably found that swarms which abandon a suitable hive for the woods, have been hived near the spot where they clustered, and allowed to remain to be moved in the evening. If the bees swarm early in the day, they will generally begin to work in a few hours (or in less time, if they have empty comb,) and many more may be lost by returning next day to the place where they were hived, than would be lost, by removing them as soon as they have entered; in this latter case, the few that are on the wing, will generally be able to find the hive if it is slowly moved to its permanent stand.

If the Apiarian wishes to secure the Queen, the bees should be shaken from the hiving basket, about a foot from the entrance to the hive, and if a careful look-out is kept, she will generally be seen as she passes over the sheet, to the entrance. Care must be taken to brush the bees back from the entrance when they press forward in such dense masses that the Queen is likely to enter unobserved. An experienced eye readily notices her peculiar form and color. She may be taken up without danger, as she never stings, unless engaged in combat with another Queen. As it will sometimes happen, even to careful bee-keepers, that swarms come off when no suitable hives are in readiness to receive them, I shall show what may be done in such an emergency. Take any old hive, box, cask, or measure, and hive the bees in it, placing them with suitable protection against the sun,

where their new hive is to stand; when this is ready, they may, by a quick jerking motion, be easily shaken out on a sheet, and hived in it, just as though they were shaken from the hiving basket.

Before leaving this subject, I will add to the directions for hiving already given, a method which I have practiced with good success.

When the situation of the bees does not admit of the basket being easily elevated to them, the bee-keeper may carry it with him to the cluster, and then after shaking the bees into it, may lower it down by a string, to an assistant standing below.

I have endeavored, even at the risk of being tedious, to give such specific directions as will qualify the novice to hive a swarm of bees, under almost any circumstances; for I know the necessity of such directions and how seldom they are to be met with, even in large treatises on Bee-Keeping. Vague or imperfect directions always fail, just at the moment that the inexperienced attempt to put them into practice.

That Natural Swarming may, with suitable hives, be made highly profitable, I cannot for a moment question. As it is the most simple and obvious way of multiplying colonies, and the one which requires the least knowledge or skill, it will undoubtedly, for many years at least, be the favorite method with a large number of bee-keepers. I have therefore, been careful to furnish suitable directions for its successful practice; and before I discuss the question of Artificial Increase, I shall show how it may be more profitably conducted than ever before; many of the most embarrassing difficulties in the way of its successful management being readily obviated by the use of my hives.

1. The common hives fail to furnish adequate protection

in Winter, against cold, and those sudden changes to unseasonable warmth, by which bees are tempted to come out and perish in large numbers on the snow; and the colonies are thus prevented from breeding on a large scale, as early as they otherwise would. Under such circumstances, they can make no profitable use of the early honey-harvest; and they will swarm so late, if they swarm at all, as to have but little opportunity for laying up surplus honey, while often they do not gather enough even for their own use, and their owner closes the season by purchasing honey to preserve them from starvation. The way in which I give the bees that amount of protection in Winter, which conduces most powerfully to early swarming, has already been described in the Chapter on Protection.

2. Another serious objection to all the ordinary swarming hives, is the vexatious fact that if the bees swarm at all, they are liable to swarm so often as to destroy the value of both the parent stock and the after-swarms. Experienced bee-keepers obviate this difficulty, by uniting second swarms, so as to make one good colony out of two; and they return to the parent stock all swarms after the second, and even this if the season is far advanced. Such operations consume much time, and often give much more trouble than they are worth. By removing all the queen cells but one, after the first swarm has left, second swarming in my hives will always be prevented; and by removing all but two, provision may be made for the issue of second swarms, and yet all after-swarming be prevented. The process of returning after-swarms is not only objectionable, on account of the time it requires, having in many instances to be repeated again and again before one Queen is allowed to destroy the others; but it also causes a large portion of the gathering season to be wasted; for the bees seem unwilling to work

with energy, so long as the pretensions of several rival Queens are unsettled.

3. Another very serious objection to Natural Swarming, as practiced with the common hives, is the inability of the Apiarian who wishes rapidly to multiply his colonies, to aid his late and small swarms, so as to build them up into vigorous stocks. The time and money which are ordinarily spent upon small colonies, are almost always thrown away; by far the larger portion of them never survive the Winter, and the majority of those that do, are so enfeebled, as to be of little or no value. If they escape being robbed by stronger stocks, or destroyed by the moth, they seldom recruit in season to swarm, and very often the feeding must be repeated, the second Fall, or they will at last perish. I doubt not that many of my readers will, from their own experience, endorse every word of these remarks, as true to the very letter. All who have ever attempted to multiply colonies by nursing and feeding small swarms, on the ordinary plans, have found it attended with nothing but loss and vexation. The more a man has of such stocks, the poorer he is: for by their weakness, they are constantly tempting his strong swarms to evil courses; so that at last, they prefer to live as far as they can, by stealing, rather than by habits of honest industry; and if the feeble colonies escape being plundered, they often become mere nurseries for raising a plentiful supply of moths, to ravage his whole Apiary.

I have already shown, in what way by the use of my hives, the smallest swarms that ever issue, may be so managed as to become powerful stocks. In the same way the Apiarian can easily strengthen all his colonies which are feeble in Spring.

4. As the loss of the young Queens in the parent stock after it has swarmed, and in the after-swarms, is a very

common occurrence, a hive which like mine, furnishes the means of easily remedying this misfortune, will greatly promote the success of those who practice natural swarming. A very intelligent bee-keeper once assured me, that he must use at least one such hive in his Apiary, for this purpose, even if in other respects it possessed no superior merits.

5. Bees, as is well known, often refuse to swarm at all, and most of the swarming hives are so constructed, that proper accommodations for storing honey, cannot be furnished to the super-abundant population. Under such circumstances, they often hang for several months, in black masses on the outside of the hive; and are worse than useless, as they consume the honey which the others have gathered. In my hives, an abundance of room for storing honey can always be given them, *not all at once*, so as to prevent them from swarming, but by degrees, as their necessities require: so that if they are indisposed, for any reason to swarm, they may have suitable receptacles easily accessible, and furnished with guide comb to make them more attractive, in which to store up any amount of honey they can possibly collect.

6. In the common hives, but little can be done to dislodge the bee-moth, when once it has gained the mastery of the bees; whereas in mine, it can be most effectually rooted out when it has made a lodgment. (See Remarks on Bee-Moth.)

7. In the common hives, nothing can be done except with great difficulty, to remove the old Queen when her fertility is impaired: whereas in my hives, (as will be shown in the Chapter on Artificial Swarming,) this can easily be effected, so that an Apiary may constantly contain a stock of young Queens, in the full vigor of their re-productive powers.

I trust that these remarks will convince intelligent Apia-

rians, that I have not spoken boastfully or at random, in asserting that natural swarming can be carried on with much greater certainty and success, by the use of my hives, than in any other way; and that they will see that many of the most perplexing embarrassments and mortifying discouragements under which they have hitherto prosecuted it, may be effectually remedied.

CHAPTER XI.

Artificial Swarming.

The numerous efforts which have been made for the last fifty years or more, to dispense with natural swarming, plainly indicate the anxiety of Apiarians to find some better mode of increasing their colonies.

Although I am able to propagate bees by natural swarming, with a rapidity and certainty unattainable except by the complete control of all the combs in the hive, still there are difficulties in this mode of increase, inherent to the system itself, and therefore entirely incapable of being removed by any kind of hive. Before describing the various methods which I employ to increase colonies by artificial means, I shall first enumerate these difficulties, in order that each individual bee-keeper may decide for himself, in which way he can most advantageously propagate his bees.

1. The large number of swarms lost every year, is a powerful argument against natural swarming.

An eminent Apiarian has estimated that one-fourth of the best swarms are lost every season! This estimate can

hardly be considered too high, if all who keep bees are taken into account. While some bee-keepers are so careful that they seldom lose a swarm, the majority, either from the grossest negligence, or from necessary hindrances during the swarming season, are constantly incurring serious losses, by the flight of their bees to the woods. It is next to impossible, entirely to prevent such occurrences, if bees are allowed to swarm at all.

2. The great amount of time and labor required by natural swarming, has always been regarded as a decided objection to this mode of increase.

As soon as the swarming season begins, the Apiary must be closely watched almost every day, or some of the new swarms will be lost. If this business is entrusted to thoughtless children, or careless adults, many swarms will be lost by their neglect. It is very evident that but few persons who keep bees, can always be on hand to watch them and to hive the new swarms. But, in the height of the swarming season, if any considerable number of colonies is kept, the Apiarian, to guard against serious losses, should either be always on the spot himself, or have some one who can be entrusted with the care of his bees. Even the Sabbath cannot be observed as a day of rest; and often, instead of being able to go to the House of God, the bee-keeper is compelled to labor among his bees, as hard as on other days, or even harder. That he is as justifiable in hiving his bees on the Sabbath, as in taking care of his stock, can admit of no serious doubt; but the very liability of being called to do so, is with many, a sufficient objection against Apiarian pursuits.

The merchant, mechanic and professional man, are often so situated that they would take great interest in bees, if they were not deterred from their cultivation by inability to take care of them, during the swarming season; and they

are thus debarred from a pursuit, which is intensely fascinating, not merely to the lover of Nature, but to every one possessed of an inquiring mind. No man who spends some of his leisure hours in studying the wonderful habits and instincts of bees, will ever complain that he can find nothing to fill up his time out of the range of his business, or the gratification of his appetites. Bees may be kept with great advantage, even in large cities, and those who are debarred from every other rural pursuit, may still listen to the soothing hum of the industrious bee, and harvest annually its delicious nectar.

If the Apiarian could always be on hand during the swarming season, it would still, in many instances, be exceedingly inconvenient for him to attend to his bees. How often is the farmer interrupted in the business of hay-making, by the cry that his bees are swarming; and by the time he has hived them, perhaps a shower comes up, and his hay is injured more than the swarm is worth. Thus the keeping of a few bees, instead of a source of profit, often becomes rather an expensive luxury; and if a very large stock is kept, the difficulties and embarrassments are often most seriously increased. If the weather becomes pleasant after a succession of days unfavorable for swarming, it often happens that several swarms rise at once, and cluster together, to the great annoyance of the Apiarian; and not unfrequently, in the noise and confusion, other swarms fly off, and are entirely lost. I have seen the Apiarian so perplexed and exhausted under such circumstances, as to be almost ready to wish that he had never seen a bee.

3. The managing of bees by natural swarming, must, in our country, almost entirely prevent the establishment of large Apiaries.

Even if it were possible, in this way, to multiply bees

with certainty and rapidity, and without any of the perplexities which I have just described, how few persons are so situated as to be able to give almost the whole of their time in the busiest part of the year, to the management of their bees. The swarming season is with the farmer, the very busiest part of the whole year, and if he purposes to keep a large number of swarming hives, he must not only devote nearly the whole of his time, for a number of weeks, to their supervision, but at a season when labor commands the highest price, he will often be compelled to hire additional assistance.

I have long been convinced that, as a general rule, the keeping of a few colonies in swarming hives, costs more than they are worth, and that the keeping of a very large number is entirely out of the question, unless with those who are so situated that they can afford to devote their time, for about two months every year, almost entirely to their bees. The number of persons who can afford to do this must be very small; and I have seldom heard of a bee-keeper, in our country, who has an Apiary on a scale extensive enough to make bee-keeping anything more than a subordinate pursuit. Multitudes have tried to make it a large and remunerating business, but hitherto, I believe that they have nearly all been disappointed in their expectations.

4. A serious objection to natural swarming, is the discouraging fact that the bees often refuse to swarm at all, and the Apiarian finds it impossible to multiply his colonies with any certainty or rapidity, even although he may find himself in all respects favorably situated for the cultivation of bees, and may be exceedingly anxious to engage in the business on a much more extensive scale.

I am acquainted with many careful bee-keepers who have managed their bees according to the most reliable informa-

tion they could obtain, never destroying any of their colonies, and endeavoring to multiply them to the best of their ability, who yet have not as many stocks as they had ten years ago. Most of them would abandon the pursuit, if they looked upon bee-keeping simply in the light of dollars and cents, rather than as a source of pleasant recreation; and some do not hesitate to say that much more money has been spent, by the mass of those who have used patent hives, than they have ever realized from their bees.

It is a very simple matter to make calculations on paper, which shall seem to point out a road to wealth, almost as flattering, as a tour to the gold mines of Australia or California. Only purchase a patent bee-hive, and if it fulfills all or even a part of the promises of its sanguine inventor, a fortune must, in the course of a few years, be certainly realized; but such are the disappointments resulting from the bees refusing often to swarm at all, that if the hive could remedy all the other difficulties in the way of bee-keeping, it would still fail to answer the reasonable wishes of the experienced Apiarian. If every swarm of bees could be made to yield a profit of twenty dollars a year, and if the Apiarian could be sure of selling his new swarms at the most extravagant prices, he could not, like the growers of mulberry trees, or the breeders of fancy fowls, multiply his stocks so as to meet the demand, however extensive; but would be entirely dependent upon the whims and caprices of his bees; or rather, upon the natural laws which control their swarming.

Every practical bee-keeper is well aware of the utter uncertainty of natural swarming. Under no circumstances, can its occurrence be confidently relied on. While some stocks swarm regularly and repeatedly, others, strong in numbers and rich in stores although the season may, in all

respects, be propitious, refuse to swarm at all. Such colonies, on examination, will often be found to have taken no steps for raising young Queens. In some cases, the wings of the old mother will be found defective, while in others, she is abundantly able to fly, but seems to prefer the riches of the old hive, to the risks attending the formation of a new colony. It frequently happens, in our uncertain climate, that when all the necessary preparations have been made for swarming, the weather proves unpropitious for so long a time, that the young Queens approaching maturity before the old one can leave, are all destroyed. This is a very frequent occurrence, and under such circumstances, swarming is almost certain to be prevented, for that season. The young Queens are frequently destroyed, even although the weather is pleasant, in consequence of some sudden and perhaps only temporary suspension of the honey harvest; for bees seldom colonize even if all their preparations are completed, unless the flowers are yielding an abundant supply of honey.

From these and other causes which my limits will not permit me to notice, it has hitherto been found impossible, in the uncertain climate of our Northern States, to multiply colonies very rapidly, by natural swarming; and bee-keeping, on this plan, offers very poor inducements to those who are aware how little has been accomplished, even by the most enthusiastic, experienced and energetic Apiarians.

The numerous perplexities which have ever attended natural swarming, have for ages, directed the attention of practical cultivators, to the importance of devising some more reliable method of increasing their colonies. Columella, who lived about the middle of the first century of the Christian Era, and who wrote twelve books on husbandry (De re rustica,) has given directions for making artificial colonies.

He says, "you must examine the hive, and view what honeycombs it has; then afterwards from the wax which contains the seeds of the young bees, you must cut away that part wherein the offspring of the royal brood is animated: for this is easy to be seen; because at the very end of the waxworks there appears, as it were, a thimble-like process (somewhat similar to an acorn,) rising higher, and having a wider cavity, than the rest of the holes, wherein the young bees of vulgar note are contained."

Hyginus, who flourished before Columella had evidently noticed the royal jelly; for he speaks of cells larger than those of the common bees, "filled as it were with a solid substance of a *red color*, out of which the winged king is at first formed." This ancient observer must undoubtedly have seen the quince-like jelly, a portion of which is always found at the base of the royal cells, after the Queens have emerged. The ancients generally called the Queen a king, although Aristotle says that some in his time called her the mother. Swammerdam was the first to prove by dissection that the Queen is a perfect female, and the only one in the hive, and that the drone is the male.

For reasons which I shall shortly mention, the ancient methods of artificial increase appear to have met with but small success. Towards the close of the last century, a new impulse was given to the artificial production of swarms, by the experiments and discoveries of Schirach, a German clergyman, who introduced to the notice of the apiarian world the fact previously known to a few, that bees are able to rear a Queen from worker brood. For want, however, of a more thorough knowledge of some important principles in the economy of the bee, these efforts met with but slender encouragement.

Huber, after his splendid discoveries in the physiology of

the bee, perceived at once, the importance of multiplying colonies by some method more reliable than that of natural swarming. His leaf or book hive consisted of twelve frames, each an inch and a quarter in width; any one of which could be opened at pleasure. He recommends forming artificial swarms, by dividing one of these hives into two parts; adding to each part six empty frames. After using a Huber hive for a number of years, I became perfectly convinced that it could only be made serviceable, by an adroit, experienced and fearless Apiarian. The bees fasten the frames in such a manner, with their propolis, that they cannot, except with extreme care, be opened without jarring the bees, and exciting their anger; nor can they be shut without constant danger of crushing them. Huber nowhere speaks of having multiplied colonies extensively by such hives, and although they have been in use more than sixty years, they have never been successfully employed for such a purpose. If Huber had only contrived a plan for suspending his frames, instead of folding them together like the leaves of a book, I believe that the cause of Apiarian science would have been fifty years in advance of what it now is.

Dividing hives of various kinds have been used in this country. After giving some of the best of them a thorough trial, and inventing others which somewhat resembled the Huber hive, I found that they could not possibly be made to answer any valuable end in securing artificial swarms. For a long time I felt that the plan *ought* to succeed, and it was not until I had made numerous experiments with my hive substantially as now constructed, that I ascertained the precise causes of failure.

It may be regarded as one of the laws of the bee-hive, that bees, when not in possession of a mature Queen, seldom build any comb except such as being designed merely for

storing honey, is *too coarse for the rearing of workers.* Until I became acquainted with the discoveries of Dzierzon, I supposed myself to be the only observer who had noticed this remarkable fact, and who had been led by it, to modify the whole system of artificial swarming. The perusal of Mr. Wagner's manuscript translation of that author, showed me that he had arrived at precisely similar results.

It may seem at first, very unaccountable that bees should go on to fill their hives with comb unfit for breeding, when the young Queen will so soon require worker-cells for her eggs; but it must be borne in mind, that bees, under such circumstances, are always in an *unnatural* state. In a state of nature they seldom swarm until the hive is full of comb, and if they do, their numbers are so much reduced, that they are rarely able to resume comb-building, until their young Queen has hatched.

The determination of bees, when they have no mature Queen, if they build any comb at all, to build such as is suited only for storing honey, and unfit for breeding, will show at once, the folly of attempting to multiply colonies by the dividing-hives. Even if the Apiarian has been perfectly successful in dividing a colony, and the part without a Queen takes the necessary steps to supply her loss, if the bees are sufficiently numerous to build a large quantity of new comb, (and they ought to be in order to make the artificial colony of any value,) they will build this comb in such a manner that it will answer only for storing honey, while they will use the half of the hive with the old comb, for the purpose of breeding. The next year, if an attempt is made to divide this hive, one half will contain nearly all the brood and mature bees, while the other, having most of the honey, in combs unfit for breeding, the new colony formed from it will be a complete failure.

Even with a Huber hive, the plan of multiplying colonies by dividing a full hive into two parts, and adding an empty half to each, will be attended with serious difficulties; although some of them may be remedied in consequence of the hive being constructed so as to divide into many parts; the very attempt to remedy them, however, will be found to require a degree of skill and knowledge far in advance of what can be expected of the great mass of bee-keepers.

The common dividing hives, separating into two parts, can never, under any circumstances, be made of the least practical value; and the business of multiplying colonies by them, will be found far more laborious, uncertain and vexatious, than to rely on natural swarming. I do not know of a solitary practical Apiarian, who, on trial of this system, has not been compelled to abandon it, and allow the bees to swarm from his dividing hives in the old-fashioned way.

Some Apiarians have attempted to multiply their colonies by putting a piece of brood comb containing the materials for raising a new Queen, into an empty hive, set in the place of a strong stock which has been removed to a new stand when thousands of its inmates were abroad in the fields. This method is still worse than the one which has just been described. In the dividing hive, the bees already had a large quantity of comb adapted for breeding, while in this having next to none, they build all their combs until the Queen is hatched, of a size unsuitable for rearing workers. In the first case, the queenless part of the dividing hive may have had a young Queen almost mature, so that the process of building large combs would be of short continuance; for as soon as the young Queen begins to lay, the bees at once commence building combs adapted to the reception of worker eggs. In some of my attempts to rear artificial swarms by moving a full stock, as described above,

I have had combs built of enormous size, nearly four inches through! and these monster combs have afterwards been pieced out on their lower edge, with worker cells for the accommodation of the young Queen. So uniformly do the bees with an unhatched Queen, build in the way described, that I can often tell at a single glance, by seeing what kind of comb they are building, that a hive is queenless, or that having been so, they have now a fertile young Queen. When a new colony is formed, by dividing the old hive, the queenless part has thousands of cells filled with brood and eggs, and young bees will be hourly hatching, for at least three weeks; and by this time, the young Queen will be laying eggs, so that there will be an interval of not more than three weeks, during which no accessions will be made to the numbers of the colony. But when a new swarm is formed by moving, not an egg will be deposited for nearly three weeks; and not a bee will be hatched for nearly six weeks; and during all this time, the colony will rapidly decrease, until by the time that the progeny of the young Queen begins to emerge from their cells, the number of bees in the new hive will be so small, that it would be of no value, even if its combs were of the best construction.

Every observing bee-keeper must have noticed how rapidly even a powerful swarm diminishes in number, for the first three weeks after it has been hived. In many cases, before the young begin to hatch, it does not contain one half its original number; so very great is the mortality of bees during the height of the working season.

I have most thoroughly tested, in the only way in which it can be practiced in the ordinary hives, this last plan of artificial swarming, and do not hesitate to say that it does not possess the very slightest practical value; and as this is the method which Apiarians have usually tried, it is not

strange that they have almost unanimously pronounced artificial swarming to be utterly worthless. The experience of Dzierzon on this point has been the same with my own.

Another method of artificial swarming has been zealously advocated, which, if it could only be made to answer, would be, of all conceivable plans the most effectual, and as it would require the smallest amount of labor, experience, or skill, would be everywhere practiced. A number of hives must be put in connection with each other, so as to communicate by holes which allow the bees to travel from any one apartment to the others. The bees, on this plan, are to *colonize themselves*, and it is asserted that in due time, a single swarm will, of its own accord, multiply so as to form a large number of independent families, each one possessing its own Queen, and all living in perfect harmony.

This method so beautiful and fascinating in theory, has been repeatedly tried with various ingenious modifications, but in every instance, as far as I know, it has proved an entire failure. It will always be found if bees are allowed to pass from one hive to another, that they will still, for the most part, confine their breeding operations to a single apartment, if it is of the ordinary size, while the others will be used, chiefly for the storing of honey. This is almost invariably the case, if the additional room is given by collateral or side boxes, as the Queen seldom enters such apartments for the purpose of breeding. If the new hive is directly *below* that in which the swarm is first lodged, then if the connections are suitable, the Queen will be almost certain to descend and lay her eggs in the new combs, as soon as they are commenced by the bees; in this case, the upper hive is almost entirely abandoned by her, and the bees store the cells with honey, as fast as the brood is hatched, as their in-

stinct impels them always, if they can, to keep their stores of honey above the breeding cells. So long as bees have an abundance of room below their main hive, they very seldom swarm, but use it in the way that I have described; if, however, the room is on the sides of their hive, or above them, they frequently prefer to swarm rather than to take possession of it. But in none of these cases, do they ever, *if left to themselves*, form separate and independent colonies.

I am aware that the Apiarian, by separating from the main hive with a slide, an apartment that contains brood, may succeed in rearing an artificial colony; but unless all his hives admit of the most thorough inspection, as he can never know their exact condition, he must always work in the dark, and will be far more likely to fail than succeed. Success indeed can only be possible when a skillful Apiarian devotes a large portion of his time to watching and managing his bees, so as to *compel* them to colonize, and even then it will be very uncertain; so that this plausible theory to be reduced to even a most precarious practice, requires more skill, care, labor and time, than are necessary to manage the ordinary swarming hives.

The failure of so many attempts to increase colonies by artificial means, as well in the hands of scientific and experienced Apiarians, as under the direction of those who are almosl totally ignorant of the physiology of the bee, has led many to prefer to use non-swarming hives. In such hives, very large harvests of honey are often obtained from a powerful stock of bees; but it is very evident that if the increase of new colonies were entirely discouraged, the insect would soon be exterminated. To prevent this, the advocates of the non-swarming plan, must either have their bees swarm, to some extent, or rely upon those who do.

My hive may be used as a non-swarmer, and may be made more effectually to prevent swarming, than any with which I am acquainted: as in the Spring, (See No. 34. p. 105,) ample accommodations may be given to the bees, below their main works, and when this is seasonably done, swarming will very seldom take place.

During the Summer of 1855, I pursued a course of experiments to test the feasibility of preventing bees from swarming in my hives, by adjusting the blocks controlling the entrance, so as to admit a loaded worker, and yet confine the Queen. The plan promises to be attended with complete success. If on further trial it is found to be embarrassed by no unexpected difficulties, results of great practical importance will flow from it. The Apiarian who wishes to be absent at any time, may easily adjust the entrance blocks, so as to prevent the bees from swarming while he is away; swarming on Sunday may be effectually stopped, and any hive may, in a few moments, be changed from a swarmer into a non-swarmer.

There are certain objections however, which must always prevent the non-swarming plan from being the most successful mode of managing bees. To say nothing of the loss to the bee-keeper, who has, after some years, only one stock, when if the natural mode of increase had been allowed, he ought to have a number, it is usually found that after bees have been kept in a non-swarming hive for several seasons, they seem to work with much less vigor than usual. Of this, any one may convince himself, who will compare the industrious working of a new swarm, with that of a much more powerful stock in a non-swarming hive. The former will work with such astonishing zeal, that to one unacquainted with the facts, it would be taken to be by far the more powerful stock.

As the fertility of the Queen decreases by age, the disadvantage of using non-swarming hives of the ordinary construction, will be obvious. This objection to the system can be remedied in my hive, as the old Queen can be easily caught and removed; but when hives are used in which this cannot be done, the Apiary, instead of containing a race of young Queens in the full vigor of their reproductive powers, will contain many that have passed their prime, and these old Queens may die when there are no eggs in the hive to enable the bees to replace them, and thus the whole colony will perish.

If the bee-keeper wishes to winter only a certain number of stocks, I will, in another place, show him a way in which this can be done, so as to obtain more honey from them, than from an equal number kept on the non-swarming plan, while at the same time, they may all be maintained in a state of the highest health and vigor.

I shall now describe a method of artificial swarming, which may be successfully practiced with almost any hive, by those who have sufficient experience in the management of bees.

About the time that natural swarming may be expected, a populous hive, rich in stores is selected, and what I shall call a *forced swarm* is obtained from it, by the following process. Choose that part of a pleasant day, say from 10 A. M. to 2 P. M., when the largest number of bees are abroad in the fields; if any bees are clustered in front of the hive, or on the bottom-board, puff among them a few whiffs of smoke from burning rags or paper, or better still from punk or rotten wood, so as to force them to go up among the combs. This can be done with greater ease, if the hive is tipped back, or elevated, by small wedges, about one quarter of an inch above the bottom-board. Have an empty

hive or box in readiness, the diameter of which is as nearly as possible, the same with that of the hive from which you intend to drive the swarm. Lift the hive very gently, and without the slightest jar, from its bottom-board; invert it, and carry it in the same careful manner, about a rod from its old stand, as bees are always much more inclined to be peaceable, when removed a short distance, than when any operation is performed on the familiar spot. If the hive is carefully placed on the ground, upside down, scarcely a single bee will fly out, and there will be little danger of being stung. Timid and inexperienced Apiarians will, of course, protect themselves with a bee-dress, and they may have an assistant to sprinkle the hive gently with sugar-water, or blow a little more smoke into it, as soon as it is inverted. After placing the hive in an inverted position on the ground, the empty hive, or box must be put over it, and every crack from which a bee might escape, must be carefully closed with paper or any convenient material. The upper hive if smooth inside should be furnished with two or three slats, about an inch and a half wide, and fastened one third of the distance from the top, so as to help the bees to cluster.

As soon as the Apiarian is perfectly sure that the bees cannot escape, he should place an empty hive upon the stand from which they were removed, so that the multitudes which return from the fields may enter it, instead of dispersing to other hives, where some of them might meet with a very unkind reception; although, as a general rule, a bee with a load of freshly gathered honey, after the extent of his resources is ascertained, is almost always welcomed by any hive to which he may carry his treasures; while a poor unfortunate that ventures to present himself empty and poverty stricken, is generally at once destroyed! The one meets with as friendly a reception as a wealthy gentleman who

proposes to take up his abode in a country village, while the other is as much an object of dislike as a pauper who is suspected of designing to become a parish charge!

To return to our imprisoned bees. Beginning at the top, or what is now, (as the hive is upside down,) the bottom, their hive should be beaten smartly with the palms of the hands, or two small rods, on the sides to which the combs are attached, so as to run no risk of loosening them. These "rappings," which certainly are not of a very "spiritual" character, produce, nevertheless, a most decided effect upon the bees; their first impulse is to sally out, and wreak their vengeance upon those who have thus rudely assailed their honied dome; but as soon as they find that they are shut in, a sudden fear that they are to be driven from their treasures, seems to take possession of them. Determined to prepare for this writ of ejection so suddenly served upon them, and to carry off with them all that they can, each bee proceeds at once to lay in a supply, and in about five minutes they are all filled to their utmost capacity. A prodigious humming is now heard, and the bees begin to mount into the upper box. In about fifteen minutes from the time the rapping began, which ought to be continued with slight intermissions, the mass of the bees, with their queen, will have ascended, and will hang clustered, just like a natural swarm. The box with the expelled bees must now be gently lifted off, and should be placed upon a bottom-board with a gauze-wire ventilator, if the bees are to be confined for any considerable time, so that they may have plenty of air. If no gauze wire bottom-board is at hand, the box must be wedged up, so as to admit an abundance of air, and be set in a shady place; or it may be put upon a sheet or cloth and carefully reversed, when this is is securely fastened.

The hive from which the bees were driven, must now be

set, without crushing any of them, upon its old spot, in the place of the decoy hive, so that all the bees which have returned from abroad, may enter. Before this change is made, these bees will be running in and out of the empty hive, in a state of the greatest distraction, but as soon as the opportunity is given them, they will crowd into their well-known home, and if there are no royal cells started, will proceed, almost at once, to construct them, and the next day they will act as though the forced swarm had left of its own accord. When the operation is delayed until about the season for natural swarming, the hive will contain immature queens, if the bees were intending to swarm, and a new queen will soon take the place of the old one, just as in natural swarming. If it is performed too early, and before the drones have made their appearance, the young queen will not be seasonably impregnated, and the parent stock must perish. As soon as the foraging bees have entered the hive, it should be removed to a new stand, and the entrance contracted to suit the reduced force of the colony.

We return now to our forced swarm. The hive in which they are to be put should be all ready, according to the directions given in the previous chapter, and placed where the old colony stood, so that the bees may be shaken out from the box, upon a sheet, and made to enter it like a new swarm. They will at once proceed to work with as much vigor as though they had swarmed in the natural way.

It might seem as though this process would be much simpler if the *new hive* was used for the decoy hive, and the *old one* carried to its new location as soon as the forced swarm was made. But such a procedure would almost ruin the old colony. Unless a very large number of bees were left in it, nearly all of them, when they came out to work, would return to the old stand and join the new colony there, and

thus the parent stock would be so depopulated that many of the young would perish for want of suitable attention. It is a well ascertained fact that bees, when their hive is moved to a new spot, or when they are forcibly expelled from it, do not adhere to the new place, as they always do when they swarm of their own accord. In each case, it is true, that as soon as a bee leaves its new place, it flies with its head turned towards the hive, in order to mark the surrounding objects, that it may be able to return to the same spot; but when they have not emigrated of their own free will, many of them, when they rise into the air, or return from their work, unless removed to a distance beyond the limits of their previous excursions, seem entirely to forget that their location has been changed; they return to the place where they have lived so long, and often die on the deserted, yet home-like spot. When they swarm of their own accord, they seldom, if ever, make such a mistake. It may be truly said that

> "A 'bee removed' against his will,
> Is of the same opinion still."

Scientific Apiarians have for some years been largely and laboriously experimenting, to ascertain how, if possible, to make a *forced* swarm, or a colony whose position has been changed, adhere just like a *natural* swarm to their new location. Some recommend subjecting the expelled bees, for a minute, to a bath of lukewarm water, and then letting them, when they recover in the sun, crawl into their new hive. I have tried this, but without success. Others carry the bees a considerable distance from home, remove their queen, and make them take wing and cluster around her, just like a natural swarm. This involves too much labor. I have, in my experiments on this point, made a discovery which I turn to very important uses; having as-

certained that nearly all the bees which have entered the decoy hive, if now presented with their own, will adhere to it, even when its location is changed! It is a well known fact that if a hive is removed when many workers are abroad, the returning bees will often alight upon a neighboring hive, and if well received, will not again return to their former stand. The temporary loss of their old home is followed by a distraction which appears to make such a permanent impression upon them, that they are just as careful as a natural swarm to mark their new location. By availing myself of this discovery, I am able to simplify very much the whole method of artificial swarming.

In forcing a swarm, I have recommended that the operation should be performed at an hour when a large number of the workers are abroad, in order to secure them to carry on the labors of the parent stock, when it is removed to a new place. Many bee-keepers, however, may find it most convenient to make their swarms early in the morning, before the bees are actively at work. In this case either the new swarm, or the old stock may be carried to the distance of a mile from their previous stand, care being taken to leave bees enough in the parent hive to develop the brood. If about one-quarter of the bees are left in it, the supply will be ample; larger than is usually left by the bees when they swarm naturally. If the bee-keeper intends to remove either the old or new colony, and the number of bees in the former is too small, he may easily reinforce it by placing the old hive on its former stand, shaking out the bees on a sheet from the box into which they have been drummed, and propping up the box to let them enter it again. Many of them will take wing and return to their old home. If enough do not take wing, when most of the bees have entered the box, the sheet with some adhering to it, may be

carried to the mouth of the old hive, and they will readily enter it.

It may often be convenient to make swarms early in the morning, by those who wish to have them remain on their own premises. In this case the decoy hive must stand on the old spot, and a suitable number of bees be made to enter it in the way just described. These bees will in a short time miss their queen, and begin to run in great confusion in and out and over the hive, and many of them to take wing. The parent hive must now be presented to them, and when they have entered, it must be removed to a new place, and the forced swarm hived and returned to the old stand.

In performing these various operations it is very desirable, especially if there are several old swarms in the apiary, standing close together, that the decoy hive, and that for the new swarm, should be of the same shape and even *color* with the hive which is to be forced. If they are very unlike, the returning bees will often prefer to enter an adjoining hive that looks more like their old home. If they attempt to do this, the neighboring hives should have sheets thrown over them to hide them from the bees until the operation is completed.

The directions which have here been given for the formation of artificial swarms, will be found to differ, in some important respects, from any which have been previously given, either by other writers, or in my former treatise, and to be so simple that any one accustomed to handle bees can very easily follow them. By means of them, any apiarian, let him use what kind of hive he pleases, can make himself entirely independent of natural swarming.

It will be obvious, however, that this whole process of artificial swarming, in order to be successfully performed,

requires a knowledge of the most important points in the economy of the bee-hive; indeed, the same remark may be made of almost any operation, and those who are willing to remain ignorant of the laws which regulate the breeding of bees, ought not to depart in the least from the old-fashioned mode of management. All such deviations will only be attended with a wanton sacrifice of bees. A man may use the common swarming hives a whole life-time, and yet remain ignorant of the very first principles in the physiology of the bee, unless he gains his information from other sources; while, by the use of my hives, any intelligent cultivator may, in a single season, verify for himself, the discoveries which have only been made by the accumulated toil of many observers, for more than two thousand years. The ease with which Apiarians may now, by the sight of their own eyes, gain a knowledge of all the important facts in the economy of the hive, should stimulate them most powerfully, to study the nature of the bee, and thus to prepare themselves for an enlightened system of management.

I doubt not that most bee-keepers, on reading this mode of creating new colonies, will be ready to object that it not only requires more skill, but more labor than to allow them to swarm, and then to hive them in the old fashioned way.

By the aid of the movable comb hive artificial swarming may be most expeditiously performed. An empty hive with its frames properly arranged must be in readiness to receive the new swarm (See p. 156-7). After removing the parent hive a short distance, and putting the decoy hive on its stand, the cover should be taken off, and the bees by a quick motion or jerk, shaken from the frames on a sheet directly in front of the new hive.* As fast as a comb is deprived of its bees it

*Full directions will be given further on in this chapter for opening hives and removing combs.

should be returned to the hive. One or two combs containing brood, eggs and stores, should be put into the new hive, to give them greater encouragement to begin their labors and to prevent the necessity of feeding them if the weather should be unfavorable after hiving. In removing the frames with the bees, I always look for the Queen, and if I see her, as I generally do, I place the frame on which she is, in the new hive, without shaking off the bees. If I do not see her on the combs I seldom fail to notice her as she is shaken on the sheet and crawls towards the hive. In dislodging the bees upon the sheet, I do not shake them all off from the frames; but leave about one quarter of them on, and return them with the combs to the old hive. The queen is seldom left on the frame after it has been shaken so that the larger portion of the bees fall off. As soon as the operation is completed, and the necessary number of bees have been transferred to the new hive, the parent stock should be put upon the old stand to catch up the returning bees, and then set in a new place. The new hive containing the artificial swarm should be returned to the old stand. If the swarm is made when but few bees are abroad, the same precautions must be used that have already been described, to secure a proper allowance of bees which will adhere to the parent stock when it is removed to a new location. Or, either the old or new stock may be removed to the distance of a mile, and the other put in the old place. If the Apiarian is so situated that he can cheaply and conveniently carry off one of the colonies, he will find this to be altogether the easiest mode of management. I have found that when forage is abundant near the Apiary, it will answer all practical purposes to remove the bees about half a mile from their former home.

If the Queen is not *seen* in the process of forming a new colony, it may be certainly ascertained, in from five to fif-

teen minutes, whether she is with them or not. If she is not in the hive, as soon as the bees have entered and begin to cluster, they search for her, and, in a short time, a few will come out and run round, acting evidently as though they had lost something, and were looking for it. The alarm will now be rapidly communicated to the whole colony; the number of explorers will rapidly increase, the ventilators will suspend operations, and soon the air will be filled with bees. If they cannot find the queen, they will return to the spot where the old hive stood, and if no hive is there, will enter one of the adjoining colonies. If their queen is presented to them before they have gone back to their former location, those running out of the hive, will make a half circle, and return; the joyful news will, in a moment, be communicated to those on the wing, and they will forthwith alight and enter the hive; all appearance of agitated running on the outside of the hive will cease, and ventilation with its joyful hum will be again resumed. If the Apiarian wishes to witness these wonderful proceedings he has only to catch the queen and hold her in his hand, until the bees show by their actions that they miss her. If the bees remain quiet for about fifteen minutes, in the new hive, the queen is certainly with them. Bees which miss their queen under such circumstances, will accept of any one that may be offered to them, and may often be pacified with brood-comb from which they can raise another. If the Apiarian in making his artificial swarm does not see the queen, he must wait until the bees show by their conduct whether she is with them or not. If they begin to leave the hive in the agitated manner above described, the entrance must be closed to confine them, until the old hive can be examined again, and the queen secured.

If the attempt is made to pacify the new colony with brood comb from which they can raise a queen, they will fill their

hive with comb unfit for rearing workers, besides being so long before they can have additions to their numbers, as to be of little if any value. (See p. 175.)

By making a few forced swarms, about a week or ten days before the time in which the most should be made, the Apiarian may be sure of having an abundance of sealed queens almost mature, so that every swarm may have one. If he can give each hive that needs it, an unhatched queen, without removing her from her frame, so much the better; but if he has not enough frames with sealed queens, while some of them contain two or more queens, he must proceed as follows.

With a very sharp knife, carefully cut out a queen cell, on a piece of comb an inch or more square; cut a place in one of the combs of the hive to which this cell is to be given, just about large enough to receive it in a natural position, and if it is not secure, with a feather, put a little melted wax, where the edges meet. The bees will soon fasten it, so as to make all right. Unless very great care is used in transferring these royal cells, the enclosed queens will be destroyed, as their bodies, until they are nearly mature, are so exceedingly soft, that a very slight compression of their cell often kills them. For this reason, I prefer not to remove them, until they are within three or four days of hatching. As the forcing of a swarm may always be conducted, with my hives, in such a manner that the Apiarian can be sure to effect a suitable division of the bees, the process may be performed at any time when the sun is above the horizon, and the weather is not too unpleasant. It ought not to be attempted when the weather is so cool as to endanger the destruction of the brood by a chill; and never unless when there is not only sufficient light to enable the Apiarian to see distinctly, but enough for the bees that take wing, to see

the hive, and direct their flight to its entrance. If hives are meddled with when it is dark, the bees are always more irascible, and as they cannot see where to fly, they will constantly be alighting upon the person of the bee-keeper, who will be almost sure to receive some stings. I have seldom attempted night work upon my bees without having occasion most thoroughly to rue my folly. If the weather is not too cool, early in the morning, before the bees are stirring, will generally be the best time for operations, as there will be less danger of annoyance from robber-bees.

If honey-water is used instead of sugar-water or smoke, in sprinkling the bees when the hive is first opened, the smell will be almost certain to entice marauders from other hives, to attempt to take possession of treasures which do not belong to them, and when they once commence such a pilfering course of life, they will be very loth to lay it aside. When the honey harvest is abundant, (and this is the very time for forcing swarms,) bees, with proper precautions, are seldom inclined to rob. I have sometimes found it difficult to induce them to notice honey-combs which I wished them to empty, even when they were placed in an exposed situation. This subject, however, will be more fully treated in the remarks on Robbing.

Perhaps some of my readers will hardly be able to convince themselves that bees may be dealt with after the summary fashion I have been describing, without becoming greatly enraged; so far is this from being the case, that in my operations I often use neither smoke, sugar-water nor bee-dress, although I do not recommend the neglect of such precautions.

The artificial swarm may be created with perfect safety, even at mid-day, when thousands of bees are returning to the hive; for these bees being laden with honey, never

venture upon making an attack, while those at home may be easily pacified.

I find a very great advantage in the peculiar shape of my hive, which allows the top to be easily removed, and the sugar-water to be sprinkled upon the bees, before they attempt to take wing. If, like the Dzierzon hive, it opened on the end, it would be impossible for me to use the sweetened water, so as to make it run down between all the ranges of comb, and I should be forced, as he does, to employ smoke in all my operations. The use of smoke alarms the bees very much, and frequently causes the queen to leave the comb for greater security. This often causes much annoyance and great delay in the formation of artificial swarms, and in all operations where it is desirable to catch the queen, or to examine her upon the comb.

Huber thus speaks of the pacific effect produced upon the bees by the use of his leaf hive. "On opening the hive, no stings are to be dreaded, for one of the most singular and valuable properties attending my construction, is its rendering the bees tractable. I ascribe their tranquility to the manner in which they are affected by the sudden admission of light; they appear rather to testify fear than anger. Many retire, and entering the cells, seem to conceal themselves." I will admit that Huber has here fallen into an error which he would not have made, had he used his own eyes. The bees are indeed bewildered by the sudden admission of light, and unless provoked by a sudden jar, or the breath of the operator, they enter the cells, but not "to conceal themselves;" they imagine that their sweets, thus unceremoniously exposed to the light of day, are to be taken from them, and they gorge themselves almost to bursting, in order to save all that they can. I always expect them to appropriate the contents of the open cells,

as soon as I remove their frames from the hive. It is not merely the *sudden* admission of light, but its introduction from an *unexpected quarter*, that for the time disarms the hostility of the bees. They appear for a few moments almost as much confounded as we should be, if, without any warning, the roof and ceiling of our house should suddenly fly off into the air. Before they recover from their amazement, the sweet libation is poured out upon them, and surprise is quickly converted into pleasure rather than anger; or they are saluted with a puff of smoke, which, by alarming them for the safety of their treasures, induces them to snatch whatever they can. In the working season, almost all the bees near the top are gorged with honey, and this is another reason why opening the hive from *above* is so easily effected. The bees below that are disposed to resent any intrusions, are met in their threatening ascent with an avalanche of nectar, which, like "a soft answer," most effectually "turneth away wrath;" or if the case requires, by a harmless smoke, which excites their fears, but leaves no unpleasant smell behind. No genuine lover of bees ought ever to use the sickening fumes of the disgusting weed.

In managing bees, the greatest care should be taken to repress at once, by the sweetened water or smoke, the very first manifestations of anger. Bees communicate their sensations to each other with almost magic celerity, and in a moment the whole colony will catch the pleased or subdued notes uttered by a few, or will be roused to fury by the shrill note of anger from even a single bee. When once thoroughly excited, it will be found almost impossible to subdue them, and the unfortunate experimenter, if inexperienced, may be inclined to abandon the attempt in despair. That bees are not prepared to make an instant assault from the top of their hive, but only near the entrance, may be

ascertained by any one who will put my frames into a suspended hive, with a movable bottom made to drop at pleasure. If now, for any purpose, he attempts to meddle with the combs from below, he will find that unless he uses smoke, the bees will be almost, if not quite, unmanageable.

I shall now furnish some directions which will greatly assist the Apiarian in his operations. He must bear in mind that nothing irritates bees more than a sudden jar, or breathing upon them, and these must in all cases be most carefully avoided. Every motion should be gentle and deliberate, and no attempt whatever should be made to strike at them. If inclined to be cross, they will resent even a quick *pointing* at them with the finger, darting upon it, and leaving their stings behind. A novice or a person liable to be stung, will of course protect his face and hands, in the manner hereafter to be described.

To open one of my hives, first blow a very little smoke into one of the holes of the board which covers the frames, and on which the receptacles for surplus honey stand. This board should now be loosened with a thin knife, or what is better, an apothecary's spatula, which will be useful for many purposes in the Apiary. When the honey-board is removed, its lower surface will be usually covered with bees, and it should be carefully set on end, so as not to crush them. There is not the least danger of their offering to sting, as they are completely bewildered by the sudden introduction of light, and their removal from the hive. As soon as the cover is disposed of, the Apiarian should sprinkle the bees with the sweet solution. This should descend from the watering-pot in a fine stream, so as not to *drench* the bees, and should fall upon the tops of the frames, as well as between the ranges of comb. The bees will at once accept the proffered treat, and begin lapping it up, as peaceably as

so many chickens helping themselves to corn. While they are thus engaged, the frames must be very gently pried by a stick, from their attachments to the rabbets on which they rest; this may be done without any injurious jar, and without wounding or enraging a single bee, as the rabbets are made wide enough to admit the stick behind the shoulders of the frames, so that they can be pried from the *rear* to the *front*. If the rabbets were just wide enough to receive the shoulders of the frames, it would be necessary, in loosening the frames, to pry them laterally or *towards* each other, by which they might be brought so close together, as to crush the bees, injure the brood, disfigure the combs, or even kill the queen. The frames may all be loosened, preparatory to removing them, in less than a minute.* By this time, the sprinkled bees will have filled themselves, or if all have not done so, the grateful intelligence that sweets have been furnished them, will diffuse an unusual good nature through all the honied realm. The Apiarian should now *gently* push the third comb from one of the ends, a little nearer to the fourth one; and then the second one as near as he can to the third one, so as to get ample room to lift out the end comb without crushing it or injuring any of the bees. To remove the end or outside comb, take hold of its two shoulders which rest upon the rabbets, and carefully lift it without letting it touch the sides of the hive so as to crush the bees. In the same way, if it is desired to remove any particular frame, room must be gained by pushing away from it the adjoining frames on each side. As bees usually build their combs slightly waving, it will be found impossible

* Before I discovered the efficacy of smoke or sweetened water, I have often spent more than ten minutes in opening and shutting a single frame in the Huber hive, and even then have crushed some of the bees.

safely to remove a frame, without making room for it in the way just described. In handling the frames, be careful not to incline them from their perpendicular, or the combs will be liable to break and fall out from their own weight.

If the combs are all to be examined, proceed as follows: After lifting out the outside frame, set it carefully on end, near the hive. The second comb may now be easily moved towards the vacant space, and lifted out. After examination, put it in the place of the comb just removed. In the same way examine the third comb, and put it in place of the second one, and so proceed until all have been examined. If the bees are to be removed, they must of course be shaken off on a sheet, as previously described. If the comb first taken out will fit, it may be put in the vacant space now remaining; if it will not fit, the combs must be slid on the rabbets into their former places, beginning with the last one examined, and the comb taken out may then be returned to its old position.

The inexperienced operator, on examining a hive, and seeing that some small pieces of comb have been made between the outside of the frames and the sides of the hive, or that the upper part of the combs are fastened slightly together, will often imagine that the frames cannot be removed at all. Such slight attachments, however, offer no practical difficulty to their removal. The great point to be gained is to secure a single comb on each frame. This I have effected after many experiments, and the device may be applied to any hive, so that the expense of a few cents will always secure straight combs. This invention alone will, I am confident, be worth the cost of my patent to any one who keeps a few stocks of bees.

If bees were disposed to fly away at once from their combs, as soon as they were taken out, it would be very

difficult to manage them, but so far are they from doing this, that they adhere to them with most wonderful tenacity. All the combs may be removed and arranged in a continued line, and the bees will not only refuse to leave them, but will stoutly defend them against the thieving propensities of other bees. By shaking the bees from the combs upon a sheet, and securing the queen, I can, on any pleasant day, exhibit nearly all the appearances of natural swarming. The bees, as soon as they miss their queen, will rise into the air, and by placing her on the twig of a tree, they will soon cluster around her in the manner already described.

A word as to the manner of catching the queen. I seize her very gently, as I espy her among the bees, and by taking care to crush none of them, run not the least risk of being stung. The queen herself never stings, even if handled ever so roughly. When closely confined in the hand, she will often bite the operator, so as to cause some slight uneasiness. If she is to be kept for some considerable time from her colony, I usually place her in a small piece of paper, folded like a funnel, the ends being twisted together. She can be easily taken from this whenever she is needed. It is perfectly amazing to see how soon a queen will fail, and die for want of food when taken from the bees. If absent from them not more than fifteen minutes, she will solicit honey when returned. If she is to be kept away an hour or more, she must be fed, or a few bees put with her to supply her wants.

In removing the frames from the hive, it will be found very convenient to have an empty hive into which they may be temporarily put, and covered over with a piece of cotton cloth. They may thus be very easily protected from the cold, and from robbing bees, if they are to be kept out of the hive for some time; and such a hive will be very con-

venient to receive frames that are lifted out for examination. In returning the frames to a hive, care must be taken not to crush the bees where their ends rest upon the rabbets; they must be put in very slowly, so that a bee, when he feels the slightest pressure, may have a chance to creep from under them before he is hurt.

When the hive is to be shut up again, the surplus honey-board must not be laid down over the frames, as this might crush some of the bees. It should be very carefully *slid* on, so that any bees which are in the way may be pushed before it, instead of being crushed. A beginner will find it to his advantage to practice the directions which I have given for opening and shutting hives, and lifting out the frames, with an empty hive, until he is confident that he fully understands them. If any bees are upon such parts of the hive as to be imprisoned, if the outside cover is closed, it should be propped up a little, until they have flown to the entrance of the hive.

It cannot be too deeply impressed upon the bee-keeper, that all his motions must be slow and gentle, and that the bees must not be injured or breathed upon. If he will carefully follow the directions I have given, he may soon open a hundred hives, and perform any necessary operation upon them, without any bee-dress, and yet with very little risk of being stung. But I almost despair of being able to convince even the most experienced Apiarians of the ease and safety with which bees may be managed on my plan, until they have actually been eye-witnesses of its successful operation.

I can make an artificial colony in ten minutes from the time that I open the hive, and if I see the queen as quickly as I often do, in not more than five minutes. Ffteen minutes will be a very liberal average allowance of time to an expert,

to complete the whole work. If I had an Apiary of a hundred colonies, in less than a week, if the weather was pleasant, I could by devoting to them a few hours every day, without any asssistance, easily finish the business of swarming for the whole season.

But how can the Apiarian, if he delays the formation of artificial swarms until near the season for natural swarming, be sure that his bees will not swarm in the usual way? Must he not still be constantly on hand, or run the risk of losing many of his best swarms? I come now to the entirely novel plans by which such objections are completely obviated.

If the Apiarian decides that he can most advantageously multiply his colonies by artificial swarming, he may deprive all his fertile queens of their wings, so that they can not lead off new swarms. As an old queen never leaves the hive except to accompany a new swarm, the loss of her wings does not, in the least interfere with her usefulness, or with the attachment of the bees. Occasionally, a wingless queen is so bent on emigrating, that in spite of her inability to fly, she tries to go off with a swarm; she has "a will," but contrary to the old maxim, she can find "no way," but helplessly falls upon the ground, instead of gaily mounting into the air. If the bees succeed in finding her, they will never desert her, but cluster directly around her, and may thus be easily secured by the Apiarian. If she is not found, the bees will return to the parent stock to await the maturity of the young queens. As soon as the piping of the first hatched queen is heard, (p. 149,) the Apiarian may force his swarm in the mannner previously described; unless he prefers, (having fair warning of their intentions,) to allow them to swarm in the natural way. The large number of queens in such a hive, nearly ready to hatch, may be very advantageously used at the swarming season.

The following is the best plan for removing the wings from the queens: Every hive containing a young queen should be examined about a week after she has hatched, (see Chapter on Loss of Queen,) in order to ascertain that she has been impregnated, and has begun to lay eggs. Some of the central combs or those on which the bees are most thickly clustered, should be first lifted out, for she will almost always be found on one of them; the Apiarian when he has caught her, should remove the wings on one side with a pair of scissors, taking care not to hurt her. On examining his hives next season, let him remove one of the two remaining wings from the queen. The third season, he may deprive her of her last wing. Bees always have four wings, a pair on each side. By this plan he will always know the age of a queen, as soon as he sees her.

As the fertility of the queen generally decreases after the second year, I prefer, just before the drones are destroyed, to kill all the old queens that have entered their third year. In this way, I guard against some of my stocks becoming queenless, in consequence of the queen dying of old age, when there is no worker-brood in the hive, from which they can rear another; or of having a worthless, drone-laying queen whose impregnation has been retarded. These old queens are removed at a period of the year when their colony is strong in numbers; and as the honey-harvest is by this time, nearly over, their removal is often a positive benefit, instead of a loss. The population is prevented from being over crowded at a time when the bees are consumers and not producers, and when the young queen, reared in the place of the old one, matures, she will rapidly fill the cells with eggs, and raise a large number of bees to take advantage of the late honey-harvest, and to prepare the hive to winter most advantageously.

In regions however, where the bees are apt to gather an excess of bee-bread, a young queen, or a sealed one nearly mature, should be given to them, the second day after the removal of the old one. Otherwise, the cells may be so filled with pollen, as to leave but little room for new brood. A very strong stock, if deprived of their queen, in the height of the honey harvest, and compelled to rear another from the egg, will often fill nearly every cell with honey or pollen, before she is prepared to lay. I have occasionally known hives, in a very productive season, when left to themselves, to fill nearly all their combs with honey. The consequences can be easily seen. But few bees can be reared in the latter part of the season, and when Winter sets in, the colony will be so reduced in numbers, that it cannot maintain heat enough to keep it alive. I have just been examining some of my stocks which are in this condition, (July 1856,) and removing some of the full combs, so as to get room for four or five empty frames in the center of the hive. These will at once be supplied with comb, and the queen will fill them with eggs. This evil can not easily be remedied in hives which do not give the control of the combs. A colony which thus perishes from excess of wealth, furnishes a very apt illustration of the condition of rich men, who are morally dead, from that icy coldness of the heart, engendered by the indulgence of their avaricious propensities.

I shall now furnish another method of preventing swarming, which may sometimes be employed with very great advantage. The size of the queen bee is such that she can not pass through an opening 5-32ds of an inch high, which will just admit a loaded worker. If therefore, the entrance to the hive be contracted to this dimension, she will not be able to leave with a swarm. By cutting a depression of 5-32ds of an inch, on one surface of the blocks which regulate the

entrance to my hive, or by beveling their edges, so that they can be slid under the entrance, just far enough to admit a loaded bee, I can, in a moment, adjust them so as to confine the queen. By this arrangement all swarming on Sunday, or any other day, when the Apiarian does not desire it, may be prevented.

This method of preventing swarming, requires great accuracy of measurement, for a very trifling deviation from the dimensions given, will either shut out the loaded workers, or let out the queen. It must only be employed to prevent first swarming, for if a young queen is confined to her hive, she cannot become fertile. The same method employed to confine a queen, will, in the Winter, exclude mice from the hive, if the blocks are confined so that they can not move them out of their places.

A very important use may be made of blocks thus arranged, to get rid of the drones. In that part of the day when they are out in full flight, adjust the blocks so that they cannot enter. Towards dark, or early next morning, they will be found sprawled out upon the alighting board, or hanging in clusters under the portico, and may be brushed into a vessel of water and destroyed, or given to chickens, which can easily be taught to devour them. In a few days nearly all the drones in the Apiary, may be thus destroyed. This must not be attempted, however, in hives which contain a queen not yet impregnated, as it will prevent her either from coming out, or returning, if she has already left the hive, to meet the drones.

The great importance of getting rid early in the season, of the excess of drones, must be obvious to any one who knows how few are needed in an Apiary, and how much honey is required to sustain such large corporations. Let the bee-keeper catch a few drones as they are issuing from

the hive, and on tearing them in two, he will find that they always have quite a large drop of honey in their stomachs. Now let him catch and tear asunder those which are returning, and he will be surprised to see, that while on the wing, they have actually digested all this honey, and are going back for a new supply! I have seen hives which have been so crowded with drones, that all the spare honey they could gather, was needed to feed them, and nothing remained for their owner.

The experienced bee-keeper will be able by the use of movable-comb hives, so to repress the production of drones by removing the combs in which they are bred, that his hive will be much more productive in honey, than those where the drones are allowed to remain, or are killed after consuming much honey, and entailing much worse than useless labor upon the bees. If it were possible entirely to repress the production of drones, it would not be desirable, as some are needed in every Apiary, and the bees knowing this, would be very uneasy if prevented from raising any. When my blocks are used to prevent swarming entirely, it will be necessary to move them about an hour or two before sun-set, so that the bees may carry out any dead drones. They may again be adjusted to confine the queen, an hour or two after sun-rise the next morning. I do not feel that I have given this method of preventing swarming, such a full trial that I can confidently recommend it, unless for temporary purposes, although I have but little doubt that it will be found to prevent entirely the issue of a swarm. If so, it will be of vast importance to all who desire to keep non-swarming hives, and who are too timid or inexperienced to open a hive to cut off the wings of a queen, or to remove the queen cells.

It may be found on further experiment, that the entrances to all the spare honey receptacles, may be so adjusted that

the queen will never be able to enter them for the purpose of depositing eggs. This, and many other points of interest and importance, I have been prevented, by the state of my health, from testing this season, (1856.)

The certainty, rapidity and ease, of making artificial swarms with my hives, amaze those most who have had the greatest experience and success in the management of bees. Instead of weeks wasted in watching the Apiary, in addition to all the other vexations and embarrassments which are so often found to attend reliance on natural swarming, the Apiarian will find not only that he can create all his new colonies in a very short time, but that he can, if he chooses, entirely prevent the issue of all after-swarms. In order to do this, he ought to examine the stocks which are raising young queens, in season to cut out all the queen cells but one, before the larvæ come to maturity. If he gave them a sealed queen nearly mature, they will raise no others, and no swarming, for that season, will take place. If the Apiarian wishes to do more than to double his stocks in one season, and is favorably situated for practicing natural swarming, or for any reason prefers this mode of increasing his stocks, he can prevent all after-swarming by cutting out the excess of queen cells, or he can strengthen all the small swarms, by giving to them comb, with honey and maturing brood from other hives.

I do not know that I can find a better place, in which to impress certain highly important principles upon the attention of the bee-keeper. I am afraid that in spite of all that I can say, many persons, as soon as they find themselves able to multiply colonies at pleasure, will so overdo the matter, as to run the risk of losing all their bees. If the Apiarian aims at obtaining a large quantity of surplus honey in any one season, he cannot at the furthest, more than double the

number of his stocks; nor can he do this, unless they are all strong, and the season favorable. The moment that he aims, in any season not unusually favorable, at a more rapid increase, he must not only renounce the idea of having any surplus honey, but must expect to purchase food for the support of his colonies, unless he is willing to see them all perish by starvation. The time, food, care and skill required to multiply stock with very great rapidity, in our short and uncertain climate, are so great, that not one Apiarian in a hundred can expect to make it profitable; while the great mass of those who attempt it, will be almost sure, at the close of the season, to find themselves in possession of stocks which have been so managed as to be of very little value.

Before explaining some other methods of artificial swarming, which I have employed to great advantage, I shall endeavor to impress upon the mind of the bee-keeper, the great importance of thoroughly understanding, each season, the precise object at which he is aiming, before he enters on the work of increasing his colonies. If his object is, in any one season, to get the largest yield of surplus honey, he must at once make up his mind to be content with a moderate increase of stocks. If, on the contrary, he desires to multiply his colonies, say, three or four fold, he must be prepared, not only to relinquish the expectation of obtaining any surplus honey, but, if the season should prove unfavorable, to purchase food for the support of his bees. Rapid multiplication of colonies, and large harvests of surplus honey, cannot in the very nature of things, be secured in our climate, in any one season.

If the number of colonies is to be increased to a large extent, then the bees in the Apiary will be tasked to the utmost in building new comb, as well as in rearing brood. For these purposes, they must consume the supply of honey

which, under other circumstances, they would have stored up, a part for their own use in the main hive, and the balance for their owner in the spare honey-boxes.

To make this matter perfectly plain, let us suppose a colony to swarm. If the new hive, into which the swarm is put, holds, as it ought, about a bushel, it will require nearly two pounds of wax to fill it with comb, and forty pounds of honey will often be used in its manufacture! If the season is favorable, and the swarm was large and early, they may gather, not only enough to build this comb, and to store it with honey sufficient for their own use, but a number of pounds in addition, for the benefit of their owner. If the old stock does not swarm again, it will rapidly replenish its numbers, and as it has no new comb to build in the main hive, which already contains much honey, it will be able to store up a generous allowance in the upper boxes. These favorable results are all on the supposition that the season was ordinarily productive in honey, and that the hive was so powerful in numbers as to be able to swarm seasonably. If the season should prove to be unfavorable, the first swarm cannot be expected to gather more than enough for its own use, while the parent stock will yield only a small return. The profits of the bee-keeper, in such an unfortunate season, will be mainly in the increase of his stocks. If the swarm was late, in consequence of the stock being weak in Spring, the early part of the honey-harvest will pass away, and the bees will be able to obtain from it, but a small share of honey. During all this time of comparative inactivity, the orchards may present

> "One boundless blush, one white empurpled shower
> Of mingled blossoms,"

and tens of thousands of bees from stronger stocks, may be engaged all day in sipping the fragrant sweets, so that every

gale which "fans its odoriferous wings" about their dwellings, dispenses

> "Native perfumes, and whispers whence they stole*
> Those balmy spoils."

By the time that the feeble stock is prepared to swarm, if it swarm at all that season, the honey-harvest is almost over, and the new colony will seldom be able to gather even enough for its own use, so that unless fed, it must perish the succeeding Winter. Bee-keeping, with colonies feeble in the Spring, except in extraordinary seasons and locations, is most emphatically nothing but "folly and vexation of spirit."

I have shown how the bee-keeper, with a strong stock-hive which has swarmed early, and but once, may in a favorable season realize a handsome profit from his bees. If the parent stock throws a second swarm, then, as a general rule, unless this swarm was very early, and the honey season good, if managed on the ordinary plan, it will seldom prove of any value. It will almost always perish in the Winter, if it does not desert its hive in the Fall, and the family from which it issued, will not only gather no surplus honey, (unless it was secured before the first swarm issued,) but will very often perish likewise. Thus the inexperienced owner who was so delighted with the rapid increase of his colonies, begins the next season with no more colonies than he had the year before, and has very often entirely lost all the time he has bestowed upon his bees. I can, to be sure, on my plan, prevent the death of the bees, and can build up all the feeble colonies, so as to make them strong and powerful; but only by giving up all idea of obtaining a single pound of

* The scent of the hives, during the height of the gathering season, will usually inform us from what sources the bees have gathered their supplies.

honey. From the first swarm I must take combs containing muturing brood, to strengthen my weak swarms, and this first swarm, however powerful or early, instead of being able to store its combs with honey, will be constantly tasked in building new combs to replace those taken away, so that when the honey harvest closes, it will have scarcely any honey, and must be fed to prevent it from starving. Any man who has sense enough to be entrusted with bees, can, from these remarks, understand exactly why it is impossible to multiply colonies rapidly in any ordinary season, and yet obtain from them large supplies of honey. Even the doubling of stocks in one season, will very often be too rapid an increase, if the greatest quantity of spare honey is to be obtained from them; and when this is desired, I much prefer to form, in a way soon to be described, only one new stock from two old ones; this will give even more honey from the three, than could have been obtained from the two, on the ordinary non-swarming plan.

I would very strongly dissuade any but experienced Apiarians, from attempting, at the furthest, to do more than treble their stocks in one year. In order to furnish directions for very rapid multiplication, sufficiently full and explicit for the inexperienced, I should have to write a book on this one topic; and even then, the most of those who should undertake it, would be sure at first to fail.

I have no doubt that with ten strong stocks of bees in a good location, in movable-comb hives, in one favorable season, I could so increase them as to have, on the approach of Winter, one hundred good colonies: but I should expect to feed hundreds of pounds of honey, to devote nearly all my time to their management, and to bring to the work, the experience of many years, and the judgment acquired by numerous failures. After all, what we most need, in order

to be successful in the cultivation of bees, is a *certain*, rather than a *rapid*, multiplication of stocks. A single colony doubling every year would in ten years increase to 1024 stocks, and in twenty years to over a million! It would require, therefore, but a very few years to stock our whole country with bees, if colonies could only be doubled annually; and an increase of even one-third, would before long, give us bees enough. This rate of increase I should always encourage in the swarming season, even if, in the Fall, I reduced my stocks (see Union of Stocks) to the Spring number. In the long run, it will keep the colonies in a much more prosperous condition, and secure from them the largest yield of honey.

I have never myself hesitated, if necessary, to sacrifice one or more colonies, in order to ascertain a single fact, and it would require a separate volume, quite as large as this, to detail the various experiments which I have made on the single subject of Artificial Swarming. The practical bee-keeper, however, should never, for a moment, lose sight of the important distinction between an Apiary managed principally for the purposes of experiment and discovery, and one conducted almost exclusively with reference to pecuniary profit. Any bee-keeper can easily experiment with my hives; but I would recommend him to do so, at first, only on a small scale, and if profit is his object, to follow the directions furnished in this treatise, until he is *sure* that he has discovered others which are preferable. These cautions are given to prevent persons from incurring serious losses and disappointments, if they use hives, which, if they are not on their guard, may tempt them into rash and unprofitable courses, by allowing so easily of all manner of experiments.

Let the practical Apiarian remember that the less he disturbs

the stocks on which he relies for surplus honey, the better. After they are properly lodged in their new hive, they ought by all means to be allowed to carry on their labors without any interruption. Their hive ought not to be opened, except for some very sufficient reason, and the bees should never be so much interfered with, as to feel that they hold their possessions by a very uncertain tenure. Such an impression will often very seriously impair their zeal for accumulation. The object of giving the control over every comb in the hive, is not to enable the bee-keeper to be incessantly taking them in and out, and subjecting the bees to all sorts of annoyances. Unless he is conducting a course of experiments, such interference will be almost as silly as the conduct of children who pull up the seeds which they have planted, to see if they have sprouted, or how much they have grown. If, after these cautions, any still choose to disregard them, the blame of their losses should fall, not upon the hive, but upon their own mismanagement.

Let me not, for a moment, be understood as wishing to discourage investigation, or to intimate that perfection has been so nearly attained that no more important discoveries remain to be made. On the contrary, I should be glad to learn that many who have the time and means, are disposed to use the facilities furnished by hives which give the control of each comb, to experiment on a large scale; and I hope that every intelligent bee-keeper who follows my plans, will experiment at least on a small scale. In this way, we may soon expect to see, more satisfactorily elucidated, some points in the natural history of the bee, which are still involved in doubt.

Having described the way in which forced swarms are made, both in common hives and in my own, when the Apiarian wishes in one season merely to double his colonies,

I shall now show in what manner he can secure the largest yield of honey, by forming only one new colony from two old ones.

Early in the season, before the bees fly out, or better still, after they ceased to fly in the previous Fall, the two hives from which the new colony is to be formed, should be placed near each other, unless they are already not more than one or two feet apart. When the time for forming the artificial colony has arrived, one of these hives should be removed from its stand, and the bees driven from it, precisely in the way already described. After the forced swarm is secured, the removed hive is replaced, in order to catch up all the returning bees, and then put in a new place. The other old stock must now be carried to a new location, and the forced or artificial swarm hived, and placed with its entrance as near as possible in the center of the space previously occupied by the two colonies. Thousands of bees returning from the fields will now peaceably enter the new hive, and in this way a very powerful colony will be formed, which in a short time, will not only fill its hive, but also store up much surplus honey, if suitable facilities are given to it. The hive which was not forced, but simply removed to a new place, will not only part with all the bees which were abroad at the time, but will lose the larger portion of those which leave it for work, for two days after its removal. Still it will not suffer near as great a loss of bees as though it had been first forced and then removed, and will speedily recruit and make a powerful stock.

When I wish to secure only an increase of one new colony from two old stocks, I often proceed as follows: I force an old stock, and take from it all the bees, setting the new colony at once on the old stand, so as to secure for it all the returning bees. The old hive from which the swarm

was taken, is now put in the place of any strong stock, so that it may catch up a sufficient number of bees to carry on the work of the hive, and the stock whose place it occupies, is removed to a new location. Of all the methods for creating artificial swarms, I consider this to be the simplest and best. It may be practiced at any time in a pleasant day, from sunrise until four o'clock in the afternoon; and when the artificial swarm is made so early that no bees are abroad, to recruit the old stock, this hive may be shut up, until it can be put upon the stand of any hive which begins to work with vigor, and which has not swarmed. By such a mode of management which I earnestly recommend as the safest, simplest and best, the Apiarian will not only secure a reasonable increase of his colonies, but will maintain them all in high vigor, and in ordinary seasons obtain more spare honey than he would, if he did not encourage any increase. If all bee-keepers would adopt it, they would avoid many discouragements, and the country would soon be once more "a land flowing with milk and honey."

The Apiarian who relies upon natural swarming, can double his new colonies if they issue at the same time, by hiving them together, or if this cannot be done, he may hive them in separate hives, and then, towards evening, set one hive on a sheet, and shake down the bees from the other, so that they can enter and join the first. It may be safely done, even if several days have elapsed before the second colony swarms; although in this case, I prefer to sprinkle both swarms with scented sugar-water. I have doubled natural swarms in this way, repeatedly, and have never, when they were early, failed to secure from them a large quantity of honey. In sprinkling bees, let the operator remember that they are not to be *drenched*, or almost drowned, as in this case, they will require a long time to

enter the hive. Bees seem to recognize each other by the sense of smell; and when made to have the same odor, they will always mingle peaceably. This is the reason why I use a few drops of peppermint in the sugar-water.

In doubling swarms in this manner, it will never be safe to attempt to mingle first and second swarms unless they are first thoroughly scented so that they cannot distinguish each other. Bees which have a fertile queen, will almost always quarrel with those which have one still unimpregnated, and this is the reason why when new swarms attempt to mingle of their own accord, or are put together by the bee-keeper, thousands of bees are often destroyed.

If an increase of only one third is desired, and the Apiarian chooses to rely on natural swarming, as soon as he has hived a swarm, he should remove the hive from which it issued, and put the new swarm in its place. It will thus secure nearly all the bees and will make a very powerful colony. The old stock from which it came, should now be put on the stand of another powerful stock, to be replenished with bees, and this third stock removed to a new location. Of all the various methods of practicing natural swarming, I consider this to be the very best. If the colonies stand close together, all these various processes will be much better performed when the hives are all alike in shape and color. If the bees are very near together, and the hives quite unlike, they should not be attempted, except with the precautions which have been previously described.

Beginners will find it very important to follow as closely as they can, my directions for performing the various processes, as I have constantly aimed to give none which are not important; and while I utterly repudiate the notion that these directions may not be modified and improved, I am quite

certain that this cannot be done by any but those who have considerable experience in the management of bees.

As some Apiarians may be so situated as to wish to increase their bees quite rapidly, I shall give such methods as from numerous experiments, many of them conducted on a large scale, I have found to be the best. I wish it however to be most distinctly understood, that I do not consider *very* rapid multiplication as likely to succeed, except in the hands of a skillful Apiarian. Its chief merit consists in the short time which it requires to build up a large Apiary, and under ordinary circumstances it requires too much time, care and honey, to be of very great practical value. If the careful attention of the bee-keeper is at any critical time relaxed, by a flagging of the zeal with which he commenced, or sickness, or other necessary hindrances, he will find at the close of the season, or by the return of Spring, that his gains consist only of *experience*, purchased at a very extravagant price. After trying my mode of management for a few seasons, a bee-keeper may find that he is favorably situated for taking care of a large stock of bees. Suppose him to have acquired both skill and confidence, and that he has ten powerful colonies. If he is willing to do without surplus honey for one season, and the honey-harvest should be very productive, he may, without feeding, or very much labor, safely increase his ten colonies to thirty. If he chooses to feed largely, he may *possibly* end the season with fifty or sixty, or even more; but he will *probably* end it in such a manner as most thoroughly to disgust him with his folly, and to teach him that in bee-keeping, as well as in other things, "Haste makes waste."

On the supposition that by the time the fruit-trees are in blossom, the Apiarian has, in movable-comb hives, ten pow-

erful colonies, let him select four of the strongest, and make from each a forced swarm. He will then have four queenless colonies, which will at once, proceed to supply themselves with a young queen. In about ten days, he may make from his other six stocks, six more forced swarms. He will probably find in making these, many sealed queens, if he has delayed the operation until about swarming time; so that he may give to each of the six stocks from which he has expelled a swarm, the means of soon obtaining another queen. If he has not queens enough for this purpose, he must take the required number from the four stocks which are raising young queens, the exact condition of which ought to have been previously ascertained. Some of these stocks will be found to contain a large number of queen cells. Huber, in one of his experiments, found twenty-four in one hive, and even a larger number has sometimes been reared by a single colony.

As the Apiarian will always have many more queens than are wanted, he should select those combs which contain a sealed queen, so as to obtain about fifteen combs, each of which has one or more queens. If necessary, he can cut out some of the cells, and adjust them in the manner previously described. Each comb containing a sealed queen, must be put with all the bees adhering to it, into an empty hive; water should be given to them, and honey, if there is none in the comb. I always prefer to select a comb which contains a large number of workers just beginning to hatch, so that even if a considerable number of the bees should return to the parent stock, after their liberty is given them, there will still be a sufficient number hatched, to attend to the young, and especially to watch over the maturing queens.

If the comb has a large number of bees just emerging from their cells, I prefer to confine them only one day,

otherwise I keep them shut up until about an hour before sunset of the third day. The hives containing these small colonies, ought, if not well protected by being made double, to be set where they are thoroughly sheltered from the intense heat of the sun; and the entrances should be so adjusted as to give them sufficient ventilation.

These small colonies I call *nuclei*, (from the Latin word nucleus, a small cluster,) and the system of forming stocks from them, my nucleus system; and before I describe this system more particularly, I shall show other ways in which the nuclei can be formed. If the Apiarian chooses, he can take a frame containing bees just ready to mature, and eggs and young worms, all of the worker kind, together with the old bees which cluster on it, and shut them up in the manner previously described, even if he has no sealed queen to give them. He will find that a comb from which about one third of the brood has just hatched, will almost always contain eggs freshly deposited in the empty cells. If all things are favorable, the bees will set about raising a queen in a few hours. I once took not more than a tea-cup full of bees, and on confining them in a dark place with a small piece of brood comb, found that in about an hour, they had begun to enlarge some of the cells, to raise a new queen! If the Apiarian has sealed queens on hand, they ought to be given to the nuclei, in order to save all the time possible.

I sometimes make these nuclei as follows: A suitable comb with bees, &c., is taken from a stock-hive, and put in an empty one made to stand partly in the place of the old hive, which, of course, must previously be moved a little on one side. In this way, I am able to divert a considerable number of the bees from the old stock, to my nucleus, and the necessity of shutting it up, is done away with. If the bees from the old stock do not enter the small one, in suf-

ficient numbers, I sometimes close their hive, or cover it with a sheet, so that the returning bees can find no other place to enter. My object is not to obtain a *large* number of bees. For reasons previously assigned, I do not want enough to build new comb, but only enough to adhere to the removed comb, and raise a new queen from its brood, or develop the sealed one which has been given them. A short time after one nucleus has in this way, been formed, another may be made by moving the old hive again, and so a third or fourth, if so many are wanted. This plan requires considerable skill and experience, to secure the right number of bees, without getting too many.

If bees are to be made to enter a new hive, by removing the old one from its stand, it will always be very desirable not only to have the new one contain a piece of comb, but a considerable number of bees *clustered* on that comb. I repeatedly found that my bees, after entering the hive, refused to have anything to do with the brood comb, and for a long time, I was unable to conjecture the cause; until I ascertained that they were dissatisfied with its deserted appearance, and that, by taking the precaution to have it well covered with bees, I seldom failed to reconcile them to this system of forced colonization. I can usually tell, in less than two minutes, whether the operation will succeed or not. If the returning bees intend to accept of their new home, they will, however much agitated at first, soon begin to join the cluster on the comb; while if they are dissatisfied, they will abandon the hive, and nearly all the bees that were originally on the comb, will leave with them. They seem capricious in this matter, and are sometimes so very self-willed, that they refuse to have anything to do with the brood comb, when no good reason can be seen for their being so rebellious.

I shall here state some *conjectures* which have occurred to me on this subject. Is it absolutely certain that bees can raise a queen from *any* egg or young worm which would produce a worker? Or if this is possible, is it certain that *every kind of workers* can accomplish this? Huber ascertained to his own satisfaction that there were two kinds of workers in a hive. He thus describes them:

"One of these is, in general, destined for the elaboration of wax, and its size is considerably enlarged when full of honey; the other immediately imparts what it has collected, to its companions, its abdomen undergoes no sensible change, or it retains only the honey necessary for its own subsistence. The particular function of the bees of this kind is to take care of the young, for they are not charged with provisioning the hive. In opposition to the wax workers, we shall call them small bees or nurses."

"Although the external difference be inconsiderable, this is not an imaginary distinction. Anatomical observations prove that the capacity of the stomach is not the same: experiments have ascertained that one of the species cannot fulfill all the functions shared among the workers of a hive. We painted those of each class with different colors, in order to study their proceedings; and these were not interchanged. In another experiment, after supplying a hive deprived of a queen with brood and pollen, we saw the small bees quickly occupied in nutrition of the larvæ, while those of the wax working class neglected them. Small bees also produce wax, but in a very inferior quantity to what is elaborated by the real wax workers."

Now if these statements can be relied on, and I have nearly always found Huber's statements, wherever I have tested them, perfectly reliable, then it may be that when bees refuse to cluster on the brood comb, to rear a new queen, it is because

they find that some of the conditions necessary for success, are wanting. Either there may not be a sufficient number of wax-workers, to enlarge the cells, or a sufficient number of nurses to take charge of the larvæ; or perhaps the cells contain only young wax-workers which cannot be developed into queens, or only young nurses which may be in the same predicament.

If any of my readers imagine that it is an easy work, carefully to experiment, in order to establish facts upon the solid basis of complete demonstration, let them attempt to prove or disprove the truth of any or all of my conjectures upon this single topic. They will probably find the task more difficult than to blot over whole quires or reams of paper with careless assertions.

All operations of any kind which interfere in the very least, with the natural mode of forming colonies, are best performed in the swarming season: or at least, at a time when the bees are breeding freely, and are able to bring in large stores of honey from the fields. At other times, they are very precarious, and unless under the management of persons who have great experience, will in most cases, end in nothing but vexatious losses and disappointments.

It is quite amusing to see how bees act, when they find, on their return from foraging abroad, that their hive has been moved, and another put in its place. If the new hive is precisely similar to their own, in size and outward appearance, they enter it at once, as though all was right; but, in a few moments, rush out in violent agitation, imagining that by a prodigious mistake they have entered the wrong place. They now take wing again, in order to correct their blunder, but find to their increasing surprise, that they had previously directed their flight to the familiar spot; again they enter, and again they tumble out, in bewildered crowds,

until at length, if they can find the means of raising a new queen, or one is already there, they make up their minds that if this is not home, it not only looks like it, but stands just where their home ought to be, and is at all events the only home they are likely to get. No doubt they often feel that a very hard bargain has been imposed upon them, but they generally are wise enough to make the best of it.

There is one trait in the character of bees, for which I feel, not merely admiration, but the most profound respect. Such is their indomitable energy and perseverance, that under circumstances apparantly hopeless, they will still labor to the utmost, to retrieve their losses, and sustain the sinking State. So long as they have a queen, or any prospect of raising one, they struggle most vigorously against impending ruin, and never give up, unless their condition is absolutely desperate. In one of my observing hives, I once had a colony of bees, the whole of which might have been spread out on my two hands, busy at work in raising a new queen, from a small piece of brood comb. For two long weeks, they adhered with unfailing perseverance and industry, to their forlorn hope: until at last, one of the two queens which they raised, came fourth, and destroyed the other while still in her cell. The bees had now dwindled away to less than half their original number, and the new queen had wings so imperfect that she was unable to fly. I watched their proceedings with great interest; they actually paid very unusual attention to this crippled queen, treating her with almost as much regard as though she were fertile. In the course of a week, there were not more than a dozen bees left in the hive, and in a few days more, I missed the queen, and saw only a few disconsolate wretches crawling over the deserted comb!

Shame on the faint-hearted and cowardly of our own race, who, if overtaken by calamity, instead of nobly breasting the

dark waters of affliction, and manfully buffeting with their tumultuous waves, meanly resign themselves to their ignoble fate, and sink and perish, where they might have lived and triumphed; and double shame upon those who thus "faint in the day of adversity," when living in a Christian land, they might, if they would only receive the word of God, and open the eye of faith, behold a bow of promise spanning the still stormy clouds, and hear a voice bidding them, like the great apostle of the Gentiles, learn not merely to "rejoice in hope of the glory of God," but to "glory in tribulations also."

I have been informed by Mr. Wagner, that Dzierzon has recently devised a plan of making *nuclei*, substantially the same with my own. His book, however, contemplates having two Apiaries, three or four miles apart, and his plans for multiplying colonies, as there described, were based upon the supposition that the Apiarian has two such establishments. Such an arrangement would no doubt very greatly facilitate many operations. Our forced swarms might all be removed from the Apiary where they were formed, to the other, and our nuclei treated in the same way, and there would be no necessity for confining the bees after their removal. There are however, weighty objections to such an arrangement, which will prevent it, at least for some time, from being extensively adopted. The labor and expense of removing the bees backwards and forwards, is a serious objection to the whole plan; and in addition to this, the necessity of having a skillful Apiarian at each establishment, unfits it for the purposes of most persons who keep bees. It might answer, however, if two bee-keepers, sufficiently far apart, would enter into partnership, and manage their bees as a joint concern.

Those who cannot remove their bees, and who from timidity, are desirous of forming their artificial swarms in

the morning, before the bees are on the wing, and for this reason, or, for want of time, cannot take the proper precautions, to secure for the old stocks the necessary number of adhering bees, may still force swarms with advantage by proceeding as follows: After the new colony has been formed, in the manner previously described, care being taken to leave in the old stock a sufficient number of bees, set this old stock in a cool or shady place, and shut up the bees, giving them an abundance of air, until late in the afternoon of the third day. They may now be placed in any convenient situation, and an hour or two before sun-set, allowed their liberty. They will often take wing, almost as though they were intending to swarm. Some will even now return to the place where their hive originally stood, and join the forced swarm, but most of them, after hovering a short time in the air, will re-enter their hive. During the time they have been shut up, thousands of young bees will have emerged from their cells, all of which, knowing no other home, will aid in carrying on the work of the hive. While confined, the bees ought to be supplied with water, or they will not be able to prepare food for the larvæ, multitudes of which would necessarily perish. If the hive is so constructed that water cannot conveniently be given them, a small gimblet hole may be made on the front, near the top, through which it may be easily injected with a straw.

The following is Dzierzon's new plan of creating nuclei, already alluded to: Towards evening, he removes a piece of brood comb, with eggs and bees just hatching, and puts it into an empty hive, with a sufficient number of mature bees to keep the brood from being chilled over night. If the operation is performed so late, that the bees are not disposed to take wing, and leave the hive, by morning a sufficient number will have hatched, to supply the place of those which may abandon

the nucleus. In my numerous experiments in the Summer, of 1842, in the formation of artificial swarms, I tried this plan, and found that it answered a good purpose; the chief objection to it, is the difficulty often of selecting the suitable kind of comb, if the operation is delayed until late in the afternoon. I prefer, therefore, to perform it, when the sun is an hour or two high, and to confine the bees until dark. If there are not a sufficient number of bees on the comb, I shake off some from another frame, directly into the hive, and shut them all up, giving them a supply of water. Sealed queens if possible, should be used in all these operations.

I shall now describe a novel mode of creating nuclei, which I have devised, and which I find to be attended with great success: Hive a new swarm in the usual manner, in an old box, and as soon as the bees have entered it, shut them up and carry them down into the cellar, unless they can be put in a cool place, and supplied with a liberal allowance of air. About an hour before sunset, take combs suitable to form as many nuclei as you judge best, say five or six, or even eight or ten, if the swarm was large, and you need as many. Take the new swarm, and shake it out upon a sheet, sprinkling it gently with sugar-water. With a large spoon or tumbler, scoop up, without hurting any of the bees, a pint or more of them, and place them before the mouth of one of the hives containing a brood comb; repeat the process, until each nucleus has about a quart of bees. If you see the queen, you may give the hive in which you put her, three or four times as many bees as any other; and the next day it may be strengthened with a few combs, containing brood, just ready to mature. If you do not see her, at the time of forming the nuclei, the one in which you afterwards find her, may be properly reinforced with bees and comb, so as to enable it to work to the best advantage.

If this plan of forming nuclei, were attempted earlier in the afternoon, it would be difficult to prevent the bees from communicating on the wing, and going to the nucleus which contains their queen. If, however, the bees when first shaken out of the temporary hive, are so thoroughly sprinkled, as not to be able to take wing and unite together, this mode of forming colonies may be practiced at any hour of the day; and an experienced Apiarian may prefer to do it, as soon as he has fairly hived the new swarm.

When the bees are shaken out in front of a hive which has a sealed queen, or eggs from which they can raise one, having a whole night in which to accustom themselves to their new situation, they will be found, the next day, to adhere to the place where they were put, with as much tenacity as a natural swarm to their new hive. How wonderful that the act of swarming should so thoroughly impress upon the bees, an absolute indisposition to return to the parent stock! If this were a fixed and invariable unwillingness, a sort of blind, unreasoning instinct, it would not be so surprising, but we have already seen that when the bees lose their queen, they return, in a very short time, to the stock from which they issued. If the nuclei formed in the manner just described, found in their new hive, no means of obtaining a queen, they would return, next morning, to the parent stock.

When the Apiarian can obtain a forced swarm from some other Apiary, two or three miles from his own, it may be divided into nuclei, which will prosper equally well; and if he cannot conveniently obtain a forced swarm from an Apiary, at least a mile distant, he may, before the bees begin to fly out in the Spring, transport one of his stocks to a neighbor's, and force from it a swarm at the desired time. Even if it is moved not more than half a mile off, at a time

when forage is abundant near his own hives, the operation will be almost sure to succeed. Of all modes of forming the nuclei, this I believe will be found to be the neatest, simplest, surest and best.

Having thus described the methods by which I form my nuclei, I shall now show how they may be built up into powerful stocks. It will be very obvious, that on the ordinary plan of management, they would be absolutely worthless, even if it were possible to form them with the common hives. If they were not fed, being unable to collect the means of building new comb, they would gradually dwindle away, like third or fourth swarms which issue late in the season; nor could they be saved, even by the most generous feeding, since they would only use their supplies to fill up the little comb they had; so that when the queen was ready to lay, there would be no empty cells to receive her eggs, and too few bees to build any, even if they had all the honey that they required. Such small colonies must gradually waste away, unless they can be speedily and effectually supplied with the requisite number of bees, and this can be successfully done, only by hives which give the control of all the combs. With such hives, I can speedily build up my nuclei, (unless I have too many,) to the strength necessary to make them powerful stocks.

The hives containing these miniature swarms, ought, if possible, to stand at some considerable distance from other hives; and if this cannot be conveniently done, they should in some way, be so distinguished from the adjoining hives, that the young queens when they are hatched, and go out to seek the drones, will not be liable, on their return, to lose their lives, by entering a wrong hive. A small leafy twig, fastened on the front of such hives, when they stand near to others, will be almost sure to prevent such a catastrophe:

or some may be marked in this way, and others with a piece of colored cloth. (See p. 152-3.) To guard them against robbers, the entrances to these nuclei should be contracted, so that only a few bees can pass in at once. Those which were confined, should be examined, the day after their liberty is given to them; the others the day after they were formed, when, if they were not supplied with a sealed queen, they will be found actively engaged in constructing royal cells. A new range of comb should now be given to each one, and it should contain no old bees, but brood rapidly maturing, and if possible, eggs and worms only a few days old.

This addition of strength will greatly encourage the nuclei, and give them the means of starting young queens, if they have not succeeded, with the first comb. I have often found, that for some cause, they start a large number of queen cells, which in a few days, are all discontinued, and untenanted. The second attempt seldom fails. Does practice make them more expert? But I will simply state the fact, referring to my conjectures on page 218; and remarking that when they make a second attempt, they are frequently disposed to start a much larger number than they would otherwise have done. In two or three days after giving them the first piece of comb, I give them another, if their queen is nearly mature, and then let them alone, until she ought to be depositing eggs in the hive. I now give them at intervals of a few days, two or three combs more, which make them sufficiently powerful in bees, to gather large quantities of honey, and fill the empty part of their hive. The young queen is supplying with thousands of worker-eggs, the cells from which the brood has emerged, and also the new ones built by the bees, and the young colony will soon be one of the best stock hives in the Apiary.

But what, in the mean time, is the condition of the hives from which we are taking so many brood combs, for the proper development of our nuclei? are they not tasked so much as to become quite enfeebled? This brings us to the turning point of the whole nucleus system. If due judgment has not been used, but the sanguine bee-keeper has multiplied his colonies too rapidly, a grievous disappointment awaits him. Either his nuclei cannot be strengthened at the right time, or this can be done, only by impoverishing the old stocks, so that the result of the whole operation will be a decided failure; and if he is in the vicinity of sugar-houses, confectionaries, or other tempting places of bee resort, he will find the population of his colonies so seriously diminished, that he will have to break up most of the nuclei which he had formed, besides incurring the danger of losing nearly all his stock.

I consider it a fundamental principle in my nucleus system, that the old stocks must never be so much weakened by the removal of brood-comb and bees, as to be unable to keep their numbers strong enough to refill rapidly all vacancies among their combs. If the Apiarian attempts to multiply his stocks too rapidly for this, I will ensure him ample cause to repent at leisure of his folly. If, however, the attempt at very rapid multiplication is made only by those who are favorably situated, and who have great skill in the management of bees, a very large gain may be made in the number of stocks, and yet all be strong and flourishing.

If a strong stock of bees in a hive of moderate size, is examined at the height of the honey harvest, nearly all the cells will often be found filled with brood, honey, or bee-bread. The great laying of the queen, according to some writers, is now over, yet not as they erroneously imagine,

because her fertility has decreased, but merely because there is not *room* in the hive for all her eggs. She may often be seen restlessly traversing the combs, seeking in vain for empty cells, until finding none, she is compelled to extrude her eggs, only to be devoured by the bees. If some of the full combs are removed, and empty ones substituted, she will speedily fill them, laying at the rate of two or three thousand eggs a day! A queen in a small colony, or in a hive where nearly all the brood comb is occupied, will often appear almost as slender as one which is still unfertile; but give her plenty of bees and empty comb, and in a short time, her proportions will become so much enlarged, that she will often be wholly incapable of flight. (See p. 51-2.)

When strong stocks are, from time to time, deprived of one or two combs, if honey can easily be procured, (and if it cannot, the Apiarian must himself supply it,) the bees proceed at once to replace them, and the queen commences laying in the new combs, as soon as the cells are fairly started.

If the combs are not removed *too fast*, and care is taken not to deprive the stock of so much brood that the bees cannot maintain a vigorous population, a queen in a hive so managed, will lay her eggs in cells to be nurtured by the bees, instead of being eaten up; and thus, in the course of the season, she may become the mother of three or four times as many bees, as are reared in a hive under other circumstances. By careful management, brood enough may, in this way, be taken from a single hive, to build up a large number of nuclei. Towards the close of the season, however, as such a hive has been constantly tasked in building comb and feeding young bees, nearly all its honey will have been used for these purposes, and although it may be very populous, it will surely perish, unless liberally fed. Since

the discovery that unbolted rye flour will answer so admirably as a substitute for pollen, we can supply the bees not only with honey, when none can be gathered from the blossoms, but with an abundance of bee-bread, when pollen is scarce. As I am writing this chapter, (March 29, 1853,) my bees are zealously engaged in taking flour from some old combs in front of their hives, and can be seen most beautifully moulding the little pellets on their thighs. By my moveable combs I can give them the flour, at once, in their hives, as it can easily be rubbed into an empty comb. The importance of Dzierzon's discovery of a substitute for pollen, can hardly be over-estimated. If he had done nothing more for Apiarian science, no true-hearted bee-keeper would ever allow his name to be forgotten.

In the Chapter on Feeding, I shall give more specific directions as to the way in which the cultivator must feed his bees, when he aims at increasing, as rapidly as possible, the number of his stocks. Unless this work is done with great judgment, he will often find that the more he feeds, the fewer bees he has in his hives, the cells being all occupied with honey instead of brood. Such is the passion of bees for storing away honey, that large supplies will always most seriously interfere with breeding, unless there are enough bees to build new comb, in which the queen can find room for her eggs.

I have no doubt that some who have not much experience in the management of bees, are ready to imagine that they can easily strike out a simpler and better way of increasing the number of colonies. For instance: let a full hive have half its comb and bees put into an empty one, and the work of doubling, is without further trouble, effectually accomplished. But what will the queenless hive do, under such circumstances? Why, build of course, queen cells, and

rear another. But what kind of comb will they fill their hives with, before the young queen begins to breed? Of that, perhaps, you had never thought. Let me now give the only safe rule for all who engage in the multiplication of artificial swarms. Never, under *any* circumstances, take so much comb and brood from your stock hives, as seriously to reduce their numbers. This should be to the Apiarian, as "the law of the Medes and Persians, which altereth not."

Suppose that I should divide a populous stock, at the swarming season, into four or five colonies; the probability is, that not one, if left to themselves, will be strong enough to survive the Winter. If fed in the ordinary way, and yet not supplied with combs and bees, their ruin will often be only accelerated. If, on the contrary, I take, from time to time, combs sufficient to form three or four nuclei, and strengthen the new colonies, in such a way as not to draw too severely upon the resources of the parent stock, I may expect to see them all, in due time, strong and flourishing.

In the Spring, if I desire to determine the strength of a colony principally to raising young bees, I can easily effect it by the following plan. A box is made, of the same inside dimensions with the lower hive, into which the bees of a full hive, with their combs, can all be transferred, as soon as they are gathering honey enough to build new combs. This box is now set over the old hive, which contains its complement of empty frames, or better still, of frames supplied with worker comb. As soon as the bees are strong enough to build new comb, they take possession of the lower hive, and the queen descends with them, in order to lay her eggs in the lower combs. When the lower apartment becomes pretty well filled, a large number of combs with maturing bees, may be taken from the upper one, and when the hive

below is full, they may all be safely removed. If none of the upper combs are removed, they will be filled with honey, as soon as the brood is hatched; and as they will contain large stores of bee-bread, they will answer admirably for replenishing stocks which have an insufficient supply.

If two swarms are hived together, or a very powerful stock is lodged in a hive, and immediate access given them to the upper apartment, an extraordinary quantity of honey, of excellent quality, can be secured. As soon as the bees have raised one generation of young, in the combs of the upper box, or rather in a part of them, they will use it chiefly for storing honey, and its contents may be taken from them. In flavor, it will be found to be nearly as good as honey stored in what is called "virgin comb." There is always some risk, however, in making a very large colony, that they will build an excess of drone comb, if the season is very propitious for gathering honey.

In the Chapter on the Requisites of a good hive, it was said that in size it should be adapted to the natural instincts of the bee, and yet admit of being enlarged or contracted, according to the wants of the colony placed in it. I never use a hive, the main apartment of which, holds less than a bushel. If small colonies are placed in such a hive, it may be temporarily partitioned off, to suit the size of its inmates; for if bees have too much room, they cannot so well concentrate their animal heat, and are so much discouraged that they often abandon the hive. I am aware that many judicious Apiarians recommend hives of much smaller dimensions, and I shall now give my reasons for using one so large. If a hive is too small, then in the Spring, the combs are soon filled with honey, bee-bread, and brood, and the surprising fertility of the queen bee can be turned to no efficient account. If the honey-harvest in any year is de-

ficient, such a colony is very apt to perish in the succeeding Winter; whereas in a large hive, the honey stored up in a fruitful season, is a reserve supply, for time of need. In very large hives, I have seen accumulations of honey which have been untouched for years, while by their side, stocks of the same age, in small hives, have perished by starvation.

A good early swarm in any favorable situation, will the first season, fill a hive that holds a bushel; and if there is any location in which they cannot do this, a doubled swarm should be put into the hive, or, unless the non-swarming plan is pursued, bee-keeping, as far as profit is concerned, may be abandoned. But it may be objected that if the swarm is not strong enough to fill the hive, the bees will often suffer from the cold in Winter, and become too much reduced in numbers, to build early and rapidly, in the ensuing Spring. This is undoubtedly true, and hence the importance of putting, at the start, a generous allowance of bees into a hive, unless, as on my plan, the requisite strength can be given to them, at a subsequent period. The hive, if large, should be all the more carefully protected from extremes of cold, in order to give the bees an opportunity of developing, to the best advantage, their natural powers of reproduction.

In such a hive, the queen will be able to breed almost every month in the year, even in the coldest climates where bees can flourish, and on the return of Spring, thousands of young bees will be found in it, which could not have been bred in a small, or badly protected hive. The Polish hives have already been referred to. Some of these hold about three bushels, and yet the bees swarm with great regularity, and the swarms are often of immense size. These hives are admirably protected, and at the time of hiving, at least *four* times the number of bees are lodged in them, that are

ordinarily put into one of our hives. The queen, in such a hive, has ample room to lay daily, her three thousand or more eggs, and an immense colony is raised, which often stores enormous supplies of honey. As all the frames in my hives are of the same dimensions, the size of the hive may be conveniently varied, to suit the views of different bee-keepers; for it may be large or small, according to the number of frames designed to be used.

This whole subject of the proper size of hives, certainly needs to be taken entirely out of the region of conjecture, and put upon the basis of careful observations. Unquestionably, the size will require, in some respects, to be modified by the more or less favorable character of a district, for bee-keeping; but I am satisfied that small hives will be found of but little profit, and that large ones, unless well stocked with bees, from the first, and thoroughly protected, will seldom answer any good end. If I should find, on further experiment, that very large hives are better, my hives are at present so constructed, that without any alteration of existing parts, they can easily be supplied with the required additions. I have already mentioned, that to save expense, I sometimes build my hives, two or three in one structure. I do not, however, wish to be considered as recommending such hives as best for general use. For some purposes, a single hive is unquestionably better, as it can be easily moved by one person; and this will often be found to be a point of great importance.

It has been already stated that the queen bee cannot be induced to sting, by any kind of treatment however severe. The reason of this strange unwillingness to use her natural and powerful weapon, will be obvious, when we consider how indispensable to the very existence of the colony, is the preservation of her life, and that her sting, the loss of which

would cause her death, could avail but little for their defence, in case of an attack. She never uses it, except when engaged in mortal combat with another queen. As soon as the two rivals meet, they clinch, at once, with every demonstration of the most vindictive hatred. Why then, are not both often destroyed? and why are not hives, in the swarming season, almost certain to become queenless? We can never sufficiently admire the provision so simple, and yet so effectual, by which such a calamity is prevented. The queen, in the combat, never stings, unless she has such an advantage, that she can curve her body under that of her rival, so as to inflict a deadly wound, without any risk to herself! The moment that the position of the two combatants is such that neither has the advantage, but both are liable to perish, they not only refuse to sting, but disengage themselves, and suspend their conflict for a short time! It it were not for this peculiarity of instinct, such combats would very often end in the death of both the parties, and the race of bees would be in danger of becoming extinct.

The following very interesting statements are from the pen of Hon. Simon Brown, of Concord, Massachusetts, Lieutenant Governor of that Commonwealth in 1855. The observations were made in a parlor observing hive, of my invention, and were published by him, in the New England Farmer, for Oct. 1855, pages 450-1.

"On the 17th of July last, we placed in our dining-room window, an observing bee-hive, constructed of glass, so that all the operations of the bees could be plainly and conveniently seen. A comb about a foot square was placed in it, containing some brood, with plenty of workers and drones, but *without a queen.* The hive was then carefully observed by one of the ladies of the family, who has given us the following account of their doings."

"The first business the bees attended to, was to commence cells for a queen, and they prosecuted it with energy for two days. At the end of that time, a queen was taken from another colony and placed with them, upon which they pulled down the cells they had made, in less than half the time it had required to construct them, and then began to piece out and repair the comb, which needed a corner. The queen at once commenced laying, and soon filled the unoccupied cells, when she was again removed, and the bees once more began the construction of queen cells.

"The young bees now began to hatch forth, and in two weeks the family increased so fast as to make it necessary for them to prepare to emigrate. They had built six queen cells, and in about twelve days, the first queen was hatched. As soon as she was fairly born, she marched rapidly, and in the most energetic manner, over the comb, and visited the other cells in which were the embryo queens, seeming at times furious to destroy them. The workers, however, surrounded her, and prevented such wholesale murder. But for two days she was intent upon her fell purpose, and kept in almost continuous motion to effect it. On the fourteenth day the second queen was ready to come out, piping and making various noises to attract attention".

"A part of the colony then seemed to conclude that it was time to take the first queen and go, but by some mistake she remained in the hive after the swarm had left. The second queen came out as soon as possible after the others had gone, and then there were now *two* hatched queens in the hive! they ran about on the comb, which was now nearly empty, so that they could be distinctly seen. But they had not apparently, noticed each other, while the workers were in a state of great uneasiness and commotion, seeming impatient for the

destruction of one of them. The mode they adopted to accomplish it was of the most deliberate and cold-blooded kind. A circle of bees kept one queen stationary, while another party dragged the other up to her, so that their heads nearly touched, and then the bees stood back, leaving a fair field for the combatants, in which one was to gain her laurels, and the other to die! The battle was fierce and sanguinary. They grappled each other, and like expert wrestlers, strove to inflict the fatal blow, by some sudden or adroit movement. But for some moments the parties seemed equally matched; no advantage could be gained on either side. The bees stood looking calmly on the dreadful affray, as though they themselves had been the heroes of a hundred wars. But the battle, like all others, had its close; one fell upon the field, and was immediately taken by the workers and carried out of the hive. By this time, the bees which had swarmed, made the discovery that their queen was missing, and although they had been hived without any trouble, came rushing back, but not in season to witness the fatal battle, and the fall of their poor slain queen, who should have gone forth with them to seek a future home."

The unwillingness of a colony deprived of its queen, to receive another, until after some time, must always be borne in mind, by those who make artificial swarms. About 24 hours must elapse, before it will be safe to introduce a strange mother into a queenless hive; and even then, if she is not fertile, she runs a great risk of being destroyed. To prevent such losses, I adopt the German plan of confining the queen, in what they call, "a queen cage." A small hole, about as large as a thimble, may be made in a block, and covered over with wire gauze, or any kind of perforated cover, so that when the queen is confined in it, and placed in the hive,

the bees cannot destroy her. Before long, they will cultivate an acquaintance, by thrusting their antennæ through, to her ; so that when she is liberated the next day, they will gladly adopt her, in place of the one they have lost. If a hole large enough for her to creep out, is closed with wax, they will gnaw the wax away, and liberate her themselves, from her confinement. Queens that seem bent on departing to the woods, may be confined in the same way, until the colony gives up all thoughts of forsaking its hive. A small paste-board box with suitable holes, or a wooden mach-box thoroughly scalded, I have found to answer a very good purpose.

I shall here describe what may be called a *Queen Nursery*, which I have contrived, to aid those who are engaged in the rapid multiplication of colonies by artificial means. A solid block about an inch and a quarter thick, is substituted for one of my frames; holes, about one and a half inches in diameter, are bored through it, and covered on both sides with gauze wire, which should be permanently fastened on one side, and arranged in the form of slides, or the other for convenience in opening. A hole should be made in the wire large enough to admit a worker, and yet confine the young queen when hatched.

If the Apiarian has a number of sealed queens, and there is danger that some may hatch, and destroy the others, before he can make use of them in forming artificial swarms, he may very carefully cut out the combs containing them, (p. 190,) and place each in a separate cradle! The bees having access to them, will give them proper attention, supplying them with food as soon as they are hatched, and thus they will always be on hand, for use when needed. This nursery must of course be established in a hive which has no mature queen, or it will quickly be transformed into a slaughter house by the bees.

In the first edition of this work, in speaking of the Queen Nursery, I remarked as follows: "I have not yet tested this plan so thoroughly as to be *certain* that it will succeed; and I know so well, the immense difference between theoretical conjectures and practical results, that I consider nothing in the bee line, or indeed in any other, as established, until it has been submitted to the most rigorous demonstration, and has triumphantly passed from the mere regions of the brain, to those of actual fact. A *theory* on any subject may seem so plausible as almost to amount to positive demonstration, and yet when put to the working test, may be encumbered by some unforeseen difficulty, which speedily convinces even its sanguine projector, that it has no practical value. Nine things out of ten, may work to a charm, and yet the tenth may be so connected with the other nine, that its failure renders their success of no account. When I first used this Nursery, I did not give the bees access to it, and I found that the queens were not properly developed, and died in their cells. Perhaps they did not receive sufficient warmth, or were not treated in some other important respects, as they would have been, if left under the care of the bees. In the multiplicity of my experiments, I did not repeat this one under a sufficient variety of circumstances, to ascertain the precise cause of failure; nor have I as yet, tried whether it will answer perfectly, by admitting the bees to the queen cells."

Since writing the above, I have found that this Nursery answers perfectly the end designed, by giving the workers access to the young queens. Where rapid multiplication, however, is attempted, the nucleus system will ordinarily be found the best, for securing a sufficient number of young queens. If the Apiarian pursues the common swarming plan, he will often find it to his advantage, when hiving after-

swarms, or returning them to the old stocks, to catch the supernumerary queens, and confine them in any of his small honey boxes, with about a pint of workers to each. These small colonies may be put in any shady place, apart from the other stocks; their queens will soon become fertile, and may be easily caught, if needed for any purpose.

I often make one queen supply several hives with eggs, so as to keep them all strong in numbers, and yet constantly engaged in rearing a large number of spare queens. Two hives which I shall call A and B, are deprived at intervals of a week, each of its queen,* in order to induce them to raise a number of young sealed queens, for the use of the Apiary. As soon as the queens in A, are of an age suitable to be removed, I take them away, and give the colony a fertile queen from another hive, C; when she has laid a large number of eggs in the empty cells, I remove the sealed queens from B, and give it the loan of this fertile mother, until she has performed the same useful office for them. By this time, the queen cells in C, are sealed over; these are now removed, and the queen restored; she has thus made one circuit, and laid a very large number of eggs, in the two hives which were first deprived of their queens. After allowing her to replenish her own hive with eggs, I send her out again, on her perambulating mission, and by this new device am able to get an extraordinary number of young queens from the three hives, and at the same time preserve their numbers from seriously diminishing. Two queens may in this way, be made in six hives, to furnish all the supernumerary queens which will be wanted in quite a large Apiary.

It must be obvious to every intelligent Apiarian, that the

* The queens taken from such hives, may be advantageously used in forming artificial colonies.

perfect control of the comb, is the *soul* of an entirely new system of practical management, which may be modified to suit the wants of all who cultivate bees. Even the advocate of the old fashioned plan of killing the bees, can with one of my hives, destroy his faithful laborers, by shaking them into a tub of water, almost, if not quite, as speedily as by setting them over a sulpher pit; while when he has accomplished the work of death, his honey will be free from disgusting fumes, and all the labor of cutting it out of the hive, may be dispensed with. At the same time, he will have in reserve for future use, much empty worker-comb, which will be worth far more for new swarms, the coming season, than to be melted into wax.

I am now prepared to answer an objection which doubtless has been present in the minds of many, all the time that they have been reading the various processes on which I rely, for the artificial multiplication of colonies. A very large number of persons who keep bees, or who wish to keep them, are so much afraid of them, that they object entirely even to natural swarming, because they are in danger of being stung, in the process of hiving the bees. How are such persons to manage bees on a plan, which seems like bearding a lion in its very den! The truth is, that some persons are so very timid, or suffer so dreadfully from the sting of a bee, that they are every way disqualified from having anything to do with them, and ought either to have no bees upon their premises, or to entrust the care of them to others. By managing bees according to the directions furnished in this treatise, almost any one can learn, by using a bee-dress, to superintend them, with very little risk; while those who are favorites with them, may dispense entirely with any protection. I find, in short, that the risk of being

stung, is really diminished by the use of my hives; although it will be hard to convince those who have not seen them in use, that this can be so.

There is still another class, who are anxiously inquiring for some new hive or plan, by which, with little or no trouble, they may reap copious harvests of the luscious nectar. This is emphatically *the* class to seize hold of every new device, and waste their time and money, to fill the coffers of the ignorant or unprincipled. There never will be a "royal road" to profitable bee-keeping. Like all other branches of rural economy, it demands care and experience, for its profitable management; and those who have a painful consciousness that the disposition to put off and neglect, was, so to speak, born with them, and has never been got out of them, will do well to let bees alone, unless they hope, by the study of their systematic industry, to reform evil habits which are well nigh incurable.

While I feel sanguine that my system of management will ultimately be used very extensively, by skillful Apiarians,* I know too much of the world to expect that it will, with the masses, very speedily supersede other methods, even if it were so perfect, as to admit of no possible improvement. There is an inherent difficulty in rapidly introducing any system of management, however valuable, which is much in advance of the knowledge possessed by the great mass of those whose attention is called to it; while devices worse than useless, which pander to the ignorance,

* The very day on which I contrived the plan, so perfectly simple, and yet efficacious, of gaining control of the combs by these frames, I not only foresaw the consequences which would follow their adoption, but wrote as follows, in my Bee-Journal. "The use of these frames will, I am persuaded, give a new impulse to the easy and profitable management of bees; and will render the making of artificial swarms an easy operation."

conceit, or credulity of the pubiic, often find the readiest purchasers. To describe a tithe of the wonders of the bee-hive, even those most thoroughly demonstrated, is, in the estimation of many of the oldest bee-keepers, to deserve the name of a fool, a liar, or a cheat.

CHAPTER XII.

The Bee-Moth, and other Enemies of Bees. Diseases of Bees.

Of all the numerous enemies of the honey-bee, the Bee-Moth, (Tinea mellonella,) in climates of hot Summers, is by far, the most to be dreaded. So wide spread and fatal have been its ravages in this country, that thousands have abandoned the cultivation of bees in despair, and in districts which once produced abundant supplies of the purest honey, bee-keeping has become a very insignificant pursuit. Contrivances almost without number, have been devised, to defend the bees against this insidious foe, but still it continues its desolating inroads, almost unchecked, laughing as it were to scorn, at all the so-called "moth-proof" hives, and turning many of the ingenious fixtures designed to entrap or exclude it, into actual aids and comforts in its nefarious designs.

I should feel but little confidence in being able to make bee-keeping, in our country, a certain and profitable pursuit, if I could not show the Apiarian in what way he may safely bid defiance to the pestiferous assaults of this, his most implacable enemy. Having patiently studied its habits for years, I am at length able to announce a system of manage-

ment founded, in part, upon the peculiar construction of my hives, which will enable the careful bee-keeper to protect his colonies against the enemy. The *careful* bee-keeper, I say; for to pretend that the careless one, can, by any contrivance, effect this, is "a snare and a delusion;" and no well-informed man, unless steeped to the very lips, in fraud and imposture, will claim to accomplish anything of the kind. The bee-moth infests our Apiaries, just as weeds take possession of a fertile soil; and the negligent bee-keeper will find a "moth-proof" hive, when the sluggard finds a *weed-proof* soil. Before explaining the means upon which I rely, to circumvent the moth, I will give a brief description of its habits.

Swammerdam, towards the close of the 17th century, gave an accurate description of this insect, which was then called by the expressive name of the "bee-wolf." He has furnished good drawings of it, in all its changes, from the worm to the perfect moth, together with the peculiar webs or galleries which it constructs, and from which the name of Tinea Galleria, or gallery moth, has been given to it by some entomologists. He failed, however, to discriminate between the male and the female, which, because they differ so much in size and appearance, he supposed to be two different species of the wax-moth. It seems to have been a great pest in his time; and even Virgil speaks of the "dirum tineæ genus," the dreadful *offspring* of the moth; that is the worm.

This destroyer usually makes its appearance about the hives, in April or May; the time of its coming, depending upon the warmth of the climate, or the forwardness of the season. It is seldom seen on the wing, unless startled from its lurking place about the hive, until towards dark, and is evidently, chiefly nocturnal in its habits. In cloudy days, however, I

have noticed it on the wing long before sunset, and on such days, the female, when oppressed with the urgent necessity of laying her eggs, may be seen endeavoring to gain admission to the hives. She is much larger than the male, and "her color is deeper, and more inclining to a darkish gray, with small spots or blackish streaks on the interior edge of her upper wings." The color of the male inclines more to a light gray; they are so unlike that they might easily be mistaken for different species of moths. These insects are surprisingly agile, both on foot and on the wing; the motions of a bee being very slow, in comparison. "They are," says Reaumur, "the most nimble-footed creatures that I know."

"If the approach to the Apiary* be observed of a moonlight evening, the moths will be found flying or running round the hives, watching an opportunity to enter, whilst the bees that have to guard the entrances against their intrusion, will be seen acting as vigilant sentinels, performing continual rounds near this important post, extending their antennæ to the utmost, and moving them to the right and left alternately. Woe to the unfortunate moth that comes within their reach!" "It is curious," says Huber, "to observe how artfully the moth knows how to profit, to the disadvantage of the bees, which require much light for seeing objects; and the precautions taken by the latter in reconnoitering and expelling so dangerous an enemy."

The entrance of the moth into a hive, and the ravages committed by her progeny, forcibly illustrate the sad havoc which vice often makes of character and happiness, when it finds admission into the human heart, and is allowed to prey unchecked, upon all its most precious treasures; and he who would not be so enslaved by its power, as to lose all spiritual

*Bevan.

life and prosperity, must be ever on the " watch " against its fatal intrusions.

Only some tiny eggs are deposited by the moth, giving birth to a very delicate, innocent-looking worm; but let these apparently insignificant creatures once get the upper hand, and all the fragrance of the honied dome, is soon corrupted by their abominable stench; every thing beautiful and useful, is ruthlessly destroyed; the hum of happy industry is stilled, and at last, nothing is left in the desecrated hive, but a set of ravenous, half famished worms, knotting and writhing around each other, in most loathsome convolutions.

Wax is the proper food of the larvæ of the bee-moth: and upon this seemingly indigestible substance, they thrive and fatten. When obliged to steal their living, as best they can, among a powerful stock of bees, they are exposed, during their growth, to many perils, and seldom fare well enough to reach their natural size; but when rioting at pleasure, among the full combs of a feeble and discouraged population, they often attain a size and corpulence truly astonishing. If the bee-keeper wishes to see their innate capabilities fully developed, let him rear a number for himself, among some old combs, and if prizes were offered for fat and full grown worms, he might easily obtain one. In the course of a few weeks, the larva, like that of the silk worm, stops eating, and begins to think of a suitable place for encasing itself in its silky shroud. In hives where they reign unmolested, this is a work of but little difficulty; almost any place will answer their purpose, and they often pile their cocoons, one on another, or join them in long rows together; but in hives strongly guarded by healthy bees, this is a matter not very easily accomplished; and many a worm while it is cautiously prying about, to find a snug

place in which to ensconce itself, is caught by the nape of the neck, and very unceremoniously served with an instant writ of ejectment from the hive. If a hive is thoroughly made, of sound materials, and has no cracks or crevices under which the worm can retreat, being obliged to leave the interior in search of a suitable place, it runs a most dangerous gauntlet, as it passes, for this purpose, through the ranks of its enraged foes. Even in the worm state, however, its motions are exceedingly quick; it can crawl backwards or forwards, and as well one way as another; it can twist round on itself, curl up almost into a knot, and flatten itself out like a pancake! in short, it is full of stratagems and cunning devices. If obliged to leave the hive, it gets under any board or concealed crack, spins its cocoon, and patiently awaits its transformation. In most of the common hives, it is under no necessity of leaving its birth place for this purpose, being almost certain to find a crack or flaw into which it can creep, or a small space between the bottom board and the edges of the hive which rest upon it. A *very* small crevice will answer, as it enters, by flattening itself almost as much as though it had been passed under a roller, and as soon as safe from the bees, speedily begins to give its cramped tenement, the requisite proportions. It is amazing, how an insect apparently so feeble, can do this; but it will often gnaw for itself a cavity, even in solid wood, and thus enlarge its retreat, until it has ample room for making its cocoon! The time when it will break forth into a winged insect, varies with the temperature to which it is exposed. In a temperature of about 70°, I have had them spin their cocoons, and hatch in ten or eleven days; and they often spin so late in the Fall, that they remain all Winter, undeveloped, and if they survive the cold, do not emerge until the warm weather of the ensuing Spring.

If they are hatched in the hive, they leave it, to attend to the business of impregnation. In the moth state, they do not attack the hives, to plunder them of food, although having a "sweet tooth" in their head, they are easily attracted by the odor of liquid sweets. The male, having no special business in the hive, usually keeps himself at a safe distance from the bees; but the female, impelled by an irresistible instinct, seeks admission, that she may deposit her eggs where her offspring can gain the readiest access to their natural food. She carefully explores the cracks and crevices about the bottom-board, and lays her eggs among the parings of the combs, and other refuse matter which have fallen from the hive. If she enters a feeble or discouraged stock, where she can act her own pleasure, she will lay her eggs among the combs. In a hive where she is too closely watched to effect this, she will insert them in the corners, into the soft propolis, or in any place where there are small pieces of wax and bee-bread, which having fallen upon the bottom-board, furnish a temporary place of concealment for her progeny, and also the requisite nourishment, until they have strength and enterprise enough to reach the main combs of the hive, and fortify themselves there. "As soon as hatched,* the worm encloses itself in a case of white silk, which it spins around its body; at first it is like a mere thread, but gradually increases in size, and during its growth, feeds upon the cells around it, for which purpose it has only to put forth its head, and find its wants supplied. It devours its food with great avidity, and consequently increases so much in bulk, that its gallery soon becomes too short and narrow, and the creature is obliged to thrust itself forward and lengthen the gallery, as well to obtain more room as to procure an addi-

* Bevan.

tional supply of food. Its augmented size exposing it to attacks from surrounding foes, the wary insect fortifies its new abode with additional strength and thickness, by blending with the filaments of its silken covering, a mixture of wax and its own excrement, for the external barrier of a new gallery, the *interior* and partitions of which are lined with a smooth surface of white silk, which admits the occasional movements of the insect, without injury to its delicate (?) texture. In performing these operations, the insect might be expected to meet with opposition from the bees, and to be gradually rendered more assailable as it advanced in age. It never, however, exposes any part but its head and neck, both of which are covered with stout helmets or scales impenetrable to the sting of a bee, as is the composition of the galleries that surround it." As soon as it has reached its full growth, it seeks in the manner before described, a secure place for undergoing its changes into a winged insect.

Before describing how I protect my hives from this deadly pest, I shall first show why the bee-moth has so wonderfully increased in numbers in this country, and how the use of patent hives has so powerfully contributed to encourage its ravages. It ought to be borne in mind that our climate is altogether more propitious to its rapid increase, than that of Great Britain. Our intensely hot summers develop insect life most rapidly and powerfully, and those parts of our country where the heat is most protracted and intense, have, as a general thing, suffered most from the devastations of the bee-moth.

The honey bee is not a native of the American continent, but was brought here by colonists from Great Britain, and was called by the Indians, the white man's fly. Longfellow, in his "Song of Hiawatha," in describing the advent of the

European to the New World, makes his Indian warrior say :

> "Wheresoe'er they move, before them
> Swarms the stinging fly, the Ahmo,
> Swarms the bee, the honey-maker;
> Wheresoe'er they tread, beneath them
> Springs a flower unknown among us,
> Springs the White man's Foot in blossom."*

With the bee, was introduced its natural enemy, created for the special purpose, not of destroying the insect, on whose industry it thrives, and whose extermination would be fatal to the moth itself, but that it might gain its livelihood, as best it could, in this busy world. Finding itself in a country whose climate is exceedingly propitious to its rapid increase, it has multiplied and increased a thousand fold, until now there is hardly a spot where bees inhabit, which is not infested by its powerful enemy.

I have often listened to glowing accounts of the vast supplies of honey obtained by the first settlers, from their bees. Fifty years ago, the markets in our large cities were much more abundantly supplied than they now are, and it was no uncommon thing, to see, exposed for sale, large washing-tubs filled with beautiful honey. Various reasons have been assigned for the present depressed state of Apiarian pursuits. An old German adage, runs thus :

> "Bells' ding dong,
> And choral song,
> Deter the bee
> From industry :
> But hoot of owl,
> And "wolf's long howl,"
> Incite to moil
> And steady toil."

In accordance with this, many, at the present time, contend that newly settled countries, are altogeter most favorable

* The white clover, a plant unknown to the aborigines.

to the labors of the bee: others, that we have overstocked our farms with bees, so that they cannot find sufficient food. That neither of these reasons will account for the change, I shall prove more at length, in my remarks on Honey, and when I discuss the question of overstocking a district with bees. Others lay all the blame upon the bee moth, and others still, upon our departure from the good old-fashioned way of managing bees. That the bee-moth has multiplied astonishingly, is undoubtedly true. In many districts, it so superabounds, that the man who should expect to manage bees with as little care as his father and grandfather bestowed upon them, and yet realize as large profits, would find himself wofully mistaken. The old bee-keeper often never loooked at his bees, after swarming season, until the time came for appropriating their spoils. He then carefully "hefted" his hives, so as to be able to judge as well as he could, how much honey they contained. All which were judged too light to survive the Winter, he at once condemned; and if any were deficient in bees, or, for any other reason, appeared to be of doubtful promise, they were, in like manner, sentenced to the sulphur pit. A certain number of those containing the largest supplies of honey, were also treated in the same summary way; while the requisite number of the *very best*, were reserved to replenish his stock another season. If the same system precisely, were now followed, a number of colonies would still perish annually, through the increased devastations of the moth.

The change which has taken place in the circumstances of the bee-keeper, may be well illustrated, by supposing that when a country was first settled, weeds were almost unknown. The farmer plants his corn, and then lets it alone, and as there are no weeds to molest it, at the end of the season he harvests a fair crop. Suppose, however, that in

process of time, the weeds begin to spread more and more, until at last, this farmer's son or grandson finds that they entirely choke his corn, and that he cannot, in the old way, obtain a remunerating crop. Now listen to him, as he gravely informs you that he cannot tell how it is, but corn with him has all "run out." He manages it precisely as his father or grandfather always managed his, but somehow the pestiferous weeds will spring up, and he has next to no crops. Perhaps you can hardly, in such a case, conceive of such transparent ignorance and stupidity; but it would be difficult to show that it would be one whit greater, than that of a large number who keep bees, in places where the bee-moth abounds, and yet imagine that those plans which answered perfectly well, fifty or a hundred years ago, when moths were scarce, will answer equally well now.

If however, the old plan had been rigidly adhered to, the ravages of the bee-moth would never have been so great as they now are. The introduction of *patent hives* has contributed most powerfully, to fill the land with the devouring pest. I am perfectly aware that this is a bold assertion, and that it may, at first sight, appear to be uncourteous, if not unjust, to the many intelligent and ingenious Apiarians, who have devoted much time, and spent large sums of money, in perfecting hives designed to enable the bee-keeper to contend most successfully against his worst enemy. As I do not wish to treat such persons, with even the appearance of disrespect, I shall endeavor to show just how the use of the hives which they have devised, has contributed to undermine the prosperity of the bees. Some of these hives have valuable properties, and if they were always used in strict accordance with the enlightened directions of those who have invented them, they would undoubtedly be real and substantial improvements over the old box or straw hive, and would materially aid the

bee-keeper in his contest with the moth. The great difficulty is, that they are none of them, able to give him the facilities which alone can make him completely victorious. No hive, as I shall soon show, can ever do this, which does not give the complete and easy control of all the combs.

I do not know of a single improved hive which does not aim at entirely dispensing, with the old-fashioned plan of killing the bees. Such a practice is denounced as being almost as cruel and silly as to kill a hen for the sake of obtaining her feathers or a few of her eggs. Now if the Apiarian can be furnished with suitable instructions, and such as he will *practice*, for managing his bees so as to avoid this necessity, then I admit the full force of all the objections which have been urged against it, and should be glad to see the following epitaph, taken from a German work, placed on every pit of brimstoned bees.

HERE RESTS
CUT OFF FROM USEFUL LABOR,
a COLONY of
INDUSTRIOUS BEES,
BASELY MURDERED
by its
UNGRATEFUL AND IGNORANT
OWNER.

I have never read the beautiful verses of the poet Thompson, without feeling all their force:

"Ah, see, where robbed and murdered in that pit
Lies the still heaving hive! at evening snatched,
Beneath the cloud of guilt-concealing night,
And fixed o'er sulphur! while, not dreaming ill,
The happy people, in their waxen cells,
Sat tending public cares;
Sudden, the dark oppressive steam ascends,
And, used to milder scents, the tender race,
By thousands, tumble from their honied dome!
Into a gulf of blue sulphureous flame."

The plain matter of fact, however, is, that in our country, almost as many bees in proportion to the stocks kept, die of starvation in their hives, as ever were killed by the fumes of sulphur. Commend me rather to the humanity of the old-fashioned bee-keeper, who put to a speedy and therefore more merciful death, the poor bees which are now, by millions, tortured by slow starvation among their empty combs!

If the use of the common patent hives could only keep the stocks strong in numbers, and if bee-keepers would always see that they were well supplied with honey, then I admit that to kill the bees would be both cruel and unnecessary. Such however, are the discouragements and losses necessarily attending the use of any hive which does not give the control of the combs, that there are few who do not continually find, that some of their stocks are too feeble, to be worth the labor and expense of an attempt to preserve them over Winter. How many colonies are annually wintered, which are not only of no value to their owner, but are positive nuisances in his Apiary; being so feeble, in the Spring, that they are speedily overcome by the moth, and serve, only to breed a horde of destroyers, to assail the rest of his Apiary. The time spent upon them, is often as absolutely wasted, as the time devoted to an animal so incurably diseased that it can never be of any service, while by nursing it along, its owner incurs the risk of infecting his whole stock with its deadly taint. If, on the score of kindness, he should shut it up, and let it starve to death, few of us, I imagine, would care to cultivate a very intimate acquaintance with one so extremely original in the exhibition of his humanity!

Ever since the introduction of patent hives, the notion has almost universally prevailed, that stocks must not, under *any* circumstances, be voluntarily broken up; and hence, instead

of Apiaries, filled in the Spring, with strong and healthy stocks of bees, easily able to protect themselves against the bee-moth, and all other enemies, we have multitudes of colonies, which, if they had been kept on purpose to furnish food for the worms, could scarcely have answered a more valuable end, in encouraging their increase. The simple truth is, that improved hives, without an improved system of management, have done on the whole more harm than good; in no country have they been so extensively used as in our own, and no where has the moth so completely gained the ascendency. Just so far as they have discouraged bee-keepers from the old plan of killing off all their weak swarms in the Fall, just so far have they extended "aid and comfort" to the moth, and made the condition of the bee-keeper worse than it was before. That some of them might be so managed as in all ordinary cases, to give the bees complete protection against the moth, I do not, for a moment, question; but that they cannot, from the very nature of the case, answer fully in all emergencies, the ends for which they were designed, I shall endeavor to prove and not to assert.

The kind of hives of which I have been speaking, are such as have been devised by intelligent and honest men, practically acquainted with the management of bees: as for many of the "swindle-traps" which have been introduced, they not only afford the Apiarian no assistance against the inroads of the bee-moth, but are so constructed as positively to assist its nefarious designs. The more they are used, the worse off, are the poor bees: just as the more a man uses the lying nostrums of the brazen-faced quack, the further he finds himself from health and vigor.

I once met with an intelligent man who told me that he had paid a considerable sum, to a person who professed to be in possession of many valuable *secrets* in the manage-

ment of bees, and who promised, among other things, to impart to him an infallible remedy against the bee-moth. On the receipt of the money, he gravely told him that the secret of keeping the moth out of the hive, was to keep the stocks strong and vigorous! A truer declaration he could not have made, but I believe that the bee-keeper felt, notwithstanding, that he had been imposed upon, as outrageously, as a poor man would be, who after paying a quack a large sum of money, for an infallible, life-preserving secret, should be turned off with the truism, that the secret of living forever, was to keep well!

There is not an intelligent Apiarian who has been in the habit of carefully examining the operations of bees, not only in his own Apiary, but wherever he could find them, who has not seen strong stocks flourishing under almost any conceivable circumstances. They may be seen in hives of the most miserable construction, unpainted and unprotected, sometimes with large open cracks and clefts extending down their sides, and yet laughing to defiance, the bee-moth, and all other adverse influences.

Almost any thing hollow, in which bees have established themselves, will often be successfully tenanted by them for a series of years. To see such hives, as they sometimes may be seen, in possession of persons both ignorant and careless, and who hardly know a bee-moth from any other kind of moth, may at first sight well shake the confidence of the inquirer, in the necessity or value of any particular precautions to preserve his hives from the devastations of the moth.

After looking at these powerful stocks in what may be called log-cabin hives, let us examine others in the most costly hives, which have ever been constructed; in what have been called real "Bee-Palaces;" and we shall often find them weak and impoverished, infested and almost devour-

ed by the worms. Their owner, with books in his hand, and all the newest devices in the Apiarian line, unable to protect his bees against their enemies, or to account for the reason why some hives appear, like the children of the poor, almost to thrive upon ill-treatment and neglect, while others, like the offspring of the rich and powerful, are feeble and diseased, apparently in exact proportion to the means used to guard them against noxious influences, and to minister most lavishly to all their wants.

I used formerly to be much surprised to hear so many bee-keepers speak of having "good luck," or "bad luck," with their bees; but really as bees are generally managed, success or failure does seem to depend, almost entirely, upon what the ignorant or superstitious are wont to call "luck."

I shall now attempt what I have never yet seen satisfactorily done by any writer on bees; namely, to show exactly under what circumstances the bee-moth succeeds in establishing itself in a hive; thus explaining why some stocks flourish in spite of all neglect while others fall a prey to the moth, let their owner be as careful as he will. I shall finally show how, in suitable hives, and with proper precautions, it may always be kept from seriously annoying the bees.

It often happens, when a large number of stocks are kept, that in spite of all precautions, some of them are found in the Spring, so greatly reduced in numbers, that if left to themselves, they are in danger of falling a prey to the devouring moth. Bees, when in feeble colonies, seem often to lose a portion of their wonted vigilance, and as they have a large quantity of empty comb which they cannot guard, even if they would, the moth enters the hive, and deposits a large number of eggs, and thus, before the bees have become sufficiently numerous to protect themselves, the combs are filled with worms, and the destruction of the colony speedily

follows. The ignorant or careless bee-keeper is informed of the ravages which are going on in such a hive, only when its ruin is fully completed, and a cloud of winged pests issues from it, to destroy if they can, the rest of his stocks.

But how, it may be asked, can it be ascertained that a hive is seriously infested with the all-devouring worms? The aspect of the bees, so discouraged and forlorn, proclaims at once that there is trouble of some kind within. If the hive be slightly elevated, the bottom.board will be found covered with pieces of bee-bread, &c., mixed with the *excrement of the worms*, which looks almost exactly like fine grains of powder. As the bees in Spring, clean out their combs, and prepare the cells for the reception of brood, their bottom-board will often be so covered with parings of comb, and small pieces of bee-bread, that the colony may appear to be in danger of being destroyed by the worms. If, however, few or none of the *black* excrement is perceived, the refuse on the botom-board, like the shavings in a carpenter's shop, are proofs of industry, and not the signs of approaching ruin.

In the early part of the season, before the hive is replenished with bees, the Apiarian should assist them in keeping their bottom-boards clean. In the common hive this may easily be effected, by blowing a little smoke into the entrance, to cause the bees to retreat to their combs; the bottom-board may then be removed, and effectually cleansed. The manner in which this is done, in the movable-comb hive will be subsequently explained.

The most careful and experienced Apiarian will find, too often, that although he is well aware of the plague that is reigning within, his knowledge can be turned to no good account, the interior of his hive being almost as inaccessible as the interior of the human body; whereas, in my hives, it can always be ascertained, as soon as the weather is warm

enough to open them, whether a feeble colony has a fertile queen, and precautions can be taken at once to give it the strength which is indispensable, not merely to its safety, but to its ability for any kind of successful labor.

As a certain number of bees are needed in a hive, as well to warm and hatch the thousands of eggs which a healthy queen can lay, as to feed and properly develop the larvæ after they are hatched, it is evident that a feeble colony must remain so for a long time, unless it can at once be supplied with a considerable accession of numbers. Even if there were no moths in existence, to trouble such a hive, it would not be able to rear a large number of bees, until after the best of the honey-harvest had passed away: and then it would become powerful, only that its increasing numbers might devour the food, which the others had previously stored in the cells.

If a small colony has a considerable number of bees, and is able to cover and warm, at least one comb, in addition to those containing brood which they already have, I take from one of my strong stocks, a frame, having three or four thousand or more young bees, which are almost ready to emerge from their cells. These bees which require no food, and need nothing but warmth to develop them, will, in a few days, hatch in the new hive to which they are given, and thus the requisite number of workers, in the full vigor and energy of youth, will be furnished to the hive, and the discouraged queen, finding at once a suitable number of nurses* to take charge of her eggs, deposits them in the proper cells, instead of simply extruding them, to be devoured by the bees. While bees often attack full grown strangers which are introduced into their hive, they never fail to receive gladly all

* A bee, a few days after it is hatched, is as fully competent for its duties, as it ever will be, at any subsequent period of its life.

the brood comb that we choose to give them. If they are sufficiently numerous, they will always cherish it, and in warm weather, will protect it, even if it is laid against the outside of their hive!

If the bees in the weak stock, are too much reduced in numbers, to be able to cover the brood comb taken from another hive, I give them this comb with all the old bees that are clustered upon it, and shut up the hive, after supplying them with water, until two or three days have passed away. By this time, most of the strange bees will have formed an inviolable attachment to their new home, and even if a portion of them should return to the parent hive, a large number of the maturing young will have hatched, to supply their desertion. A little sugar-water scented with peppermint, may be used to sprinkle the bees, at the time that the comb is introduced, although I have never yet found that they had the least disposition, to quarrel with each other. The original settlers are only too glad to receive such a valuable accession to their scanty numbers, while the expatriated bees are too much confounded by their unexpected emigration, to feel any desire for making a disturbance. If a sufficient increase of numbers has not been furnished by one range of comb, the operation may, in the course of a few days, be repeated, and if judiciously performed, the colony will be powerful in numbers, long before the weather is warm enough to develop the bee-moth, and will thus be effectually protected from the hateful pest. If the Apiarian has not the means of reinforcing a feeble colony, he may save its empty combs from the ravages of the moth, by removing them, on their frames, from the hive, and returning them, when the colony has increased so as to be able to defend them.

A very simple change in the organization of the bee-moth would have rendered it, almost if not quite, impossible for the

bees to protect themselves from its ravages. If it had been constituted so as to require but a small amount of heat for its full development, it would have become exceedingly numerous, early in the Spring, and might then have easily entered the hives, and deposited its eggs among the combs without any hindrance; for at this season, not only is there no guard maintained, by the bees, at night, at the entrance of their hive, but large portions of their comb being left bare, are entirely unprotected. How does every fact in the history of the bee, when properly investigated, point with unerring certainty, to the power, wisdom, and goodness of Him who made it!

If there is reason to apprehend that the combs which are not occupied with brood, contain any of the eggs of the moth, these combs may be removed, and smoked with the fumes of burning sulphur; and then, in a few days, after they have been exposed to the fresh air, returned to the hive. By soaking them in clean water, for a day, they will be cleansed, and the eggs or larvæ of the moth effectually destroyed. After removing them from the water, and carefully shaking out all that you can, hang them where they will thoroughly dry. If not returned to the care of the bees, they should be kept in a clean and dry place, out of the reach of the moth.

Bees, as is well known to every experienced bee-keeper, frequently swarm so often as to endanger their destruction by the moth. When the after-swarms have left, the parent colony often contains too few bees to cover and protect their combs, from the insidious attacks of their wily enemy. As a number of weeks must elapse before the brood of the young queen matures, the colony, for a considerable time, at the season when the moths are very numerous, is constantly diminishing in numbers, and often before it can re-

plenish the exhausted hive, the destroyer has effected a fatal lodgment.

In the movable-comb hive, such calamities are easily prevented. If artificial increase is relied upon for the multiplication of colonies, it can be so conducted, as to give the moth no chance to fortify itself in the hive. No colony is ever allowed to have more combs than it can cover and protect; and the entrance to the hive may be contracted, if necessary, so that only a single bee can go in and out, at a time, and yet sufficient ventilation be given to the bees.

If natural swarming is allowed, after-swarms may be prevented from issuing, by cutting out all the queen cells but one, soon after the first swarm leaves the hive; or if it is desired to have as fast an increase of stocks, as can possibly be obtained from natural swarming, then instead of leaving the combs in the parent hive to be attacked by the moth, a certain portion of them may be taken out, when swarming is over, and given to the second and third swarms, to aid in building them up into strong stocks.

I have yet to describe the most fruitful cause of the desolating ravages of the bee-moth. If a colony has *lost its queen*, and this loss cannot be supplied, it must, inevitably, unless otherwise destroyed, fall a sacrifice to the bee-moth: and I do not hesitate to assert, that by far the larger portion of colonies which are destroyed by it, perish under precisely such circumstances! Let this be remembered by all, who have any thing to do with bees, and let them understand, that unless a remedy for the loss of the queen can be provided, they must constantly expect to lose some of their best colonies. The crafty moth is not so much to blame, after all, as we are apt to imagine; for a colony deprived of its queen, and possessing no means of securing another, would certainly perish, even if never attacked by so deadly an enemy; just as the

body of an animal, when deprived of life, will speedily go to decay, even if it is not, at once, devoured by ravenous swarms of filthy flies and worms.

In order to ascertain all the important points connected with the habits of the bee-moth, I have purposely deprived colonies, in some of my observing hives, of their queen, and have closely watched all their proceedings, when thus reduced to a state of despair. I have invariably found that in this state, they have made little or no resistance to the entrance of the bee-moth, but have allowed her to deposit her eggs, just where she pleased. The worms, after hatching, have always appeared to be even more at home than the poor dispirited bees themselves, and have grown and thrived in the most luxuriant manner. In some instances, these colonies, so far from losing all spirit to resent other intrusions, were positively the most vindictive set of bees in the whole Apiary. One, especially, assaulted every body that came near it, and when reduced in numbers to a mere handful, seemed as ready for fight as ever.

How utterly useless, then, for defending a queenless colony against the moth, are all the traps and other devices which have, of late years, been so much relied upon. If a single female gains admission into such a hive, she will lay eggs enough to destroy it in a short time, however strong. Under a low estimate, she would lay, at least, two hundred eggs in the hive, and the second generation will count by thousands, while those of the third will exceed a million.

Not only do the bees of a hive which is hopelessly queenless, make little or no opposition to the entrance of the bee-moth, and the ravages of her progeny, but by their forlorn condition, they positively invite the attacks of their destroyers. The moth seems to have an instinctive knowledge of the condition of such a hive, and no art of man can ever

keep her out. She will pass by other colonies to get at the queenless one, as though she knew that she would there find all the necessary conditions for the proper development of her young.

Among the many mysteries in the insect world, is the manner in which the moth arrives at so correct a knowledge of the condition of the queenless hives in an Apiary. It is certain that such hives very seldom maintain a guard about the entrance, and that they do not fill the air with the pleasant voice of happy industry; for, even to our dull ears, the difference between the hum of the prosperous hive, and the unhappy note of the despairing one, is sufficiently obvious: may it not be even more so to the acute senses of the provident mother, seeking a proper place for the development of her young?

The unerring sagacity of the moth, closely resembles that peculiar instinct by which the vulture, and other birds that prey upon carrion, are able to single out from the herd, a diseased animal, following it, with their dismal croakings, hovering over its head, or sitting in ill-omened flocks, on the surrounding trees, watching it as its life ebbs away, and stretching out their filthy and naked necks, and opening and snapping their blood-thirsty beaks, that they may be all ready to tear out its eyes just glazing in death, and banquet on its flesh still warm with the blood of life! Let any fatal accident befall an animal, how soon will you see them, first from one quarter of the heavens, and then from another,—

"First a speck and then a Vulture,"

speeding their eager flight to their destined prey, when only a short time before, not a single one could be seen or heard.

I have repeatedly seen powerful colonies speedily devoured by the worms, because of the loss of their queen,

when they have stood side by side with feeble colonies, which, being in possession of a queen, have been left untouched!

That the common hives furnish no sure remedy for the loss of the queen, is well known: indeed, the owner cannot, in many cases, be sure that his bees are queenless, until their destruction is certain, while not unfrequently, after keeping bees for many years, he does not even believe that there is such a thing as a queen bee! In the Chapter on the Loss of the Queen, I shall show how this loss may be ascertained, and ordinarily remedied, and thus the colony be protected from that calamity, which, more than all others, exposes them to destruction.

When a colony has become hopelessly queenless, then, moth or no moth, its destruction is certain. Even if the bees retained their wonted industry in gathering stores, and their usual energy in defending themselves against their enemies, their ruin could only be delayed, for a short time. In a few months, they would all die a natural death, and there being none to replace them, the hive would be utterly depopulated. Occasionally, such instances occur, where the bees have all died, and large stores of honey have been found untouched in their hives. This, however, but seldom happens: for they rarely escape from the assaults of other colonies, even if after the death of their queen, they do not fall a prey to the bee-moth. A motherless hive is almost always assaulted by stronger stocks, which seem to have an instinctive knowledge of its orphanage, and hasten at once, to take possession of its spoils. If it escape the Scylla of these pitiless plunderers, it is soon dashed upon a more merciless Charybdis, when the miscreant moths have ascertained its destitution. Every year, large numbers of hives are bereft of their queen, most of which are either robbed by other bees,

or sacked by the bee-moth, or first robbed, and afterwards sacked, while their owner imputes all the mischief to something else than the real cause. He might just as well imagine that the carrion birds or worms, which are devouring a dead horse, were the primary cause of its untimely end. Before the rapid dissemination of the bee-moth, large numbers of colonies annually perished, from the loss of their queens. Sometimes they were robbed by other stocks, and often the bees gradually dwindled away, leaving all their stores for their owner.

In a conversation with Judge Fishback, of Batavia, Ohio, a very intelligent and successful bee-keeper, I was informed by him, that his experience in bee-keeping began before the introduction of the bee-moth into that vicinity; and that he very often lost colonies in both the ways just described. The second season after he noticed the appearance of the moth, in his Apiary, it proved much more destructive in its ravages than at any subsequent period! I can only account for this, by supposing the bees, at first, to be unaware of the destructive nature of their new enemy, and to take, on that account, but few precautions to guard against it.

Huber informs us that his hives, in some seasons, were despoiled of their honey by the large death-head moth, (Sphinx atropos,) many of which would enter them, and leave with a large table-spoonful of honey in their abdomens! I received various specimens of honey-eating moths, from Ohio, last Summer, all of them much larger than the bee-moth. The Apiarian who sent them, spoke of them as notorious pests, consuming often a large portion of the contents of his hives. He had often caught them forcing their way into weak hives, and found, by examination, that on leaving the hive they were gorged with honey. I have never noticed any such about my Apiary.

From these remarks, the bee-keeper can gather, in this Chapter, the means on which I most rely, to protect my colonies from the bee-moth. Knowing that strong stocks supplied with a fertile queen, are always able to take care of themselves, in almost any kind of hive, I am careful to keep them in the state which is found to be so secure. If they are weak, they should be properly strengthened, and only as much comb given to them, as they can warm and defend: and if queenless, they must be supplied with the means of repairing their loss, or if that be impossible, they should at once be broken up, (See Remarks on Queenlessness,) and added to other stocks.

It cannot be too deeply impressed on the mind of the bee-keeper, that a small colony should be confined to a small space, if we wish the bees to work with the greatest energy, and offer the stoutest resistance to their numerous enemies. Bees do most unquestionably, "abhor a vacuum," if it is one which they can neither fill, warm, nor defend. Let the prudent bee-master keep his stocks strong, and they will do more to defend themselves against all intruders, than he can possibly do for them, even though he spend his whole time in watching and assisting them.

It is hardly necessary, after the preceding remarks, to say much upon the various contrivances to which so many resort, as a safeguard against the bee-moth. The idea that gauze-wire doors, to be shut daily at dusk, and opened again at morning, can exclude the moth, will not weigh much with one who has seen them flying and seeking admission, especially in dull weather, long before the bees have given over their work for the day. Even if the moth could be excluded by such a contrivance, it would require, on the part of those who use it, a regularity almost akin to that of the heavenly bodies in their course, and so sytematic, in

short, as either to be impossible, or likely to be attained by very few.

A contrivance, exceedingly ingenious to say the least, to remedy the necessity for such close supervision, is that by which the movable doors of all the hives are governed by a long lever in the shape of a hen-roost, so that they may all be closed seasonably and regularly, by the crowing and cackling tribe, when they go to bed at night, and opened again when they fly from their perch, to greet the merry morn. Alas! that so much ingenuity should all be in vain! Chickens are often sleepy, and wish to retire sometime before the bees feel that they have completed a full day's work, and some of them are so much opposed to early rising, either from ill-health, or downright laziness, that they sit moping on their roost, long after the cheerful sun has purpled the glowing East. Even if this device were perfectly successful, it could not save from ruin, a colony which has lost its queen. The truth is, that most of the contrivances on which we are instructed to rely, are just about equivalent to the lock carefully put upon the stable door, after the horse has been stolen; or to attempts to prevent corruption from fastening on the body of an animal, after the breath of life has forever departed.

Are there then no precautions to which we may resort, except by using hives which give the control of every comb? Certainly there are, and these precautions shall now be described.

Let the prudent bee-master be deeply impressed with the great importance of destroying *early* in the season, the larvæ of the bee-moth. "Prevention is," at all times, "better than cure:" a single pair of worms permitted to change into the winged insect, may give birth to some hundreds, which before the close of the season, may fill the Apiary

with thousands of their kind. The destruction of a single worm early in the Spring, may thus be more efficacious than that of hundreds at a later period. If the common hives are used, they must be sought for in their hiding places, under the edges of the hive; or the hive may be propped up, on both ends, with strips of wood, about three-eighths of an inch thick; and a piece of woolen rag put between the bottom-board and the back of the hive. Into this warm hiding-place, the full grown worm retreating to spin its cocoon, may be easily caught, and effectually dealt with. Hollow sticks, or split joints of cane may be set under the hives, to elevate them, or laid on the bottom-board, and if they have a few small openings through which the bees cannot enter, the worms will take possession of them, and may easily be destroyed.

Only provide some hollow, easily accessible to the worms when they wish to spin, and to yourself when you want them, and if the bees are in good condition, so that they will not permit the worms to spin among the combs, you can, with ease, entrap nearly all of them. If the hive has lost its queen, and the worms have gained possession of it, break it up as soon as possible, unless you prefer to reserve it as a moth breeder, to infest your whole Apiary.

In the movable-comb hive, blocks of a peculiar construction, are used, both to entrap the worms, and exclude the moth. The only place where the moth can get into these hives, is at the entrance, and this passage may be contracted to suit the size of the colony: the very shape of it is such that if the moth attempts to force an entrance, she is obliged to travel over a space, which, continually narrowing, is more and more easily defended by the bees. My traps may be slightly elevated, so that the heat and odor of the hive pass under them, and come out through small openings, into

which the moth can enter, but which do not admit her into the hive. These openings, which are much like the crevices between the common hives and their bottom-boards, the moth will enter, rather than attempt to force her way through the guards, and finding here the nibblings and parings of comb and bee-bread, in which her young can flourish, she deposits her eggs in a place where they may be reached and destroyed. All this is on the supposition that the hive has a healthy queen, and that the bees have no more comb than they can warm and defend. If there are no guards and no resistance, or at best but a very feeble one, she will not rest in any outer chamber, but will penetrate to the very heart of the citadel, and there deposit her seeds of mischief. These same blocks have also grooves which communicate with the *interior* of the hives, and which appear to the prowling worm in search of a comfortable nest, the very best place, so warm, and snug, and secure, in which to spin its web, and "bide its time." When the hand of the bee-master lights upon it, it has reason to feel that it has been caught in its own craftiness.

If asked how much will such contrivances help the careless bee-man, I answer, not one iota; nay, they will positively furnish him greater facilities for destroying his bees. Worms will spin and hatch, and moths will lay their eggs, under the blocks, and he will never remove them; thus instead of traps, he will have most beautiful devices for giving more effectual aid and comfort to his enemies. Such persons, if they ever attempt to keep bees on my plans, should use only my smooth blocks, which will enable them to regulate the entrance to the hives, and which are exceedingly important in aiding the bees to defend themselves against moths and robbers, and all other enemies which seek admission to their castle.

Let me, however, strongly advise the incorrigibly careless, to have nothing to do with bees, either on my plan of management, or any other; for they will find both time and money almost certainly thrown away; unless their mishaps open their eyes to the secret of their failure in other things, as well as in bee-keeping.

If I find that the worms, by any means, have got the upper hand in one of my hives, I take out the combs, shake off the bees, destroy the worms, and restore the combs again to the bees: if there is reason to fear that they contain eggs and small worms, they may be smoked with sulphur, or soaked in water, before they are returned. Such operations, however, will very seldom be required. Shallow vessels containing sweetened water, placed on the hives after sunset, will often entrap many of the moths. So fond are the moths of something sweet, that I have caught them *sticking fast* to pieces of moist sugar candy. Pans of milk have been recommended for entrapping the moth. If milk was as cheap as water, it might be used for such a purpose.

I cannot deny myself the pleasure of making an extract from an article* from the pen of that accomplished scholar, and well-known enthusiast in bee-culture, Henry K. Oliver, Esq. "We add a few words respecting the enemies of bees. The mouse, the toad, the ant, the stouter spiders, the wasp, the death-head moth, (Sphinx atropos,) and all the varieties of gallinaceous birds, have, each and all, "a sweet tooth," and like, very well, a dinner of raw bee. But the ravages of all these are but a baby bite to the destruction caused by the bee-moth, (Tinea mellonella.) These nimble-footed little mischievous vermin may be seen, on any evening, from early May to October, fluttering about the apiary, or running about the hives, at a speed to outstrip the swiftest

*Report on bees to the Essex County Agricultural Society, 1851.

bee, and endeavoring to effect an entrance into the door way for it is within the hive that their instinct teaches them they must deposit their eggs. You can hardly find them by day, for they are cunning and secrete themselves. 'They love darkness rather than light, because their deeds are evil.' They are a paltry looking, insignificant little grey-haired pestilent race of wax-and-honey-eating and bee-destroying rascals, that have baffled all contrivances that ingenuity has devised to conquer or destroy them."

"Your committee would be very glad indeed to be able to suggest any effectual means, by which to assist the honey-bee and its friends, against the inroads of this, its bitterest and most successful foe, whose desolating ravages are more lamented and more despondingly referred to, than those of any other enemy. Various contrivances have been announced, but none have proved efficacious to any full extent, and we are compelled to say that there really is no security, except in a very full, healthy and vigorous stock of bees, and in a very close and well made hive, the door of which is of such dimensions of length and height, that the nightly guards can effectually protect it. Not too long a door, nor too high. If too long, the bees cannot easily guard it, and if too high, the moth will get in over the heads of the guards. If the guards catch one of them, her life is not worth insuring. But if the moths, in any numbers, effect a lodgment in the hive, then the hive is not worth insuring. They immediately commence laying their eggs, from which comes, in a few days, a brownish white caterpillar, which encloses itself, all but the head, in a silken cocoon. This head, covered with an impenetratable coat of scaly mail, which bids defiance to the bees, is thrust forward, just outside of the silken enclosure, and the gluttonous pest eats all before it, wax, pollen, and exuviæ, until ruin to the stock is inevitable.

As says the Prophet Joel, speaking of the ravages of the locust, 'the land is as the garden of Eden before them, and behind them a desolate wilderness.' Look out, brethren bee lovers, and have your hives of the best unshaky, unknotty stock, with close fitting joints, and well covered with three or four coats of paint. He who shall be successful in devising the means of ridding the bee world of this destructive and mercilous pest, will richly deserve to be crowned 'King Bee,' in perpetuity, to be entitled to a never-fading wreath of budding honey flowers, from sweetly breathing fields, all murmuring with bees, to be privileged to use, during his natural life, 'night tapers from their waxen thighs,' best wax candles, (two to the pound!) to have an annual offering from every bee-master, of ten pounds each, of very best virgin honey, and to a body guard, for protection against all foes, of thrice ten thousand workers, all armed and equipped, as Nature's law directs. Who shall have these high honors?"

It might seem highly presumptuous for me, at this early date to lay claim to them, but I beg leave to enroll myself among the list of honorable candidates, and to cheerfully submit my pretensions to the suffrages of all intelligent bee-keepers.

I have already spoken of the ravages of the mouse, and described the way in which my hives are guarded against its intrusion. That some kinds of birds are fond of bees, every Apiarian knows, to his cost; still, I cannot advise that any should, on this account, be destroyed. It has been stated to me, by an intelligent observer, that the King-bird, which devours them by scores, confines himself always, in the seasons of drones, to those fat and lazy gentlemen of leisure. I fear however, that this, as the children say, "is too good news to be true," and that not only the industrious portion of the busy community fall a prey to his fatal snap, but that the luxuri-

ous gourmand can distinguish perfectly well, between an empty bee in search of food, and one which is returning full laden to its fragrant home, and whose honey-bag sweetens the delicious tit-bit, as the unfortunate owner, all ready sugared, glides daintily down his voracious maw! Drones are not in the habit of visiting honey-producing trees when in blossom, and yet king-birds are often seen plying their vocation in such trees. Still, I have never yet been willing to destroy a bird, because of its fondness for bees; and I advise all lovers of bees to have nothing to do with such a foolish practice.

Unless we can check among our people, the stupid, as well as inhuman custom of destroying so wantonly, on any pretence, and often on none at all, the insectivorous birds, we shall soon, not only be deprived of their aerial melody, among the leafy branches, but shall lament over the ever increasing horde of destructive insects, which ravage our fields and desolate our orchards, and from whose successful inroads, nothing but the birds can ever protect us. Think of it, ye who can enjoy no music made by these winged choristers of the skies, except, that of their agonizing screams, as they fall before your well-aimed weapons, and flutter out their innocent lives before your heartless gaze! Drive away as fast and as far as you please, from your cruel premises, all the little birds that you cannot destroy, and then find, if you can, those who will sympathize with you, when the caterpillars weave their destroying webs over your leafless trees, and insects of all kinds riot in glee, upon your blasted harvests!

It is to be hoped that such a healthy public opinion will soon prevail, that the man or boy who is armed with a gun to shoot the little birds, will be scouted from all humane and civilized society, and if caught about such contemptible business, will be too much ashamed even to look an honest man in the face. I shall close what I have to say about the birds,

with the following beautiful translation of an old Greek poet's address to the swallow.

"Attic maiden, honey fed,
Chirping warbler, bear'st away
Thou the busy buzzing bee,
To thy callow brood a prey?
Warbler, thou a warbler seize?
Winged, one with lovely wings?
Guest thyself, by Summer brought,
Yellow guests whom Summer brings?
Wilt not quickly let it drop?
'T is not fair, indeed 'tis wrong,
That the ceaseless warbler should
Die by mouth of ceaseless song."
Merivale's Translation.

The toad is a well-known devourer of bees. Sitting before a hive, toward evening, he will seize many a late-returning bee; but as he is also a diligent consumer of various insects injurious to the garden and nursery, he can plead equal immunity with the insectiverous birds.

It may seem amazing that birds and toads are able to swallow bees, without incurring the risk of death from their formidable stings. They seldom, however, meddle with any except such as are returning fully laden with honey to their hives, or being away from home, are more indisposed to resent an injury. The bees are usually swallowed whole, and, as they are not crushed, do not instinctively thrust out their stings; before they can recover from their surprise, they are safely entombed, and speedly perish from the want of air. In some cases, the bees taken from the crop of a king bird, have been known to recover when exposed to the sun, and to fly away apparently unharmed.

My limits forbid me to speak at length of the other enemies of the honied race: nor is it necessary. If the Apiarian keeps his stocks strong, they will be their own best protectors, and if he does not, they would be of little value, even though

they had no enemies, ever vigilant, to watch for their halting. As Nations, which are both rich and feeble, invite attack, as well as unfit themselves for vigorous resistance, just so a commonwealth of bees, unless amply guarded by thousands ready to die in its defence, is ever liable to fall a prey to some one of its many enemies, which are all agreed in this one opinion, at least, that stolen honey is much more sweet than the slower accumulations of patient industry.

In the Chapters on Protection and Ventilation, I have spoken of the fatal effects of dysentery. This disease may be prevented by suitable precautions on the part of the bee-keeper. Let him be careful not to feed his bees, late in the season, on liquid honey, (see Chapter on Feeding,) and to keep them in dry and thoroughly protected hives.

There is one disease, called by the Germans, "foul brood," of which I know nothing by my own observation, but which is, of all others, the most fatal in its effects. The brood appear to die in the cells, after being sealed over by the bees, and the stench from their decaying bodies infects the hive, and paralyzes the bees. This disease is, in two instances, attributed by Dzierzon, to feeding bees on "American Honey," or, as we call it, Southern Honey, which is brought from Cuba, and other West India Islands. That such honey is not ordinarily poisonous, is well known: probably that used by him, was taken from diseased colonies. It is well known that if any honey or combs are taken from a hive in which this pestilence is raging, it will most surely infect the colonies to which they may be given. No foreign honey ought therefore to be extensively used, until its quality has been thoroughly tested. The extreme virulence of this disease may be inferred from the fact, that Dzierzon in one season, lost by it, between four and five hundred colonies!

There are two kinds of foul-brood, one of which the

Germans call the *dry*, and the other, the *moist* or *fœtid*. The dry appears to be only partial in its effects, and not contagious; the brood simply dying and drying up in certain parts of the combs. The moist differs from the dry in this, that the brood dies and speedily rots and softens, diffusing a noisome stench through the hive.

Queen bees are not subject to the dysentery, nor will a queen taken from a colony infected with foul brood, communicate the disease to a healthy colony or an artificial swarm.

"A hive which contained a colony suffering from foul brood, may retain the infectious matter for years, and communicate the disease, and a healthy colony placed on the spot where a diseased one stood, may catch the malady: yet it not unfrequently happens that in the midst of a diseased colony, a portion of the brood will be healthy and will mature without injury."

In Spring or Summer, when the weather is fine and pasturage abounds, the following cure for foul-brood is recommended by a German Apiarian; "Drive out the bees into an old clean hive, and shut them up in a dark place without food for twenty-four hours; prepare for them a clean hive properly fitted up with comb from healthy colonies, transfer the bees into it, and feed them with pure honey for two days, still keeping them confined. After this the hive may be placed on its old stand, and the bees permitted to fly." If any of my colonies were attacked by it, I should be tempted to burn up the bees, combs, honey and even frames, from every diseased hive; and should then thoroughly scald and smoke with sulphur, all such hives, and replenish them with bees from a healthy stock.

I have discovered that there is a peculiar kind of dysentery which does not affect all the bees of a colony, but confines its ravages to a few. In the early stages of this disease,

those attacked are excessively irritable, and will attempt to sting any person who approaches their hive. When dissected, their stomachs are found slightly discolored by the disease. In the latter stages of this complaint, they not only lose all their irascibility, but appear stupid, and may often be seen crawling on the ground, unable to fly. Their abdomens are now unnaturally swollen, and of a much lighter color than usual, being filled with a yellow matter exceedingly offensive to the smell. I have not yet ascertained the cause of this disease.

CHAPTER XIII.

Loss of the Queen.

THAT the queen of a hive is often lost, and that the ruin of the whole colony soon follows, unless the loss is seasonably remedied, are facts which ought to be well known to every bee-keeper.

The queen sometimes dies of old age or disease, and at a time when there are no worker-eggs, or larvæ of a suitable age, to supply her loss. It is evident, however, that but a small portion of the queens which perish, are lost under such circumstances. Either the bees are aware of the approaching end of their aged mother, and take seasonable precautions to rear a successor; or else she dies very suddenly, so as to leave behind her, brood of a proper age for supplying her loss. It is seldom that a queen in a hive strong in numbers and stores, dies at a period of the year when there is no brood from which another can be reared, or

when there are no drones to impregnate the one reared in her place.

In speaking of the age of bees, it has already been stated that queens commonly die in their fourth year, while none of the workers live to be a year old. Not only is the queen much longer lived than the other bees, but she is possessed of much greater tenacity of life, so that when disease overtakes the colony, she is usually among the last to perish. By an admirable provision, her death ordinarily occurs under circumstances the most favoroble for her bereaved family. If it were otherwise, a much greater number of colonies would annually perish; for as many superannuated queens die every year, some, or even most of them, might die at a season when their loss would necessarily involve the ruin of their whole colony. In non-swarming hives, I have found cells in which queens were reared, not to accompany a new swarm, but to supply the place of the old one which had died in the hive. There are a few well authenticated instances, in which a young queen has been matured before the death of the old one, but after she had become quite aged and infirm. Still, there are cases where old queens die, either so suddenly as to leave no young brood behind them, or at a season when there are no drones to impregnate the young queens.

That queens occasionally live to such an age as to become incapable of laying worker eggs, is now a well established fact. The seminal reservoir sometimes becomes exhausted, before the queen dies of old age, and as it is never replenished, she can only lay unimpregnated eggs, or such as produce drones instead of workers. This is an additional confirmation of the theory first propounded by Dzierzon. I am indebted to Mr. Wagner for the following facts. "In the Bienenzeitung, for August, 1852, Count Stosch gives us

the case of a colony examined by himself, with the aid of an experienced Apiarian, on the 14th of April, previous. The worker-brood was then found to be healthy. In May following, the bees worked industriously, and built new comb. Soon afterwards they ceased to build, and appeared dispirited; and when, in the beginning of June, he examined the colony again, he found plenty of drone brood in worker cells! The queen appeared weak and languid. He confined her in a queen cage, and left her in the hive. The bees clustered around the cage; but next morning the queen was found to be dead. Here we seem to have the commencement, progress and termination of superannuation, all in the space of five or six weeks."

In the Spring, as soon as the bees begin to fly, if their motions are carefully watched, the Apiarian may, even in the common hives, generally ascertain from their actions, whether they are in possession of a fertile queen. If they bring in water, and gather bee-bread with great eagerness, it follows, as a matter of course, that they have brood, and are anxious to obtain the means of its nourishment. If any hive does not industriously gather pollen, or accept the rye flour upon which the others are feasting, and if it refuses clean water put in empty comb, in or near the hive, then there is an almost absolute certainty, either that it has no queen, or that she is not fertile, or that the hive is seriously infested with worms, or on the very verge of starvation.

An experienced eye will decide upon the queenlessness (to use the German term,) of a hive, from the restless appearance of the bees. At this period of the year, when they first realize the magnitude of their loss, and before they have become in a manner either reconciled to it, or indifferent to their fate, they roam in an inquiring manner, in and out of the hive, and over its outside as well as inside, and

plainly manifest that some great calamity has befallen them. Often those that return from the fields, instead of entering the hive with that dispatchful haste so characteristic of a bee returning well stored to a prosperous home, linger about the entrance with an idle and very dissatisfied appearance, and the colony is restless, late in the day, and long after the other stocks are quiet. Their home, like that of the man who is cursed rather than blessed in his domestic relations, is a melancholy place: and they only enter it with reluctant and slow-moving steps!

And here, if permitted to address a friendly word of advice to every married woman, I would say, "Do all that you can to make your husband's home a place of attraction. When absent from it, let his heart glow at the very thought of returning to its dear enjoyments; and let his countenance involuntarily assume a more cheerful expression, and his joy-quickened steps proclaim, as he is approaching, that he feels in his "heart of hearts," that "there is no place like home." Let her whom he has chosen as a wife and companion, be the happy and honored Queen in his cheerful habitation: let her be the center and soul about which his best affections ever revolve. I know that there are brutes in the guise of men, upon whom all the winning attractions of a prudent, virtuous and loving wife, make little or no impression. Alas that it should be so! but who can tell, how many, even of the most hopeless cases, have been saved for two worlds, by a union with a virtuous woman, in whose "tongue was the law of kindness," and of whom it could be said, "the heart of her husband doth safely trust in her," for "she will do him good and not evil, all the days of her life."

Said a man of large experience, "I scarcely know a woman who has an intemperate husband, who did not either

marry a man whose habits were already bad, or drive her husband to evil courses, (often when such a calamitous result was the furthest possible from her thoughts or wishes,) by making him feel that he had no happy home." Think of it, ye who find that home is not full of dear delights, as well to yourselves, as to your affectionate husbands! Try how much virtue there may be, in winning words and happy smiles, and the cheerful discharge of household duties, and prove the utmost possible efficacy of love and faith and prayer, before those words of fearful agony are extorted from your despairing lips,

> "Anywhere, anywhere
> Out of the world;"

when amid tears and sighs of inexpressible agony, you are crushed with the heart-breaking conviction, that you can have no home, until you have passed into that habitation not fashioned by human hands, or inhabited by human hearts!

Is there any husband who can resist all the sweet attractions of a lovely wife? who does not set a priceless value upon the very gem of his life?

> "If such there be, go mark him well;
> High though his titles, proud his fame,
> Boundless his wealth as wish can claim,
> The wretch, concentered all in self,
> Living, shall forfeit fair renown,
> And doubly dying, shall go down
> To the vile dust from whence he sprung
> Unwept, unhonored, and unsung."—*Scott.*

When the bees commence their work in the Spring, they give, as previously stated, reliable evidence either that all is well, or that ruin lurks within. In the common hives, however, it is not always easy to decide upon their real condition. The queenless ones do not, in all cases, disclose their

misfortune, any more than all unhappy husbands or wives see fit to proclaim the full extent of their domestic wretchedness: there is a vast amount of *seeming* even in the little world of the bee-hive. One great advantage in my mode of construction is, that I am never obliged to leave anything to vague conjecture; but I can, in a few moments, open the interior, and know precisely what is the real condition of the bees.

On one occasion I found that a colony which had been queenless for a considerable time, utterly refused to raise another, and even devoured all the eggs which were given to them for that purpose! This colony was afterwards supplied with an unimpregnated queen, but they refused to accept of her, and attempted at once to smother her to death. I then gave them a fertile queen, but she met with no better treatment. Facts of a similar kind have been noticed by other observers: thus it seems that bees may not only become reconciled, as it were, to living without a mother, but may pass into such an unnatural state as not only to decline providing themselves with another, but actually to refuse one by whose agency they might be rescued from impending ruin! Before expressing too much astonishment at such foolish conduct, let us seriously inquire if it has not often an exact parallel in our obstinate rejection of the provisions which God has made in the Gospel for our moral and religious welfare.

If a colony which refuses to rear another queen, has a range of comb given to it, containing maturing brood, these poor motherless innocents, as soon as they are able to work, perceive their loss, and will proceed at once, if they have the means, to supply it! They have not yet grown so hardened by habit to unnatural and ruinous courses, as not to feel that something absolutely indispensable to their safety is wanting in their hive.

A word to the young who may read this treatise. Although enjoined to "remember your Creator in the days of your youth," you are constantly tempted to neglect your religious duties, and to procrastinate their performance until some more "convenient season." Like the old bees in a hive without a queen, that seek only their present enjoyment, forgetful of the ruin which must surely overtake them, so you may find that when manhood and old age arrive, you will have even less disposition to serve God than you now have. The fetters which bind us to sinful habits, usually strengthen with years, while both the inclination and ability to break them continually decrease.

In the Spring, as soon as the weather becomes pleasant enough for bees to fly, I carefully examine all hives which do not exhibit unmistakable evidence of health and vigor. If a queen is wanting, and the colony is small, I break it up, and add the bees to another stock. If however, the colony is very large, I prefer to unite with it a small stock which has a healthy queen.

If the queenless stock were supplied, so early in the season, with the means of raising another, there would be no drones to impregnate her, and the whole operation would prove a failure. It might be preserved until the season for drones approaches, and then have a queen given to it, but it would be in constant danger of being robbed or destroyed by the moth, while the bees, if added to another stock, can do far more service than if left to idleness in their old hive. It must be remembered that I am not like most bee keepers, on the old plan, extremely anxious to save every colony, however feeble: as I can, at the proper season, form as many as I want, and with far less trouble and expense than are required to make anything out of such discouraged stocks.

If any of my colonies are feeble in the Spring, but yet in

possession of a healthy queen, I give them combs containing maturing brood, in the mannner already described. In short, I ascertain, at the opening of the season, the exact condition of all my stocks, and apply the necessary remedies, giving to some, maturing brood, to others honey, and breaking up all whose condition demands it. If, however, the colonies were not multiplied too rapidly, and proper care was taken to winter none but strong stocks, they will need but little assistance in the Spring; and nearly all will show indubitable signs of health and vigor.

I strongly advise every one who uses my hives, to give them all a most thorough over-hauling and cleansing, as soon as the bees begin to work in the Spring. The bees of any stock may, with their combs, be transferred in a few minutes, to a clean hive; and their own hives thoroughly cleansed, and given to another transferred stock; in this way, with one spare hive, all may be lodged in habitations from which every speck of dirt has been removed. Hives thus treated, can by no possibility, harbor any of the eggs or larvæ of the moth, and may be made perfectly free from the least smell of must or mould, or anything offensive to the delicate senses of the bees.

In making this thorough cleansing, the Apiarian will learn the exact condition of each stock, and know which have spare honey, and which require food: in short, which are in need of help in any respect, and which have the requisite strength to lend a helping hand to others. If any hive need repairs, it may be put in perfect order, before being used again. Hives thus managed, if the roofs and outside covers are occasionally re-painted, will last for generations, and will be found cheaper, in the long run, than any other kind.

But I beg pardon, for making this suggestion, of the Genius of American cheapness, who so kindly presides over so many of

our manufactures, and under whose shrewd tuition we are fast beginning to believe that cheapness in the first cost of an article, is the main point to which our attention should be directed!

It is unquestionably wise to save all that we can in the cost of construction, by the greatest economy in the use of materials; we should compel every minute to yield the greatest possible result, by the employment of the most skillful workmen and ingenious machinery; but, in the name of common sense, do let us learn that slighting an article, so as to get up a mere sham, having all the appearance of reality, with none of its substance, is the shabbiest kind of pretended economy; to say nothing of the tendency of such a penny-wise system, to encourage in all the pursuits of life, the narrow and selfish policy of doing nothing thoroughly, but everything with reference to mere outside show, or the urgent necessities of the present moment.

We have yet to describe, under what circumstances, by far the larger portion of queenless hives meet with so great a calamity. After the first swarm has left with the old mother, both the parent stock and all subsequent swarms, will each have a young queen, which must always leave the hive, to be impregnated. It sometimes happens that the wings of the young female are, from her birth, so imperfect that she either refuses to sally out, or is unable to return to her hive, if she ventures abroad. In either case, the old stock, if left to its own resources, must perish. Queens, in their contests with each other, are sometimes so crippled as to unfit them for flight, while occasionally they are disabled by the rude treatment of the bees, who insist on driving them away from the royal cells.

But the great majority of queens which are lost, perish when they leave the hive in search of the drones. Their

extra size and *slower flight* make them a most tempting prey to the birds, ever on the watch in the vicinity of the hives; and many, in this way, perish. Others are destroyed by sudden gusts of wind, which dash them against some hard object, or blow them into the water; for they are, by no means, exempt from the misfortunes common to the very humblest of their race.

Queens not unfrequently, in spite of all their caution to notice the position and appearance of their habitation, make a fatal mistake on their return, and are imprisoned and destroyed as they attemp to enter the wrong hive. If suitable precautions to prevent such a calamity, are neglected, those who build their hives of uniform size and appearance, will lose many more queens than they would in the old-fashioned boxes, hardly any two of which looked just alike.

I am confident that more queens are lost, by mistaking their hives, when they return from impregnation, than from any or all other causes; and that the use of patent hives, has served, most widely, to increase the evil. Under the old system of management, the hives were usually of such a variety of shapes and sizes, that queens were materially assisted in regaining their own, even when the colonies stood very close together. For this reason, the most ignorant bee-keepers, persisting to use a miscellaneous assortment of forlorn and rickety hives, many of which are so rotten and shaky as with difficulty to hold together, are often far more successful than those whose hives are of the very best construction. The former class lose but few of their queens, while the latter class lose them in almost exact proportion to the taste and skill, which induced them to fashion all their hives alike, in size, shape and color.

As I have now come to a point of the very *greatest practical importance*, I solicit the most careful attention of all who

wish, no matter what kind of hives they use, to attain the largest profits from their bees.

In the summer of 1844, I first began to question the propriety of keeping colonies in hives placed very near to each other. For the purpose of giving my bees greater protection against extremes of heat and cold, I had recommended, in the first edition of this work, to set the hives over a trench, which I called a Protector, and very near to each other. In Summer, the bees were to receive from this trench, a cool air, through the ventilators; and in Winter, they were to be confined to their hives, and yet to have a sufficient supply of air, only moderately cool, from the Protector. After the experience of a severe winter, I found that I had been too hasty in supposing that I had given this plan a thorough trial, and that the Protector must be abandoned, because it supplied the hives, in Winter, with a damp, cellar-like air. In consequence of keeping my bees in hives of uniform appearance, and placed side by side on the Protector, I soon found that many young queens were lost, when seeking the males, and this led me to institute a careful course of observations, to ascertain under what circumstances, these young queens were ordinarily lost.

A number of hives were devoted to this experiment, being first deprived of their fertile mothers, and in a few days, supplied with unimpregnated queens. These hives were uniform in size, shape, and color, and were placed as near as possible to each other, at the same height from the ground, and all facing the same way. The ground before them, was free from trees and shrubs, so as to prevent, as far as possible, any hive having its location more easily remembered by a returning queen, from its relative position to some external object.

As fast as any colony succeeded in securing an impregnated queen, she was taken from it, and an unfertile one put in her place, as soon as the the bees would receive her. On

an average, only *one* queen in *four* was found to regain her own hive! I do not remember that the queens of the two end colonies, which being the first and the last in the row, could easily be distinguished from the others, failed in a single instance to return in safety!

The young queens in sallying forth from their hives, would take the usual precautions to mark their precise locality, but owing to the very great uniformity of the hives in size, shape, color, height, and position, it was next to impossible for them to be certain of returning to their own. Many even of the workers, were constantly making the same mistake, and entering hives adjoining their own.

If a traveler should be set down in a dark night, before a hotel in a strange city, and on rising, in the morning, should find the streets all filled with buildings precisely similar to his own, he would only be able, after an excursion abroad, to return to his proper place, by previously ascertaining its number, or counting how many houses it was from the corner! Such a numbering faculty, however, has not been given to the queen bee, nor indeed, in a state of nature, would it ever be needed: for who ever saw, in a state of nature a dozen or more hollow trees, or other places frequented by bees, all standing close together, precisely alike in size, shape, and color, and with their entrances all facing the same way, and at exactly the same height from the ground!

On describing to a friend, these observations on the loss of queens, I was highly amused to find, that in his management of the domestic hen, he had fallen into a mistake similar to that made by so many Apiarians, with their bees. For economy of room, and greater convenience of access to his setting hens, he had partitioned a long box, into a dozen or more apartments, each containing one nest. The result of this orderly arrangement was very unfortunate. The hens,

in returning to their nests, deceived by the exact similarity of the entrances, were continually making mistakes, so that often, one box would contain two or three very unamiable aspirants for the honors of maternity, while other boxes would be entirely forsaken. Many eggs were broken, more were addled, and scarcely enough chickens were hatched to establish one mother as the happy mistress of a flourishing family. Had the hens been left to follow the natural bent of their own instincts, they would have scattered their nests over the premises, and gladdened the eye of their owner, with their numerous offspring.

Through the length and breadth of our land, bee-keepers are constantly suffering heavy losses, from the close proximity and similarity of their hives, while all unsuspicious of the true cause of their misfortunes, they impute them to the bee-moth, or some of the many enemies of their industrious favorites. As far as we know, the larva of the bee-moth is the only insect whose natural food is wax, and there is no reason to suppose that it will ever be exterminated. In a state of nature, a queenless colony, or a hive whose inhabitants have died, being of no further account, Providence will continue the existence of some insect to "gather up the fragments, so that nothing may be lost."

A word, in this connection, to those timid bee-keepers who imagine that a colony of bees is seriously injured if not ruined, when they perceive the presence of a few worms or moths. Remember that nearly every old stock, however strong or healthy, has a few, at least, of these enemies lurking about its premises, but that all is safe, so long as the bees are numerous and have a healthy queen. Knowing this, I have for some years ceased to fear the assaults of the bee-moth, and if it were not for the precautions I am obliged to use, to preserve from its ravages my empty comb, when removed

from the bees, I should feel quite disposed to laugh it to scorn.

In the chapter on the bee-moth, I omitted to notice the fact, that a colony suffering for the want of food, becomes too weak and dispirited, to make any effectual opposition to the entrance of the moth, even although the stock may be strong in numbers and in possession of a fertile queen. Fewer battles, I imagine, would be fought, if the doughty combatants were always compelled to fight upon empty stomachs! and bees when reduced to the verge of starvation, become reluctant converts to non-resistant doctrines.

Since ascertaining the cause why so many queens are lost, I have visited the large Apiary of Judge Fishback of Batavia, Ohio, where I found that being compelled to set his colonies near together, he had, for years, been aware of the precautions necessary to prevent the loss of his young queens. The fronts of his hives were painted of different colors, and the entrances made to face in various ways, to assist the bees.

If possible, the hives should not stand very close together, but be scattered about over the owner's premises, so as to be, at least, ten or fifteen feet apart. If this is done, we shall soon cease to have so many complaints of the bee-moth. No bee-keeper who has his hives so arranged, that the queens are liable to make mistakes, need ever expect to escape from heavy losses. Let him put a number of swarming stocks, managed in the ordinary way, on a bench in an Apiary, under circumstances similar to those described, and he will never be able, without constant renewal, to keep their number good. The hives which do not swarm, will do well enough, retaining their fertile queen, who is in no danger of being lost: but many of those which swarm, will be robbed by other bees, or fall a prey to the bee-moth, or if they escape these calamities, will dwindle in numbers until all the occupants have perished.

As I am aware that it is highly desirable in many cases where space is limited, and in all cases where protection is to be given, at the least expense, against the high winds and cold of Winter, to keep colonies very close together, I shall now describe a plan which I have devised for doing this, without any risk of losing the young queens.

If the Apiarian resorts to artificial swarming, as he will move the old stock, which is to raise a young queen, to a new place, he may keep his colonies quite close together, without risking the loss of his queens. He must put, however, the old stocks when removed from the parent stand, in the most favorable situation, to ensure the safe return of their queen; and when Winter sets in, he may again place them as close together as he chooses.

If he relies upon natural swarming, he must proceed as follows: After hiving a new swarm, and before all the bees have passed from the sheet into the hive, remove the parent stock to a new place, where its young queen, when hatched, will make no mistake, and set the newly hived swarm on the old stand.

Before removing the newly hived swarm, fold the sheet over the bees which were not permitted to enter, say, two or three quarts, or about one quarter of the new swarm; carefully carry it to the front of the old stock from which they issued, now removed to a new stand, and fasten it, so that they may crawl into their old home. These bees, having the *swarming propensity*, will all adhere to the new location, and supply the place of those who will leave it, to return to the swarm, placed on the old stand!

If the old hive is moved without proper precautions being taken, to retain a sufficient number of laborers, it will suffer too severely in the loss of bees. The bee-keeper must be careful not to leave the queen upon the sheet with the bees

which he returns to the parent stock. Of this, however, there is little danger, if, in hiving the swarm, the bees were shaken off in front of the hive, as the queen, under such circumstances, seldom fails to make, at once, for the hive, and to enter as speedily as possible.

It is interesting to see how rapidly a queen passes into the hive, as soon as she recognizes the joyful note announcing that the bees have found a home. She quickly follows in the direction of the moving mass, and her long legs enable her to outstrip, in the race for possession, all who attempt to follow her. Other bees linger around the entrance, or fly into the air, or collect in listless knots on the sheet; but a fertile mother, marches straight forward, with an air of conscious importance, and looking neither to the right hand nor the left, glides into the hive, with the same dispatchful haste, that characterizes a bee, returning fully laden from the nectar-bearing fields!

In the Chapter on Artificial Swarming, I omitted to mention one method of forming such swarms, which may be successfully practiced. It can only be used, however, where the colonies stand at some distance from each other, and the parent hive, and that which is intended for the forced swarm, closely resemble each other, in shape, size and color. After the artificial colony is formed, both the new and old one should be set, one a little to the right, and the other to the left, of the old stand, so that the former entrance shall come between them. This will ordinarily secure a proper division of the bees, and if it does not, the one deficient in numbers, may be moved a little nearer to the old entrance. Where the colonies are so arranged as to permit of this method, it will be found very effectual; the only objection to it, being the fact, that it often requires considerable time and judgment, to apportion the right number of bees to each colony.

The bees appear to me, to have, as it were, an instinctive perception of the dangers which await their queen, when she makes her excursion in search of the drones, and often gather around her, and confine her, as though they could not bear to have her leave! I have repeatedly noticed this, although I cannot affirm with positive certainty, that the fear of losing her, is the cause of such conduct. They are usually excessively agitated when the queen leaves, and often exhibit all the appearance of swarming. If the queen of an old stock is lost in this way, her colony will gradually dwindle away. If that of an after-swarm fails to return, the bees speedily dwindle away, if they remain in the hive; as a general rule, however, they soon leave, and attempt to add themselves to other colonies.

It would be highly interesting to ascertain how bees become informed of the loss of their queen. When she is taken from them, under such circumstances as to excite the whole colony, we can easily see how they find out that she is gone; for when greatly excited, they always seek first to assure themselves of her safety; just as a tender mother, in time of danger, forgets herself in her anxiety for her helpless children! If, however, the queen is carefully removed, so that the colony is not disturbed, a day, or even more, may sometimes elapse, before they realize their loss. How do they first become aware of it? Perhaps some dutiful bee, feeling that it is a long time since it has seen its mother, and anxious to embrace her, makes diligent search for her through the hive! The intelligence that she cannot anywhere be found, is soon noised abroad, and the whole community are at once alarmed. At such times, instead of calmly conversing, by merely touching each other's antennæ, they may be seen violently striking, as it were, their antennæ together, and by the most impassioned demonstrations mani-

festing their agony and despair. I once removed the queen of a small colony, so as to cause the bees to take wing and fill the air, in search of her. She was returned in a few minutes, and yet, on examining the colony, two days after, I found that they had begun to build royal cells, in order to raise another! The queen was unhurt, and the cells were not tenanted. Was this work begun by some that refused for a long time to believe the others, when told that she was safe? Or was it begun from the apprehension that she might again be removed?

Every colony which has a new queen, should be watched, in order that the Apiarian may be seasonably apprised of her loss. The restless conduct of the bees, on the evening of the day that she fails to return, will inform the experienced bee-master of the accident which has befallen his hive. An old stock which cannot be supplied with another queen, or with the means of raising one, must be broken up, and the bees added to another colony: a new swarm must always be broken up, unless it can be supplied with a queen nearly mature, or else they will build combs unfit for the rearing of workers. If the new colony is large, it will be better, instead of breaking it up, to give it a queen from some old stock which can easily raise another. By the use of movable-comb hives, all these operations may be easily performed. If any hive has lost its young queen, it can be supplied, either with the means of raising another, or with a sealed or mature queen from other hives.

It is a very singular fact, that while a swarm which has no mature queen, builds only drone comb, a swarm possessing a young queen which has not yet become impregnated, will still, for some time continue to build worker cells. Often after the hiving of an after-swarm, the weather for some days, proves unpropitious for the flight of the drones, and in

many instances I have known more than a week to elapse, before the young queen commenced laying. In the mean time, much comb is often constructed, and if this were of unsuitable size, it would seriously interfere with the prosperity of the new colony. Who can fail to notice the admirable adaptation of all the facts yet discovered in the economy of the bee-hive, to develop to the utmost the productive power of this truly wonderful insect!

The only two facts of any importance which appear to a close observer to be inconsistent with the idea of such wise adaptation, is the fact that bees build drone comb only when not in possession of a mature queen, and that in the press of honey-gathering, other colonies often build, for convenience of storing, an excess of such combs, from which thousands of useless consumers are produced, to devour the fruits of their indefatigable industry. In a state of nature, however, and in the tropical climates of which the honey-bee is a native, no injury is experienced from these causes. The larger part of such comb will, year after year, continue to be used for storing up honey, while the bees, having ample room in their natural habitations, will in due season, build all the worker comb that the wants of the most productive queen may require. It is only in our climate of short Summers, and in our hives of such limited dimensions, that the instinct impelling the bees to build drone comb for store honey, is found at all injurious to their lasting prosperity.

As a matter of precaution, stocks that are raising young queens, or which have unimpregnated ones, may have given to them a range of comb containing brood and eggs, so that they may, in case of any accident to their queen, proceed at once, to supply their loss. This will prevent them from being so dissatisfied as to forsake the hive.

Among the signs of queenlessness, is one which has not

yet been specified. If a colony does not destroy its drones at the time when they are killed in other hives, it is a suspicious indication which demands immediate investigation. If it retains them late in the season, it is almost certain that it is not in possession of a fertile queen, although I have occasionally known a good stock to retain its drones until early in September.

The great importance of getting rid of the excess of drones has several times been referred to; I am indebted to Mr. P. J. Mahan, of Philadelphia, a most fearless and successful operator with bees, for the highly important discovery (pp. 202–3) showing the very large consumption of honey by the drones.

It is interesting to witness the deportment of the drones, when they find themselves excluded from the hive. For a while, they persist in searching for some wider opening, and vigorously strive to squeeze their bulky bodies into a smaller compass; finding this to be in vain, they stop the loaded workers on their passage to the entrance, and solicit from them the contents of their honey bags. After receiving a supply, they resume their efforts to force an entrance into the hive, until finding this impossible, they resign themselves to their hard fate, uttering, all the while, a plaintive note expressive of their anguish at such cruel treatment. Listening to their wailings, one may sometimes feel tempted to relent, and give them admission to the hive; still it is a satisfaction to reflect, that not only much honey is saved by their premature death, but that their sufferings are much less than when they are butchered by the workers. Those who use the movable-comb hive, however, will find it much more profitable, as well as merciful, to prevent them from being born, by removing drone comb from the breeding apartments.

About a week after the young queens have hatched, I ex-

amine all their hives, lifting out first, some of the central combs, which usually contain brood. If I find a comb which has eggs or larvæ, I am satisfied that they have a fertile queen, and shut up the hive; unless I wish to find her, in order to deprive her of her wings, (see p. 200.) Often I can ascertain their condition in two or three minutes. If no brood is found, I suspect that the queen has been lost, or that she has some defect which has prevented her from leaving the hive. If the brood-comb which I put into the hive, contains any newly-formed royal cells, or if the bees are building drone-comb, I *know*, without any further examination, that the queen has been lost. If the weather has been unfavorable, or the colony is quite weak, the young queen is sometimes not impregnated as early as usual, and an allowance of a few days must be made on this account. If the weather is favorable, and the colony a good one, the queen usually leaves, a day or two after she finds herself mistress of a family. In about two days more, she begins to lay her eggs. By waiting about a week before making the examination, ample allowance, in most cases, is made.

Early in October, I examine carefully all my hives, to see that they are in suitable condition for wintering. If any need feeding, (See Chapter on Feeding,) they are fed at this time. If any have too much vacant room, I partition off that part of the hive which they do not need. I always expect to find some brood in every healthy hive at this time, and if in any, I find none, and ascertain that it is queenless, I either at once break it up, or if it is strong in numbers, supply it with a queen, by adding to it some feebler stock. If bees, however, are properly attended to, at the season when their young queens are impregnated, a queenless colony will seldom be found in the Fall.

The practical bee-keeper, without further directions, will

readily perceive how any operation, which in the common hives, is performed with difficulty, if at all, is reduced to simplicity and certainty, by the control of the combs. If however, bee-keepers will be negligent and ignorant, no hive can possibly make them very successful. If they belong to the fraternity of "no eyes," who have kept bees all their lives, and do not know that there is a queen, they will probably derive no special pleasure from being compelled to believe what they have always derided as humbug or book-knowledge; although I have seen some bee-keepers, very intelligent in most matters, who have never learned the first rudiments in the natural history of the bee. Those who cannot, or will not learn for themselves, or have not leisure or disposition to manage their own bees, may yet, with my hives, entrust their care to suitable persons, who may, at the proper time, attend to all their wants.

Practical gardeners may find the management of bees, for their employers, to be quite a lucrative part of their profession. With but little extra labor and with great certainty, they may, from time to time, do all that the prosperity of the bees requires; carefully over-hauling them in the Spring, making new colonies, at the suitable period, if any are wanted, giving them their surplus honey receptacles, and removing them when full; and on the approach of Winter, putting all the colonies into proper condition, to resist its rigors. The business of the practical Apiarian, and that of the Gardener, seem very naturally to go together, and one great advantage of my hive, and mode of management, is the ease with which they may be successfully united.

Some Apiarians, after all that has been said, may still have doubts whether the young queens leave the hive for impregnation; or may think that the old ones occasionally leave, even when they do not go out to lead a swarm. Such per-

sons may easily convince themselves of the accuracy of my statements, by the following experiments: About a week after hiving a second swarm, or after the birth of a young queen in a hive, and after she has begun to lay eggs, open the hive and remove her: carry her a few rods in front of the Apiary, and let her fly; she will at once enter her own hive, and thus show that she has previously left it. If, however, an old queen is removed at any time after hiving the swarm, she will not be able to distinguish her own hive from any other, and will thus show that she has not left it, since the swarm was hived. If this experiment is performed upon a queen, impregnated the previous year, the same result will follow; for as she never left it after that event, she will have lost all recollection of its relative position in the Apiary. The first of these experiments, has been suggested by Dzierzon.

CHAPTER XIV.

The Apiary—Procuring Bees to start it—Transferring Bees from the Common Hive.

THE proper location of an Apiary, especially to one proposing to enter largely into the cultivation of bees, is a point of very great importance. If the bee-keeper is at liberty to choose his situation, his first solicitude should be, to select a region where the best pasturage for bees can be found. In some favored places, bees will accumulate large stores, while in others, perhaps only a few miles distant,* they may

* "While Huber resided at Cour, and afterwards at Vivai, his bees suffered so much from scanty pasturage, that he could only preserve

yield but small profits. After the best honey-yielding district is selected, his next inquiry will be, as to the particular spot on his own premises, best adapted for the purposes of an Apiary. And here there will be a wide field for the exercise of good judgment.

In *all* situations, protection against high winds, will contribute greatly to the prosperity of the bees, and if this cannot be given in any other way, a high board fence will pay a generous interest on its cost. The colonies ought always to be put where they will not be annoyed by foot passengers, or cattle, and should never be very near where sweaty horses will stand or pass. At the same time, if managed on the ordinary swarming plan, they should, for obvious reasons, be in full sight and sound of the rooms most occupied by the family of their owner. In regions where the Winter is severe, if the bees are to be exposed to its rigors, protection against cold must be specially regarded, in the selection of a site. (See remarks on wintering bees.)

In the Northern and Middle States, the hives, if possible, should have a southern exposure. I prefer that they should face about due south-east, as this will give the bees the benefit of the sun, during that part of the day when it will be most conducive to their welfare. The ground in front of the hives should be in grass, and ought to be mowed frequently, and kept free from weeds. The slovenly management of many bee-keepers, is not only offensive to the eye, but very injurious to their bees. In many cases, the hives are placed where many bees perish by falling into the dust and dirt, while in others they are surrounded by tall weeds and grass, in which spiders and toads find the choicest lurking places. I have seen hives placed on the ground, and so

them by feeding, although those that were located only two miles from him, were in each case storing their hives abundantly."—Bevan.

overrun with grass, that the bees were compelled to crawl through a tangled mat to enter their homes!

If the alighting boards are properly constructed, it will be best to set the hives about two feet from the ground; as this will make them most convenient for all purposes of superintendence by their owner. If the entrances and alighting boards are, however, so arranged that the bees in windy days, are liable to be blown down upon the ground, then the lower the hives stand, the better.

The cheapest, and probably the best stand for hives, is made, by driving four stakes or posts into the ground, and nailing to them two narrow strips of wood; the back parts should be at least three inches higher than the front ones, to give the proper slant to the roof to carry off rain, and to the bottom board for the purposes mentioned on page 102. Such stands may be made to accommodate a number of hives, although, unless room is very scarce, no more than two should be put upon them, and these should have an interval between them, of at least a foot. These stands, if designed for the movable-comb hive, must not slant from *right to left*, or the frames would be thrown out of level, so as to incline to each other, and this would interfere with the regular building of the combs.

I am entirely opposed, for reasons previously assigned, to the building of covered Apiaries. If the hives are properly constructed, and thoroughly painted, they may stand without any protection; and if they are not, then a simple roof of boards, which will turn the rain, and shelter them from the sun, will be all sufficient.

I prefer in the management of my own Apiary, to keep my colonies under the shade of trees. In the early part of the season, when the sun is grateful to them, it shines upon them with full power, and as soon as it becomes hot enough

to annoy them, the leafy branches furnish a shelter from its ardent rays, and diffuse around a grateful coolness. The shade, however, ought not to be too dense, nor the branches so low as to interfere with the flight of the bees; and if they are kept in the open air, during the Winter, it will often be necessary, when the cold weather sets in, to remove them from under the trees, to a more sheltered place. Those who follow the common swarming plan, will have to make all other things bend to the necessity of putting their colonies where the new swarms may always be seen or heard.

Procuring Bees to start an Apiary.

A person ignorant of bees, must rely chiefly on the honesty of those from whom he purchases. Many stocks are not worth accepting as a gift, but like a horse or cow, incurably diseased, will only prove a vexatious bill of expense. If an inexperienced person wishes to commence bee-keeping, I advise him to purchase a new swarm of bees. It ought to be large and early. Second swarms, and all late and small first swarms, should never be purchased by beginners. They are very apt, in such hands, to prove worthless. It would be safe to order a swarm of any bee-keeper, if all were of that exemplary class of whom an English Country Curate says, "In all my experience, I never yet met with a keeper of bees, who was not a respectable, well conducted member of society, and a moral, if not a religious man." This, however, is so far from being true, that some offer for sale, stocks which are worthless, or impose on the ignorant, small first swarms, and second, and even third swarms, as prime ones worth the highest market price. If the novice purchases an old stock, he may have the perplexities of

swarming, before he has obtained sufficient experience. As it may, however, be sometimes advisable that this should be done, he should, unless he makes his purchase of a man known to be honest, select his stock himself, at an hour when the bees, in early Spring, are busily engaged in plying their labors. He should choose a colony which is actively engaged in carrying in bee-bread, and which, from the large number going in and out, undoubtedly contains a vigorous population.

The hive should be removed to his own premises, at an hour when the bees are all at home; but as this may often be inconvenient, I will furnish a new, and valuable method, for removing bees at *any hour* of the day, without incurring a severe loss of workers: Blow into the entrance of the hive sufficient smoke to alarm the workers, and cause them to fill themselves with honey; considerable time will now elapse, before any of them will be ready for sallying out to the fields, during which, large numbers will return to the hive. If many still continue to return, and those at home begin to recover from their fright, and leave the hive for work, use more smoke, at intervals, for about half an hour, by which time nearly all will have returned to the hive. If any bees are clustered on the outside, they may all be driven in with smoke.

As soon as the bees are all in the hive, it should be gently inverted, and a coarse towel placed over it, and tacked fast. If thin strips of wood are laid over the cloth, and the nails driven through them, into the edges of the hive, the bees will be more easily fastened in. Set the hive on some straw, in a wagon having easy springs, and fasten it so that it will not be jolted about; and be sure, before starting, that it is *impossible* for a bee to get out. They will now have plenty of air, and the combs, from the inverted position of

the hive, will not be so liable to be jarred loose. Never purchase a hive which contains much new comb; for it will be next to impossible to move it, in warm weather, without loosening the combs.

If a new swarm is purchased, it may be brought home as follows. Furnish the person on whose premises it is to be hived, with a box holding at the very least, a cubic foot of clear contents. Let the bottom-board of this temporary hive be clamped on both ends, the clamps being about two inches wider than the thickness of the board, so that when the hive is set on the bottom-board, it will slip in between the upper projections of the clamps, and be kept an inch from the ground, by the lower ones, to allow air to pass under it. There should be a hole in the bottom-board, about four inches in diameter, and two of the same size, in the opposite sides of the box, covered with wire gauze, to give the bees an abundance of air. Three parallel strips, an inch and a half wide, may be nailed, about one-third of the way from the top of the temporary hive, at equal distances apart, so that the bees can have every opportunity to cluster; a few pieces of old comb, fastened strongly with melted rosin, will make it more acceptable to the bees. A handle made of a strip of leather, should be nailed on the top. Let the bees be hived in this box, and kept well shaded; at evening, or very early next morning, this temporary hive, which was propped up, when the bees were put into it, may be shut close to its bottom-board, and a few screws put into the upper projection of the clamps, so as to run through into the ends of the box. In such a box, bees may be safely transported, almost any reasonable distance: care being taken not to handle them roughly, and never to keep them in the sun, or in any place where they have not sufficient air. If the box is too small, or sufficient ventilators are not put in, or

if the bees are exposed to too much heat, they will be sure to suffocate. If the swarm is unusually large, and the weather excessively warm, they ought to be removed at night. Unless great care is taken in moving bees, in very hot weather, they will be almost sure to perish: therefore always be *certain* that they have an abundance of air. A good box for transporting new swarms, may be made out of an old tea-chest.

When a new swarm is brought, in this way, to its intended home, the bottom-board may be unscrewed, and the bees transferred at once, to the new hive; (See p. 161–2.) I very much prefer sending a box for the bees: one person can easily carry two such boxes, each with a swarm of bees; and if he chooses to fasten them to two poles, or to a very large hoop, he may carry four, or even more.

The following directions are given, in case the movable-comb hive is sent away to receive a swarm of bees, and should be carefully followed, whenever hives of this kind are to be transported to a distance: With small nails fasten the frames, at proper distances apart, to the rabbets on which they rest, leaving the nails to project, so that they may readily be drawn out again. Secure the surplus honey-board with nails or screws, removing the tins, and putting wire cloth over the holes. Take away the entrance blocks, and shut up the portico, by tacking in front of it, a towel, or cloth. Bees thus secured, will bear confinement for many hours, and will travel over rough roads, with perfect safety. If, however, they are to be shut up a day or more, it will be best to fasten wire cloth before the entrance, after the blocks are removed, and to leave off the surplus honey-board, after very firmly securing the top-cover. If confined too long, they will gnaw holes through a towel, or cloth. When an old colony is to be transported, the bees must be subdued

with smoke or sugar-water, before the nails can be driven to fasten the frames, and the same will be necessary, when they are to be drawn out. It would be unnecessary to invert my hives, even if it could easily be done, as the combs are so securely attached to the frames, and such a free admission of air can be given, that they bear transportation with perfect safety.

If the Apiarian wishes, the first season, to be sure, of getting some honey from his bees, he will do well to procure two good swarms, and put them both into one hive. (See p. 212.) To those who do not object to the extra expense, I strongly recommend this course. Not unfrequently, in a good season, they will obtain in spare honey from their doubled-swarm, an ample equivalent for its increased cost: at all events, such a powerful swarm lays the foundation of a flourishing stock, which seldom fails to answer all the reasonable expectations of its owner. If the Apiary is commenced with swarms of the current season, and they have an abundance of spare room in the upper boxes, there will be no swarming, that season, and the beginner will have time to make himself familiar with his bees, before being called to hive new swarms, or multiply colonies by artificial means.

Let no inexperienced person commence bee-keeping on a large scale; very few who do so, find it to their advantage, while most not only meet with heavy losses, but abandon the pursuit in disgust. By the use of my hives, the bee-keeper can easily and rapidly multiply the number of his colonies, as soon as he finds, not merely that money can be made by keeping bees, but *that he can make it.* While I believe that more profit can be realized by a careful and experienced bee-keeper, in a good situation, from a given sum invested in an Apiary, than from the same money invested

in any other branch of rural economy, I am confident, that there is none in which a careless, or inexperienced person, will be more sure to find his outlay result in an almost entire loss. An Apiary neglected or mismanaged, is far worse than a farm overgrown with weeds, or exhausted by ignorant tillage: for the land is still there, and may again, by prudent management, be made to blossom like the rose; but the bees, when once destroyed, can never be brought back to life, unless the poetic fables of the Mantuan Bard, can be accepted as the legitimate results of actual experience, and swarms of bees, instead of clouds of filthy flies, can be obtained from the carcass of a decaying animal! I have seen an old medical work in which Virgil's method of obtaining colonies of bees from the putrid body of a cow slain for this special purpose, is not only credited, but minutely described!

Transferring Bees from the Common to the Movable-Comb Hive.

The construction of my hive is such, as to permit bees to be transferred to it, from the common hives, whenever the weather is warm enough to allow them to fly.

On the 10th of November, 1852, in Northern Massachusetts, I transferred a colony which wintered in good health, and made an excellent stock.

The transfer may be made of any healthy colony, with tolerably regular comb, and if they are strong in numbers, the hive well provisioned, and the weather not too cool, they will scarcely feel the change. Should the weather be too cold, it will be found almost impossible to make a colony leave its old hive, and if the combs are cut out, and the bees removed upon them, many will take wing, and becoming

chilled, and unable to join their companions, will miserably perish.

The process of transferring bees to my hives, is performed as follows. Let the old hive be well drummed,* and the bees driven into an upper box. Set this box on the stand previously occupied by the bees; then carry the drummed hive to some convenient place, where you will be least liable to annoyance from other bees. Have here all the various implements which you will need for removing and transferring the combs: hatchet, or hammer and chisel, for prying off a side of the old box parallel, if possible, with the combs: a case knife for cutting out the combs: vessels for receiving the honey: a table or board on which to lay the brood combs: cotton twine for fastening them into the frames: and water to wash off, from time to time, the honey which will stick to your hands.

In cutting out the combs, endeavor, as far as possible, to remove them so that they may fit the frames, taking care, if the transfer is made after honey-gathering is over, to give the bees a generous allowance of honey, with all the combs containing brood, and such empty ones as are suitable for rearing workers. All combs, with large cells, except such as contain the honey which they need, should be rejected.

Having thus selected the combs to be transferred to the new hive, lay a frame upon a piece of comb, which cut a trifle large, so that it will just *crowd* into the frame, and remain in its place until the bees have time to attach it. If the size of the combs is such, that some of them cannot be

* Mr. Wagner queries whether the art of drumming out bees, was not known in the time of Chaucer, who says,

> "Out of the hives came swarms of bees,
> So hideous was the noise."

cut so as to fit, then cut them to the best advantage, and after putting them into the frames, wind some cotton twine around the upper and lower slats of the frame, so as to hold the combs in their place, until the bees can fasten them. If, however, any of the combs which do not fit, have no honey in them, they may be fastened, by dipping their upper edges into melted wax and rosin. When the combs are thus disposed of, the frames should be firmly tacked to the rabbets of the new hive; this will be more necessary, if the transfer is made so late in the season that the bees cannot obtain the propolis necessary to fasten them.

As soon as the new hive is thus prepared, shake out the bees from the box, upon a sheet in front of it, and when they have entered, set it upon the old stand. The work is now done; bees, brood, honey, bee-bread, empty combs, and all, have been nicely moved, and without more serious loss than is often incurred by a moving family, which has to mourn over some broken crockery, or other damage done in the necessary work of establishing themselves in their new home! If this operation is performed at a season of the year when there is much brood in the hive, and when the weather is cool, care must be taken not to expose the brood, so that it may become fatally chilled.

The best time for performing it, is about ten days after the voluntary or forced departure of a first swarm from the old stock. By this time, the brood left by the old queen, will all be sealed over, and old enough to bear the necessary exposure. A temperature, not lower than 70°, will do them no harm, for if exposed to such a temperature, they will hatch, even if taken away from the bees.

I have spoken of the *best* time for transferring. It may be done at any season of the year when the bees can fly without danger of being chilled, and I should not be afraid

to attempt it, in mid-winter, if the weather was as warm as it sometimes is. At the same time, *I do not recommend* that it should be done, unless a person is very anxious, for the purpose of experiment, to obtain a colony in a movable-comb hive. In my own Apiary, may be found bees which I have purchased in old box hives, of the rudest construction, and with all my experience in transferring, I am unwilling to dispossess them ; for I can use them as stock hives, and compel them to yield me swarms and bees, at pleasure. As a general rule, it is best not to transfer a stock which is well established, with the right kind of comb, in anything that will hold them and shelter them from the weather. In the great majority of instances, the bee-keeper who knows how to make swarms from such colonies, will find himself a loser, by transferring them to any other hive.

In all operations involving the transferring of bees, it is exceedingly desirable that the new hives should be put, as near as possible, where the old ones stood. If other colonies are in close proximity, the bees may be tempted to enter the wrong hives, if their position is changed only a little ; they are almost sure to do this, if the others resemble more closely than the new one, their former habitation. It will be often advisable, to transport to the distance of one or two miles, the stocks which are to be transferred. In a few weeks they may be brought back to the Apiary. In hiving swarms, and transferring stocks, great care should always be taken to prevent the bees from getting mixed with those of other colonies. If this precaution is neglected, many bees will be lost by joining other stocks, where they may be kindly welcomed, or may at once be put to death. It is exceedingly difficult to tell before hand, what kind of reception strange bees will meet with, from a colony which they attempt to join. In the working season they are much more

likely to be well received, than at any other time, especially if they come loaded with honey: still new swarms full of honey, that attempt to enter other hives, are often killed at once. If a colony which has an unimpregnated queen, seeks to unite with another which has a fertile one, they are, almost as a matter of course, at once destroyed! If by moving their hive, or in any other way, bees are made to enter a hive containing an unimpregnated queen, they will often destroy her, if they came from a family which was in possession of a fertile one! If any thing of this kind is ever attempted, the queen ought first to be confined in a queen cage. If while attempting a transfer of the bees to a new hive, I am apprehensive of robbers attacking the combs, or am pressed for want of time, I put only such combs as contain brood into the frames, and set the others in a safe place. The bees are now allowed to enter their new hive, and the other combs are given to them at a more convenient time. The whole process of transferral need not occupy more than an hour, and in some cases it can be done in fifteen minutes. If the weather is hot, the combs must not be exposed at all to the heat of the sun.

Until I had tested the feasibility of transferring bees from the old hives, by means of my frames, I felt irreconcilably opposed to any attempt to dislodge them from their previous habitation. Who can look, without disgust, when bees are transferred in the usual way, upon the wanton destruction of thousands of their young, and the silly waste of comb, which can be replaced only by the consumption of large quantities of honey? In the great majority of such cases, the transfer, unless made about the swarming season, and *previous* to the issue of the first swarm, will be an entire failure, and if made before, at best only one colony is obtained, instead of the two, which are secured on my plan.

I never advise the transfer of a colony into *any* hive, unless their brood combs can be transferred with them, nor is it best for any except practical Apiarians, to attempt to transfer them even to my hives. But what if a colony is so old that its combs can only breed dwarfs? When I find such a colony, I shall think it worth while to give specific directions as to how it should be managed. The truth is, that of all the many mistakes and impositions which have disgusted multitudes with the very sound of "patent hive," none has been more fatal than the notion, that an old colony of bees could not be expected to prosper. Thousands of the very best stocks have been wantonly sacrificed to this chimera; and so long as bee-keepers, instead of studying the habits of the bee, prefer to listen to the interested statements of ignorant, or enthusiastic, or fraudulent persons, thousands more will suffer the same fate. As to old stocks, the prejudice against them is just as foolish, as the silly notions of some who imagine that a woman is growing old, long before she has reached her prime. Many a man of mature years, who has married a girl or a child, instead of a woman, has often had both time enough, and cause enough to lament his folly.

It cannot be too strongly urged upon all who keep bees, either for love or for money, to be exceedingly cautious in trying any new hive, or new system of management. If you are ever so well satisfied that it will answer all your expectations, enter upon it, at first, only on a small scale; then, if it fulfills all its promises, or if *you* can make it do so, you may safely adopt it: at all events, you will not have to mourn over large sums of money spent for nothing, and numerous powerful colonies entirely destroyed. "Let well enough alone," should, to a great extent, be the motto of every prudent bee-keeper. There is, however, a golden

mean between the obstinate and stupid conservatism, which tries nothing new, and, of course, learns nothing new, and that craving after mere novelty, and that rash experimenting on an extravagant scale, which are so characteristic of a large portion of our American people. It would be difficult to find a better maxim than that which is ascribed to David Crocket: "*Be sure you're right, then go ahead.*"

What old bee-keeper has not had abundant proof that stocks eight or ten years old, or even older, are often among the very best in his whole Apiary, always healthy, and swarming with almost unfailing regularity! I have seen such hives, which for more than fifteen years, have scarcely failed, a single season, to throw a powerful swarm. (See page 14.

I have already spoken of old stocks flourishing for a long term of years, in hives of the roughest possible construction; and I shall now, in addition to my previous remarks, assign a new reason for such unusual prosperity. Without a single exception, I have found one or both of two things to be true, of every such hive. Either it was a very large hive, or else if not of unusual size, it contained a large quantity of worker-comb. No hive which does not contain a good allowance of comb, adapted to the rearing of workers, can ever in the nature of things, prove a valuable stock hive. Many hives are so full of drone combs that they breed a cloud of useless consumers, instead of the thousands of industrious bees which ought to have occupied their places in the combs.

Before closing this Chapter, I must again strongly caution all inexperienced bee-keepers, against attempting to transfer colonies from an old hive. I am determined that if any find that they have made a wanton sacrifice of their bees, they shall not impute their loss to my directions. If they persist

in making the attempt, let them, by all means, either do it at break of day, before the bees of other hives will be induced to commence robbing; or better still, let them do it, not only early in the morning, but let them carry the hive on which they intend to operate, to a very considerable distance from the vicinity of the other hives, and entirely out of sight of the Apiary. I much prefer this last plan, as I then run no risk of attracting other bees to steal the honey, and acquire mischievous habits.

The bee-keeper is very often reminded, by the actions of his bees, of some of the worst traits in poor human nature. When a man begins to sink under misfortunes, how many are ready, not simply to abandon him, but to pounce upon him like greedy harpies, dragging, if they can, the very bed from under his wife and helpless children, and appropriating all, which by any kind of maneuvering, they can possibly transfer to their already overgrown coffers! With much the same spirit, more pardonable to be sure in an insect, the bees from other hives, will gather around the one which is being broken up, and while the disconsolate owners are lamenting over their ruined prospects, will, with all imaginable rapacity and glee, bear off every drop which they can possibly seize.

CHAPTER XV.

Uniting Stocks—Wintering Bees.

Frequent allusions have been made, to the importance, for various reasons, of breaking up stocks, and uniting them to other families in the Apiary. Colonies which, late in the Fall,

or early in the Spring, are found to be queenless, ought at once to be managed thus, for even if not speedily destroyed by their enemies, they are only consumers of the stores which they gathered in their happier days.

As very small colonies, even though possessed of a healthy queen, are never able to winter as advantageously as large ones, the bees from several such colonies ought to be put together, to enable them, by keeping up the necessary animal heat, to survive the Winter with less food. A certain quantity of heat must be maintained by bees, in order to live at all, and if their numbers are too small, they can only keep it up, by eating more than they otherwise would. A small swarm will thus, not unfrequently, consume as much honey as one containing two or three times as many bees. These are facts, which have been most thoroughly tested on a very large scale. On the same principle, if a hundred persons are to occupy, with comfort, a church capable of accommodating a thousand, more fuel will be required to warm the small number, than the large one.

In uniting colonies, however, special care should be taken not to make the united stock *over-populous*. A large number of bees is desirable, but a colony containing excessive numbers, is apt to become restless, and so voracious as to be liable to dysentery. In such hives, many bees are clustered so far from the stores, that honey cannot be regularly, if at all, dispensed to them ; and as the internal heat of the colony keeps them active, they become impatient for food, separate from the cluster, and are fatally chilled. Their restlessness leads to general confusion, and an inordinate consumption of honey by those which have access to the store-combs ; and this soon brings on the dysentery. Therefore, in this matter, as well as in the formation of swarms, the

motto of the bee-keeper should be, "ne quid nimis," nothing in excess, but everything in due moderation.

If the stocks to be wintered, are in the common hives, the condemned ones must be drummed out of their old encampment, sprinkled with sugar-water scented with peppermint, or some other pleasant odor, and added to the others, (see p. 212.)

I have already stated, that bees recognize each other by the sense of smell. If there should be a thousand hives in the Apiary, the bees of any one, will, by this sense, at once detect a stranger. This may to some appear almost incredible; but it is no more so, than the well known fact, that in the darkest night, each mother, in a large flock of sheep, will, by the same sense, distinguish her own lamb from all the others. Any peculiarity in the scent of different hives, may, however, be easily removed, by some strong perfume.

A few summers ago, I made the discovery that the queen bee has a peculiar scent of her own, by which she is known to the colony, and that this is so permanent, that they will often, for a long time, adhere to any spot where she has been.

If a queen is put into a paper cone, and then removed, it will be found that the paper has, for some time, an attraction for the bees. They will run in and out, in an inquiring manner, and show that they are evidently looking for her. They will also run, in the same fashion, over our hands, after we have caught a queen, and even over the limb on which she lit, when the swarm came out.

The colonies which are to be united, ought, if possible, to stand side by side, some time before this process is attempted. This can almost always be effected by a little

management; for while it would not be safe, all at once, when other hives are near, to move a colony, even a few yards, to the right or left of the line of flight in which the bees sally out to the fields, it may be moved a slight distance one day, and a little more the next, and so on, until we have them, at last, in the desired place.

As persons may sometimes be obliged to move their Apiaries, during the working season, I will here describe the manner in which I once accomplished such a removal, so as to benefit, rather than injure the bees. Selecting a pleasant day, I moved, early in the morning, a portion of my very best stocks. A considerable number of bees from these colonies, returned, in the course of the day, to the familiar spot; after flying about for some time, in search of their hives, (if the weather had been chilly, many bees would have perished,) they at length entered those standing nearest their old homes. More of the strongest were removed, on the next pleasant day; and this process was repeated, until, at last, only one hive was left in the old Apiary. This was then removed, and but few bees returned to the old spot. I thus lost no more bees, in moving a number of hives, than I should have lost in moving one; and I conducted the process in such a way, as to strengthen some of my feeble stocks, instead of very seriously diminishing their scanty numbers. I have known the most serious losses to result from removing an Apiary in the usual manner.

The process of uniting colonies, is very simple. The combs, after the two colonies are sprinkled, are lifted out from the one to be broken up, and put, with all the bees upon them, directly into the other hive. If colonies which are to be united, do not stand near each other, and cannot be moved in the gradual manner just described, they should be removed to some distance, before a union is attempted.

If the Apiarian wishes to save any small colonies, he can confine them to one half or one third of the central part of the hive, and fill the empty ends with straw, shavings, or any good non-conductor of heat. Any one of the frames, can, in a few minutes, by being wrapped around with a piece of old cotton cloth, or even a newspaper, be fashioned into a divider, which will answer all practical purposes, and if stuffed with cotton waste, &c., it will keep the bees uncommonly warm. If a *very* small colony is to be preserved over Winter, the queen must be confined, in the Fall, and until cold weather, by the device spoken of at the bottom of the page, to prevent the bees from deserting the hive.

I shall now show how the bee-keeper who does not desire to increase his stocks, may yet obtain from a given number, the largest quantity of surplus honey. If his bees are kept in non-swarming hives, he may undoubtedly, reap a bounteous harvest from the avails of their industry. I do not, however, give the preference to this mode of bee-keeping; still there are many so situated that it may be much the best for them. Such persons, by using my hives, can pursue the non-swarming plan to the best advantage. They can manage so as to confine their queens, and thus be sure that their colonies will not suddenly leave them; a casualty to which all other non-swarming hives are sometimes liable; and by taking away the honey in small quantities, they will always give the bees ample room for storage, and yet avoid the discouragement which often follows, when large boxes are taken from them.

I have, at last, (July, 1856,) brought the device for preventing swarming, spoken of on page 202, to such perfection that it can easily be applied to almost any hive, and unless some consequences, now unforeseen, attend its use, the old queen may always be *safely* compelled to remain in the

hive. I have strong hopes that after a first swarm has been allowed to issue, it may be used to prevent all after-swarming: for if, as soon as piping is heard, it is adjusted to the hive, and kept in place about a week, the bees may allow the young queens to engage in mortal combat, and the survivor will rule as mistress of the hive.

By using what I shall call my "*non-swarmer*," the most timid persons may effectually prevent the issue of swarms. If a little smoke is used when it is adjusted to the hive, not the least annoyance will be experienced from the bees. I have ascertained, that by blowing a strong, steady stream of cold air upon bees, from a common bellows, or even from the mouth, they may be driven into their hive, or from their combs, while, as is well known, they will furiously resent a gentle current of warm breath from the lungs.

From some experiments which I have just made with this non-swarmer, I find that the entrance may be so contracted as to rub off much of the pollen from the thighs of the bees, while it still permits them to crowd into the hive! It may therefore be so adjusted as to prevent, in some cases, where it may be desirable, an excessive gathering of bee-bread. (See p. 201.)

If the old queens are removed, once in three years, the Apiarian can keep all his colonies in possession of queens, at the height of their fertility, and thus a most serious objection to the non-swarming, or as it is frequently called, the storifying system, may be avoided. If at any time, new colonies are wanted, they may be made in the manner already described.

"Queens differ much as to the degree of their fertility. Those are best, which deposit their eggs with uniform regularity, not leaving any cells unsupplied; the result of which is, that the brood will emerge at the same time, from the

same range of comb, which may again be replenished by the queen, in the same uniform manner, without losing time in seeking for empty cells, amid a number still occupied by brood. Such a queen should be preserved, till a diminution of fertility becomes apparent."—[Wagner.] It is very evident that some queens are much more orderly and systematic than others, and are thus able to dispatch a much larger amount of business!

In districts where the honey harvest is of very short continuance, the non-swarming plan may be found to yield the largest quantity of honey, and if the season should prove unfavorable for the gathering of honey, it will usually secure the largest returns from a given number of stocks. I therefore prefer to keep a considerable number of my colonies, on the storifying plan, and always secure from them, some honey, even in the most unfavorable seasons. Bee-keepers following my example, will not only be on the safe side, but will be able to determine which method the honey resources of their district, or a regard to their own convenience, will make it best for them to adopt, in order to secure the most from their bees. As a general rule, the Apiarian who increases the number of his colonies, one third in a season, making one very powerful swarm from two, (See p. 211,) will have more surplus honey from the three, than he could have obtained from the two, to say nothing of the value of his new swarms. If, at the approach of Winter, he wishes to reduce his stocks down to the Spring number, he may unite them in the manner described, appropriating all the good honey of those which he breaks up, and saving all their empty comb for the new colonies of the next season. The bees in the double stock will winter most admirably; will consume less honey, in proportion to their numbers, and be in most excellent condition when the Spring opens.

It must not, however, be forgotten, that although they eat comparatively little in the Winter, unless they have been made over-populous, they must be well supplied in the Spring; as they will then have a very large number of mouths to feed, to say nothing of the thousands of young bees bred in the hive. If any old-fashioned bee-keeper wishes, he can thus pursue the old plan, with only this modification; that he preserves the lives of the bees in the hives which he wishes to take up; secures his honey without any fumes of sulphur, and saves the empty comb, to make it worth nearly ten times as much to himself, as it would be if melted into wax. No humane bee-keeper need ever feel that there is the slightest necessity for so managing his bees as to make the comparison of Shakspeare always apposite:

> "When like the Bee, tolling from every flower
> The virtuous sweets;
> Our thighs packed with wax, our mouths, with honey,
> We bring it to the hive; and like the bees,
> Are murdered for our pains."

While I am an advocate for breaking up all stocks which cannot be wintered advantageously, I never advise that a single working-bee should be killed. Self-interest and humanity, alike forbid the unnecessary sacrifice.

Wintering Bees.

In the Chapter on protection against extremes of heat and cold, the proper principles on which the successful wintering of bees, in cold climates, depends, were discussed at some length. It was there shown how desirable it is, that the stocks should be kept as still and dry as possible, and neither too warm nor too cold. Even since the failure of a plan which seemed very promising, (see p. 124,) I have devoted much time and

thought to this most important branch of bee-keeping, but thus far without being able, except in one most important particular, available only in my hives, to make any essential improvements on the plans of others.

The usual mode of wintering bees, is to allow them to remain on their summer stands, and run the risk of all atmospheric changes; and perhaps for our Southern and South-Western States, there is no better way. In these States, colonies which are well supplied with bees and honey, are seldom exposed to any degree of cold, severe enough to do them essential harm; while the attempt to shut them up in any depositary, would often be exceedingly injurious on account of the frequent recurrence of days so warm as to excite the bees, and almost ruin them, if prevented from flying. To those living in regions so highly favored for wintering bees, but few directions will be necessary. Let them be certain that their hives contain bees enough, and food enough, and are guarded against high winds, and the entrance of mice, which are much more destructive than where the winters are colder.

The bee-keeper in cold climates, will find the Winter to be the greatest destroyer of his bees. If he sees fit to keep his stocks in the open air, he must of course, be satisfied that their resources in food and numbers, are fully adequate to meet the necessities of such a situation, Too much care cannot be taken to shelter the hives, especially their entrances, against the piercing winds, which so powerfully tend to exhaust their animal heat. Bees, if sheltered from the wind, will endure a temperature low enough to freeze mercury, without suffering as much as by exposure to a powerful and long continued current of air, some 40 or 50 degrees warmer. The winter of 1855-6, will be long remembered, not only for the uncommon degree and duration of its cold, but for

the tremendous winds, which often for days together, swept like a Polar tornado, over the land. Apiaries standing in exposed situations, were in many instances, almost wholly destroyed. The bees, having exhausted the honey in the combs where they were clustered, were unable to stir, and thus died in hives where there was an abundant supply of food.

In this connection, I will show how, in my hives, I guard bees against such a fate. It is well known, that as cold weather approachés, the bees recede from the outside combs, and gather themselves into a compact mass, in the center of the hive, so as to husband their animal heat to the best advantage. As these central combs are those most occupied for raising brood, they are seldom very generously stored with honey, and if the cold is extreme, and of very long continuance, the bees must of necessity exhaust the supplies within their reach. Strong colonies frequently having some brood, even in the depth of winter, are very reluctant to abandon it, and if the extreme cold prevents them from procuring supplies from the other combs, they prefer to die upon their brood, rather than move in a mass to those combs, even when able to do so. Such a calamity can easily be remedied by the use of the movable-comb hive. In the latter part of October, or some time before bees cease to fly, the hives should be opened, and three or four of the combs most generously stored with honey, placed in the center; care being taken that no drone comb is used for this purpose. When the bees gather towards the central combs, to economize their animal heat, they will thus find themselves not only in combs suitable for rearing workers, but such as are most amply stored with honey!

It may appear strange that the sagacity of the bee, so perfect in most respects, should seem to fail on a point of so much importance as the proper disposition of its winter stores.

To this I would reply ; 1st, that the bee is not a native of a cold climate, and that therefore its arrangements are not made with reference to such a contingency ; and 2nd, that in a state of nature, the bee, in cold climates, building long combs, in hollow trees, is not liable to be caught, as in our flat hives, in brood combs in which there is little or no honey. We might, to be sure, as in the Polish hive, guard them against this danger, by making our hives very tall, but it could only be done, by sacrificing other points of greater importance.

I shall here describe a disadvantage to which all hives with movable frames, are liable, in cold latitudes, and which, if not remedied, may often prove of serious injury to the bees. As the honey-bee is a native of a warm climate, it does not, in making passages from one comb to another, have reference to Winter, any more than it does in storing its surplus honey. In the common hive, as the combs are attached to the top and side, the bees, in order to get ready access, in Summer, from one comb to another, usually leave passages through the combs, instead of building them all solid. In mine, however, as the frames touch neither the top, sides, nor bottom of the hive, the bees have extraordinary facilities for intercommunication, and very seldom leave any holes in their combs. When cold weather surprises them, they are therefore more liable to be caught in empty combs, than colonies in hives of the usual construction. This difficulty is easily obviated. Roll up a stout piece of tin into a funnel, about five inches long, and one inch in diameter: let it be a little flaring, with a sharp edge at its smallest opening. A saw-like edge will always, if sharp, be most serviceable, in any instrument used for cutting comb. With this punch, it will take but a few moments to cut out a neat hole, in the center of each comb, a little more than one third from the top! The movable-comb hive is then much better adapted

to the easy intercommunication of the bees in winter, than one of any other construction.

To those who desire to avail themselves of some of the important improvements in my hives, and who yet are too timid to open them and properly adjust the frames for winter, I would recommend the use of slats, with my peculiar guides for securing straight combs. In hives furnished with these slats, the bees will winter, without any special care, as well as in any other hive; and if, at any time, their owner wishes to change the slats into frames, he will find no difficulty in cutting out the combs, shaking off the bees, and supplying the parts needed to complete the frames. In this way, after inventing the frames, I managed to substitute them for the slats or bars, in all the hives in my Apiary!

Not only are hives with movable frames, if not opened and adjusted for winter use, liable to the serious objection already described, but while no better than those with slats, they are more costly, and all the money invested in making the frames, is worse than thrown away. I therefore strongly advise, that slats only should be used, by all who from timidity, or any other reason, are indisposed to open their hives, and use the extraordinary facilities for the management of bees, furnished by movable frames, unless they can secure the services of a competent assistant. All money invested in frames, will be of as little service to such persons, as capital invested in labor-saving machinery, by those who cannot or will not use it.

If the hives are to be kept out of doors, it will be necessary, especially when they are not made of doubled materials, or very thick stuff, to give the bees a liberal allowance of air, guarding them at the same time from high winds. A ventilator on the bottom board, 4 inches long by 2 wide, with coarse wire-cloth nailed over the upper side, will admit all the air

needed, and in a manner the least injurious to the bees. If a few of the holes on the surplus honey-board, are left open, the moisture or breath of the bees, will ascend into the upper cover, from which it cannot, in my hive, return to annoy the colony.

When the fullest honey-combs are put in the center of the hive, in the Fall, a colony may be very much aided in resisting the cold, by removing four combs from the hive, two from each end. An empty frame well wrapped around with cloth, or even with an old newspaper, should then be set up close to the full ones, and the vacant spaces on each end, filled with cotton, shavings, straw, &c. If the combs removed have any sealed honey in them, and the hive is not amply provisioned, the caps of the cells may be sliced off, and the frames put on the spare honey-board, some of the holes leading into the hive being opened, so that the bees may remove their contents. During all these operations, smoke or sugar-water must be used, to keep the bees from annoying the operator. By confining the bees to fewer combs in the winter, they will be able to economize their animal heat to much better advantage, and the vacant spaces, filled as directed, will give them extraordinary protection against the cold.

Great caution should be used in doing anything to bees in cold weather. Irreparable mischief is often occasioned by disturbing a colony at such a time, especially, if many are tempted to separate themselves from the cluster, and some even to fly; before they become quiet again, many bees often perish, and the whole mass being disturbed, when they ought to be in almost deathless repose, are tempted to eat a much larger quantity of food than they would otherwise have needed. If, however, the weather should remain very cold for a long time, it will often be necessary to carry the

hives into a moderately warm room, until the frost is all thawed out of them, when they can again be returned to their stands. It will also be advisable, about once in six weeks, to clean the bottom-boards of dead bees. In the movable comb-hive, this is done by a small scraper made of a piece of iron wire about two feet long; this, when heated, is bent at right angles (like a poker), and the scraper part, which should be about four inches long and flattened out to one quarter of an inch wide, should be brought to an edge on both sides. With a very little smoke, by means of this scraper, the bottom-board may, in a few moments, be cleared of every dead bee, and all other refuse. (See Implements.)

If strips of wood 1-4 of an inch thick, are in the Fall, laid upon the rabbets, and the frames raised upon them, the bottoms of the frames will be 3-4 of an inch above the bottom-board of the hive; this will still allow a current of air to pass over the tops of the frames, and will give ample room for the discharge of dead bees, &c., below the frames. I should not, however, recommend this arrangement, except where passages have been made, as above described, through the combs. The frames might easily be elevated still higher above the bottom-board, by deeper strips, if on trial, any advantage was found in such an arrangement.

The bee-keeper who winters his colonies out of doors, should remember that they are never to have their entrances so closed, that they cannot fly at pleasure. Many bees, it is true, will be lost upon the snow, but often the larger part of these are diseased, and the hive is better without them. If the snow is hard enough to bear it up, a healthy bee is seldom lost, unless tempted to leave its home, by the unusual warmth of a clear sun, shining full upon the hive standing in a sheltered place. It is better, however, to lose a few bees in this way, than to incur the serious risk of shutting

up the hive. It sometimes happens that the sun comes out very warm, when the ground is covered with fleecy, new-fallen snow, the light shining upon which, so blinds the bees, that they cannot distinguish objects, or find their home, but sinking at once into the powdered snow, soon perish. At such times it would probably be better to confine the bees to the hive.

Bees when heavily loaded with fæces, are much more liable to be lost in the snow, than at any other period. It is therefore, very desirable that the first time they fly abroad after their winter confinement, the day should be calm and mild. After my bees have once made their Spring flight, and returned in safety, I apprehend but little danger from the snow; for they will not often leave the hive again until the weather is genial, and if they do, they seldom fail to return.

In latitudes where the cold is steady, and much snow falls, some Apiarians allow it to cover over their hives, and find that they winter most admirably under a snow bank! Others cover them with boughs of hemlock, or other evergreens, and then are glad to see them buried out of sight under the snow. I have known some stocks, thus cared for, to winter in perfection. If the entrance for the admission of air is sufficient, they never suffocate. (See p. 120.)

Having discussed the precautions to be observed when bees are to be wintered out of doors, or in Apiaries where they feel the various atmospheric changes, I shall now describe the methods which have been most successfully pursued, by those who aim to protect them, in a great measure, from such changes. A *very dry* cellar, where the bees can be kept in perfect darkness, and without having their hives at all jarred, is undoubtedly one of the best possible places for wintering bees. (See p. 116.)

In some countries, it is customary to deposit all the colonies

of an entire village, in a common vault or cellar. Dzierzon says, "A dry cellar is very well adapted for wintering bees, even though it be not wholly secure from frost; the temperature will still be much milder, and more uniform than in the open air; the bees will be more secure from disturbance, and will be protected from the piercing cold winds, which cause more injury than the greatest degree of cold when the air is calm."

The same writer says, "Universal experience teaches that the more effectually bees are protected from disturbance and from the variations of temperature, the better will they pass the Winter, the less will they consume of their stores, and the more vigorous and numerous will they be in the Spring. I have therefore constructed special winter quarters for my bees, near my Apiary. This is weather-boarded both outside and within, and the intervening space is filled with hay or tan, &c.; the ground plat enclosed, is dug out to the depth of three or four feet, so as to secure a more moderate and equable temperature. When my hives are placed in this depositary, and the door locked, the darkness, uniform temperature, and entire repose the bees enjoy, enable them to pass the winter securely and prosperously. I usually place here my weaker colonies, and those whose hives are not made of the warmest materials, and they always do well."

It will be obvious that if such a structure is to be partly under ground, a very dry site must be selected for it.

I shall here quote from one of the most common sense works on practical bee-keeping, which has ever been written in our language, and which I would strongly recommend every bee-keeper to purchase: I refer to the "Mysteries of bee-keeping explained, by M. Quinby." His treatise bears marks on almost every page, of being the work of an accurate, experienced, and thoroughly honest observer.

"I wished, says Mr. Quinby, "by keeping my bees warm to save them as well as honey, and at the same time, get rid of the moisture usually collected in a hive. I have found that a large family expelled it much better than small ones; and if all were put together in a close room, the animal heat from a large number combined, would be an advantage to the weak ones, at least,—this proved of some benefit. Yet I found on the side of a glass hive, that large drops of water would stand for weeks."

"The following suggestion then came to my relief. If this hive was bottom up, what would prevent all this vapor as it arises from the bees from passing off? (It always rises when warm, if permitted.) The hive was inverted;* in a few hours the glass was dry."

"This was so perfectly simple, that I wondered I had not thought of it before, and wondered still more that some one of the many intelligent apiarians had never discovered it. I immediately inverted every hive in the room, and kept them in this way till spring; when the combs were perfectly bright, not a particle of mould to be seen, and was well satisfied with the result of my experiment. Although I was fearful that more bees would leave the hives when inverted, than if right side up, yet the result showed no difference. I had now tried both methods, and had some means of judging."

* * * * * *

"I have thus wintered them for the last ten years, and am extremely doubtful if a better way can be found. For several years I made use of a small bed-room in the house, made perfectly dark, in which I put about 100 stocks. It

* Those using my hives, can leave off the spare honey-boards, when they place them in such a winter depositary; this will permit all dampness to escape, and will at the same time, prevent dead bees, and other refuse, from falling among the combs, which cannot be avoided when hives are turned up-side down.

was lathed and plastered, and no air admitted, except what might come through the floor. It was single, and laid rather close, though not matched."

"In the fall of 1849 I built a room for this purpose; the frame was eight by sixteen feet square, and seven high, without any windows. A good coat of plaster was put on the inside, a space of four inches between the siding and lath was filled with saw-dust; under the bottom I constructed a passage for the admission of air, from the north side; another over head for its exit, to be closed and opened at pleasure, in moderate weather, to give them fresh air, but closed when cold, and so arranged as to exclude all the light. A partition was extended across near the center. This was to prevent disturbing the whole by letting in light when carrying them out in the spring. By closing the door of this partition, those in one room only need be disturbed at once."

"Shelves to receive the hives were arranged in tiers one above the other; they were loose, to be taken down and put up at pleasure. Suppose we begin at the back end: the first row is turned directly on the floor, a shelf is then put across a few inches above them, and filled, and then another shelf, still above, when we again begin on the floor, and continue thus till the room is full; or if the room is not to be filled, the shelves may be fixed around the sides of the room in two or three courses. This last arrangement will make it very convenient to inspect them at any time through the winter, yet they should be disturbed as little as possible. The manner of stowing each one is to open the holes in the top, then lay down two square sticks, such as are made by splitting a board, of suitable length, into pieces about an inch wide. The hive is inverted on these; it gives a free circulation through the hive, and carries off all the moisture as fast as generated."

"The temperature of such a room will vary according to the number and strength of the stocks put in; 100 or more would be very sure to keep it above the freezing point at all times. Putting a very few into such a room, and depending on the bees to make it warm enough, would be of doubtful utility. If these means will not keep the proper temperature, probably some other method would be better. All full stocks would do well enough, as they would almost any way. Yet I shall recommend housing them whenever practicable. If the number of stocks is few, let the room be proportionably small. It is the smallest families that are most trouble: if they are too cold, it may be known by the bees leaving the hive in cold weather, and spots of excrement on the combs; they should then have some additional protection; close part or all the holes in the top, cover the open bottom partially or wholly, and confine to the hive as much as possible the animal heat; when these means fail, it may be necessary to take them to a warm room, during the coldest weather."

* * * * * *

"A few warm days will often occur, towards spring, before we can get our bees out. In these cases, a bushel or two of snow or ice pounded up should be spread on the floor; it will absorb and carry off as it melts much of the heat, that is now unnecessary, and will keep them quiet much longer than without it; (provision for getting rid of this water should be made when putting down the floor.)"

"The time for carrying out bees is generally in March, but some seasons later. A warm pleasant day is the best, and one quite cold, better than one only *moderately* warm. After their long confinement, the light attracts them out at once, (unless very cold air prevents,) and if the rays of a warm sun do not keep them active, they will soon be chilled

and lost. Some bee-keepers take out their stocks at evening. If we could be always sure of having the next day a fair one, it would probably be the best time; but should it be only moderate, or cloudy, it would be attended with considerable loss—or if the next day should be quite cold, but few would leave, and then the only risk would be to get *a good day*, before one that was just warm enough to make them leave the hive, but not quite enough to enable them to return."

"When too many are taken out at once, the rush from all the hives is so much like a swarm, that it appears to confuse them. Some of the stocks by this means will get more bees than actually belong to them, while others are proportionately short, which is unprofitable, and to equalize them is some trouble; yet it may be done. Being all wintered in one room, the scent or the means of distinguishing their own family from strangers, becomes so much alike, that they mix together without contention."

"By taking advantage of this immediately, or before the scent has again changed, and each hive has something peculiar to *itself*, you can change the stand of very weak and very strong families."

"To prevent, as far as possible, some of these bad effects, I prefer waiting for a fair day to begin, and then not until the day has become sufficiently warm to make it safe from chill."

If the place selected for a winter depositary, is liable to heavy or frequent jars, it will prove very injurious to the bees, by constantly exciting them to undue activity; for this reason it is always better that the hives should stand on the earth, or at least on supports which are not connected with the building, if it is used for other purposes. On the whole, Winter depositaries, however admirable for well-informed and experienced Apiarians, will, in the

hands of novices, prove destructive to bees; for such persons will be very liable to commit mistakes in their management, especially by removing their colonies from them too early, or allowing them to remain too late. Indeed, the most experienced, sometimes incur heavy losses of bees, by a very sudden change of weather on the day of their removal.

In my hives, I can greatly diminish this risk, by shortening the time required by a colony to discharge their fæces. As soon as the sun shines with sufficient power, I remove the top cover from the hives, and take off the spare honey board, so as to permit its full warmth to shine directly upon the bees: this, in a few moments, warms them up, and rouses them to wonderful activity, so that they will discharge their fæces in an unusually short time, and with the loss of very few bees.

In the Chapter on Feeding bees, I shall furnish the proper directions, as to the time and mode of feeding, when colonies have not a sufficient supply of stores for the Winter.

CHAPTER XVI.

Robbing, and how prevented.

In this chapter, I shall be obliged, though much against my will, to acknowledge that some branches of morals in our little friends, need very close watching, since they are often guilty of making no honest distinction between "mine and thine." The truth is, that bees are exceedingly prone to rob each other, and unless suitable precautions are used,

the Apiarian will occasionally lose some of his most promising stocks. When any departure is made from the old-fashioned mode of management, the liability to such misfortunes is increased, unless all operations are performed by careful and well informed persons. Before describing the precautions which I successfully employ, to guard against robbing, I shall first explain, under what circumstances bees are ordinarily disposed to plunder each other.

Idleness is with bees, as with men, a most fruitful mother of mischief. Hence, it is almost always when they are doing nothing in the fields, that they are tempted to increase their stores by dishonest courses. Bees are, however, much more excusable than the lazy rogues of the human family; for they are idle, not from indisposition to work, but for the want of something to do. Unless there is some gross mismanagement, on the part of their owner, they seldom attempt to live upon stolen sweets, when they have ample opportunity to reap the abundant harvests of honest industry.

In the Spring, as soon as the bees are able to fly abroad, they begin to feel the force of an innate love of honey-getting.* Unable to find anything in the fields, they at once attempt to appropriate the spoils of some weaker hive. They are often impelled to this, by the pressure of immediate want, or the salutary dread of approaching famine; but truth obliges me to confess that not unfrequently some of the strongest stocks, which have all they would be able to consume, even if they gathered nothing more for a whole year, are the most anxious to prey upon the meager possessions of some feeble colony. Just as some rich men, who have more money than they can ever use, urged on by the insatiable love of gain, "oppress the hireling in his wages,

* "Innatus urget amor habendi."—Virgil.

the widow and the fatherless," and spin, on all sides, their crafty webs to entrap their poorer neighbors, who seldom escape from their toils, until, beggared of all their worldly goods, they resemble the skins and skeletons which line the nest of some voracious old spider.

When I have seen a powerful hive, of the kind just described, condemned in the Fall, by its owner, to the sulphur pit, or deprived unexpectedly of its queen, its own stores plundered, and its combs eaten up by the worms, it has seemed a striking symbol of the destruction denounced against those who make dishonest gains "their hope, and who say unto the fine gold, thou art my confidence."

To prevent colonies from attempting to rob, they should be examined in the Spring, to ascertain that they have honey, and are in possession of a fertile queen. If they need food they are supplied with it, (see Chapter on Feeding,) and if feeble or queenless, they are managed according to the directions already given. Bees seem to have an instinctive perception of the condition of feeble colonies, and like the moth, are almost certain to attack such stocks, especially when they have no queen. Hence I usually infer that a colony is queenless, when robbers are constantly attempting to force an entrance into it.

Unless tempted by injudicious management, bees rarely overcome a colony which is in all respects in a healthy state. Such a colony may be assailed by a few marauders who are ever prowling about in search of spoils, but these bees are glad to escape with their lives, from the resolute defence of a healthy hive. As a queenless colony, or one almost devoured by worms, may be considered, in a state of nature, as of no account, the propensity which leads bees to be ever on the alert to pilfer, may have been given them to prevent any honey from going to waste!

It requires some knowledge of the habits of bees, to decide from their motions, whether they are flying about a strange hive with some evil intent, or whether they belong to the hive before which they are hovering. A little experience, however, will soon enable us to discriminate between the honest inhabitants of a hive, and the robbers which so often mingle themselves with the crowd. There is an unmistakable air of roguery about a thieving bee, which to the observing Apiarian, proclaims the nature of his calling, just as truly as the appearance of a pickpocket in a crowd, enables the experienced police officer, to distinguish him from the honest folks, on whom he intends to exercise his skill.

There is a certain sneaking look about a pilfering bee, almost indescribable, and yet perfectly apparent. He does not alight on the hive, and boldly enter at once, like an honest laborer, carrying home his load. If he could only assume the appearance of such transparent honesty, he would often be allowed by the unsuspecting door-keepers, to enter unquestioned, see all the sights within, and help himself to the sweets of the land. But there is a sort of nervous haste, and guilty agitation, in all his movements; he never alights boldly upon the entrance board, or faces the guards which watch the passage to the hive; knowing too well that if caught and overhauled by these trusty guardians, his life would hardly be worth insuring; hence his anxiety to glide in, without touching any of the sentinels. If detected by his strange smell, having no pass-word to give, he is very speedily dealt with, according to his just deserts; while if he can only effect a secret entrance, those within, taking it for granted that all is right, seldom subject him to a close examination.

Sometimes bees which have lost their way, are mistaken

by the inexperienced, for robbers ; there is, however, a most marked distinction between the conduct of the two. The arrant rogue when caught, attempts with might and main, to pull away from his executioners, while the poor bewildered unfortunate shrinks into the smallest compass, like a cowed dog, and submits to whatever fate his captors may may see fit to award him.

The class of dishonest bees which I have been describing, may be termed the " Jerry Sneaks " of their profession, and after following it for some time, they lose all disposition for honest pursuits, and assume a hang-dog sort of look, which is very peculiar. Constantly creeping into small holes, and daubing themselves with honey, they often lose all the bright feathers and silky plumes which once so beautifully adorned their bodies, and assume a smooth and almost black appearance ; just as the hat of the thievish loafer, acquires a " seedy " aspect, and his garments, a shining and threadbare look. Dzierzon is of opinion that the black bees which Huber describes as so bitterly persecuted by the rest, are nothing more than these thieving bees. I call them old convicts, dressed in prison uniform, and incurably given up to dishonest pursuits.

Bees occasionally act the part of highway robbers ; some half dozen or more, will waylay and attack a poor humble-bee returning to its nest with a sack full of honey, like an honest trader, jogging home with a well filled purse. They seize the poor fellow, giving him at once to understand that they must have the earnings of his industry. They do not slay him ! Oh no ! not they ! they are far too selfish to endanger their own precious persons ; and even if they could kill him, without losing their weapons, they would be unable to extract his sweets from the deep recesses of his honey bag : they therefore begin to bite and teaze him, after the

most approved fashion, all the time singing in his ears, (not your money, but) "your honey or your life;" until utterly discouraged, he delivers up his purse, by disgorging his honey from its capacious receptacle. The graceless creatures now cry, "Hands off!" and release him at once, while they eagerly lick up his spoils, to be carried to their own home.

The remark is frequently made that were rogues to spend half as much time and ingenuity in gaining an honest living, as they do, in seeking to defraud their fellow-men, their efforts would often be crowned with abundant success. Just so of many a dishonest bee. If he only knew his true interests, he would be safely roving the smiling fields, in search of honey, instead of longing for a tempting and yet dangerous taste of forbidden sweets.

Bees sometimes carry on their depredations on a more imposing scale. Having ascertained the weakness of some neighboring colony, through the sly intrusions of those who have entered its hive to spy out all "the nakedness of the land," they prepare for war, in the shape of a pitched battle. The well-armed warriors sally out by thousands, to attack the feeble hive against which they have declared so unjust a warfare. A furious onset is at once made, and the ground in front of the assaulted hive, is soon covered with the dead and dying bodies of innumerable victims. Sometimes the baffled invaders are compelled to sound a retreat; too often, however, as in human contests, right proves but a feeble barrier against superior might; the citadel is stormed, and the work of rapine and pillage forthwith begins. And yet after all, matters are not nearly so bad, as at first they seemed to be. The conquered bees, perceiving that there is no hope for them in maintaining the unequal struggle, submit themselves to the pleasure of the victors; nay more,

they aid them in carrying off their own stores, and are immediately incorporated into the triumphant nation! The poor mother, however, is left behind in her deserted home, some few of her children faithful to the last, remaining with her, to perish by her side, amid the sad ruins of their once happy home!

If the bee-keeper does not wish to have his bees so demoralized, that their value will be seriously diminished, he will be exceedingly careful to do all that he possibly can, to prevent them from robbing each other. He will see that all queenless colonies are seasonably broken up in the Spring, and all weak ones strengthened, and confined to a space which they can warm and defend. If once his bees get a taste of forbidden sweets, they will seldom stop until they have tested the strength of every hive, and destroyed all that they possibly can. Even if the colonies are able to defend themselves, many bees will be lost in these encounters, and a large waste of time will invariably follow; for bees whether engaged in attempting to rob, or in battling against the robbery of others, are, to a very great extent, cut off both from the disposition and ability to engage in useful labors. They are like nations impoverished by mutual assaults; or on whom the mere apprehension of war, exerts a most blighting influence over every branch of peaceful industry.

I place great reliance on the movable blocks which guard the entrance to my hive, to assist colonies in defending themselves against robbing bees, as well as the prowling bee-moth. These blocks are triangular in shape, and enable the Apiarian to enlarge or contract, at pleasure, the entrance to the hive. In the Spring, the entrance is kept open only about two inches, and if the colony is feeble, not more than half an inch. If robbers are about, the small colonies have

their entrances closed, so that only a single bee can pass at once. As the bottom-board slants forward, the entrance is on an inclined plane, so that the bees which defend it, have a very great advantage over those which attack them; the same in short, that the inhabitants of a besieged fortress would have in defending a pass-way similarly constructed. As only one bee can enter at a time, he is sure to be overhauled, if he attempts, ever so slyly, to slip in; his credentials are roughly demanded, and as he can produce none, he is at once delivered over to the executioners. If an attempt is made to gain admission by force, then as soon as a bee gets in, he finds hundreds, if not thousands, standing in battle array, and meets with a reception altogethor too warm for his comfort. I have sometimes stopped robbing, even after it had proceeded so far that the assaulted bees had ceased to offer any successful resistance, by putting my blocks before the entrance, and permitting only a single bee to enter at once: the dispirited colony have immediately recovered heart, and have battled so stoutly and successfully as to beat off their assailants.

When bees are engaged in robbing, they will often continue their depredations as late as possible, and not unfrequently some of them return home so late with their ill-gotten spoils, that they cannot find the entrance to their own hive. Like the wicked man who "deviseth mischief on his bed, and setteth himself in a way that is not good," they are all night long, meditating new violence, and with the very first peep of light, sally out to complete their unlawful doings.

Bees with whom robbing has grown into a habit, will sometimes be so intent on the dishonest pursuit, as to neglect their own brood! In this strange procedure, they closely resemble those unnatural husbands and fathers, who, in their

mad pursuit of unlawful pleasure or dishonest profit, neglect to make provision for the wants even of their own households,

Sometimes the Apiarian may be in doubt whether a colony is being robbed or not, and may confound the busy numbers arriving and departing, with the honest laborers of the hive; but if he looks into the matter a little more closely, he will soon ascertain the true state of the case; the bees that enter, instead of being heavily laden, with bodies hanging down, unwieldly in their flight, and slow in all their movements, are almost as hungry looking as Pharaoh's lean kine, while those that come out, show by their burly looks, that like aldermen who have dined at the expense of the City, they are filled to their utmost capacity.

If the Apiarian wishes to guard his bees against this fatal propensity to plunder each other, he must be exceedingly careful not to leave any combs filled with honey, unnecessarily exposed. An ignorant or careless person attempting to multiply colonies on my plan, will be almost sure to tempt his bees to dishonest courses. If he leaves any of the combs which he removes, where strange bees can find them, they will, after once getting a taste of the honey, fly to any hive upon which he begins to operate, and attempt to appropriate a part of its contents.

It has already been stated, that bees, when they can find an abundance of food in the fields, are seldom inclined to rob; for this reason, with suitable precautions, it is not difficult to perform, at the proper season, all the operations which are necessary on my plan of management, without any danger of demoralizing the bees. If, however, they are attempted when forage is scarce, they should be performed with extreme caution, and early in the morning, or late in the evening; or if possible, on a day when the bees are not flying out from their hives. If bees once get a

taste of honey from hives which are opened, they will watch the Apiarian so closely, that as soon as he begins to operate, they will pounce upon the exposed colony, and endeavor to appropriate its stores!

I have sometimes seen the most powerful colonies in an Apiary, either robbed and destroyed, or very greatly reduced in numbers, by the gross carelessness or ignorance of their owner. He neglects, for instance, to examine his hives at the proper season, and the bees begin to rob a weak or queenless stock; as soon as they are at the very height of their nefarious operations, he attempts to interfere with their proceedings, either by shutting up the hive, or by moving it to a new place. The air is now filled with greedy and disappointed bees, who, rather than fail in obtaining the expected treasures, assail, with almost frantic desperation, some of the neighboring stocks; in this way, the most powerful colonies are sometimes utterly ruined, or if they escape, thousands of bees are slain in defending their treasures, and thousands more of the assailants meet with the same untimely end.

"In Germany, when colonies in common hives are being robbed, it is customary to remove them temporarily to a distant location, or to set them in a dark cellar. A hive similar in appearance is then placed on their stand, and leaves of wormwood and the expressed juice of the plant are put on the bottom-board. The bees have so strong an antipathy to the odor of this plant, that the assailants speedily forsake the place: and the removed colony may then be brought back." (Wagner.) The oil of wormwood would be better still.

If the Apiarian perceives that one of his colonies is being robbed, he should at once contract the entrance, so that only a single bee can get in at a time; and if the robbers still persist in entering, he must close it entirely. In a

few minutes the outside of the hive will be black with the greedy cormorants, and they will not abandon it, until they have explored every crevice, and attempted to force themselves through the smallest openings. Before they assail a neighboring colony, they should be sprinkled with cold water, and then instead of feeling courage for new crimes, they will be glad to escape, thoroughly drenched, to their proper homes. Unless the bees that are shut up, can, as in my hives, have an abundance of air, it will be necessary to carry them at once into a dark and cool place. Early next morning, the condition of the hive should be examined, and the proper remedies applied; if it is weak or queenless, or if its condition is past remedy, it should at once be broken up, and the bees united to another stock.

I have been credibly informed of an exceedingly curious kind of robbing among bees, which appears to be a very close approximation to the story of the Kilkenny cats! Two colonies, both in good condition, seemed determined to appropriate each other's labors: neither made any resistance to the entrance of the plundering bees; but each seemed too busily intent upon its own dishonest gains, to notice that the work of subtraction kept equal pace with that of addition. Alas! that there should be so much of equally short-sighted policy among human beings. How many individuals, communities and nations, are seeking to thrive by attempting to prey upon the labors of others, instead of doing all that they can, by industry and enterprise, to add to the common stock! I have never, in my own experience, met with an instance of such silly pilfering as the one described; but I have known a colony having no mature queen to be carrying on their labors, while others were stealing much more than the occupants of the hive were gathering, without the rightful owners being at all aware of their rascality.

On one occasion, I gave to a stock on which robbing bees were practicing such a base imposition, a fertile queen, at sundown, after the robbing had ceased. Next morning the bees gave the rogues such a warm reception, that they were glad to make a speedy retreat. May not the fertile mother give to each colony a peculiar scent? and may not a hive which has no such queen, be so pleased with the odor of other bees as to let them do what they will with their stores?

CHAPTER XVII.

Directions for Feeding Bees.

THERE are few things in the practical department of the Apiary, more important, and yet more grossly neglected, or mismanaged, than the feeding of bees. To make this subject as clear as possible, I shall begin with the Spring examination of the hives, and furnish suitable directions for feeding, whenever it ought to be attempted. In the movable comb hives, the exact condition of the bees with regard to stores, may be easily ascertained, as soon as the weather is warm enough to lift out the frames. In the common hives, this can sometimes be learned from the glass sides; but often, no reliable information can be obtained. Even if the weight of a hive is known, this will be no sure criterion of the quantity of honey. The comb in old hives, is often very thick, and of course, unusually heavy; while vast stores of useless bee-bread may entirely deceive the Apiarian, who

attempts to judge of the resources of a hive, from its weight alone. On my system of bee-culture, such an injurious surplus of bee-bread, is easily prevented.

If, in the Spring, the bee-keeper ascertains, or even suspects, that his bees have not sufficient food, he must at once supply them with what they need. Bees, at this season of the year, consume a very large quantity of honey; being stimulated to great activity by the returning warmth, they are compelled to eat much more than when they were almost dormant among their combs. In addition to this extra demand, they are now rearing thousands of young, which require a liberal supply of food. Owing to inexcusable neglect, thousands of swarms perish annually even after Spring has opened, and when they might have been saved, with but little trouble or expense. Such abominable neglect is incomparably more cruel than the old method of killing the bees with sulphur; and those guilty of it, are either too ignorant or careless, to have any thing to do with the management of bees. What would be thought of the skill of a farmer, who should neglect to provide for the wants of his cattle, and allow them to drop down lifeless in their stalls, or in his barn-yard, when the fields, in a few weeks, will be clothed again with the green mantle of delightful Spring! If any farmer should do this, when food might easily be purchased, and should then, while engaged in the work of skinning the skeleton carcasses of his neglected herd, pretend that he could not afford to furnish, for a few weeks, the food which would have kept them alive, he would not be a whit more stupid than the bee-keeper attempting to justify himself on the score of economy, while engaged in melting the combs of a hive, starved to death, after the Spring has fairly opened! Let such a person blush at the pretence that he could not afford to give his bees the few pounds of sugar or honey,

which would have saved their lives, and enabled them to repay him tenfold for his prudent care.

It is best to feed the bees a little, even if they have enough and to spare. There seems to be an intimate connection between the getting of honey, and the rapid increase of breeding; and the taste of something sweet, however small the addition to their hoards, exerts a very stimulating effect upon the bees; a few spoonsfull a day, will be gratefully received, and will be worth much more to a stock of bees in the Spring, than at any other time.

By judicious early feeding, a whole Apiary may not only be encouraged to breed much faster, but they will be inspired with such vigor and enterprise, as to increase their stores with unusual rapidity. Great caution should be exercised in Spring feeding, to prevent bees from robbing each other, or filling with honey, the cells which ought to be supplied with brood. Unless they are destitute of supplies, only a small allowance should be given them, and this from time to time; and as soon as they begin to gather from the fields, the feeding should be discontinued.

No greater mistake can be made than to feed largely at this season of the year. The bees, indeed, will take all they can, and store it in their cells, but what is the consequence? The honey fills up their brood-combs, and thus the increase of population is most seriously checked; so that often when stocks which have not been over-fed, are prepared not only to fill all the store combs in their main hive, but to take speedy possession of the spare honey boxes, a colony over-fed, is too small in numbers, to gather even as much as one not fed at all! The inexperienced Apiarian has thus often made a worse use of his honey, than if he had actually thrown it away! while all the time, he is deluding himself

with the vain expectation of reaping some wonderful profits, from what he has been taught to consider an improved mode of managing bees.

Such conduct, in its results, resembles very much the noxious influences, under which too many of the children of the rich are so fatally reared. With every whim gratified, pampered and fed to the very full, how often do we see them disappoint all the fond expectations of parents and friends, their money proving only a curse, while not unfrequently beggared in purse, and bankrupt in character, they prematurely sink to an ignoble or dishonored grave. Think of it, ye who are slaving in the service of Mammon, that ye may leave to your sons, the overgrown wealth which usually proves but a legacy of withering curses, if you have neglected to train them up in those habits of Christian morality, steady industry, and noble self-reliance, without which the wealth even of Crœsus would be but a despicable portion! Think of it, as you contrast its results in the bitter experience of thousands, with the happier influences under which so many of our noblest men in Church and State, have been nurtured and developed, and then pursue your sordid policy, if you can. "There is that withholdeth" from good objects, "more than is meet, and it tendeth to poverty;" yes, to poverty of Christian virtue and manliness, and of those "treasures" which we are all entreated by Christ himself, to "lay up" in the store-house of Heaven. Call your narrow-mindedness, and gross deficiencies in Christian liberality, nothing more than a natural love of your children, and an earnest desire to provide for your own household. Little fear there may be that *you* will ever incur the charge of being "worse than an infidel" on this point; but lay not on this account, any flattering unction to your souls; look

within, and see if the base idolatry of gold has not far more to do with your whole course of thought and action, than any love of wife or children, relatives or friends!

A *sermon!* does some one exclaim? Would that it might be to some of my readers a word "fitly spoken," "like apples of gold in pictures of silver."

The prudent Apiarian will always regard the feeding of bees, except the little given them by way of encouragement, as an evil to be submitted to, only when absolutely necessary; and will very much prefer to obtain his supplies, from what Shakspeare has so beautifully termed the "merry pillage" of the blooming fields, than from the more costly stores of the confectioner or grocer. If not engaged in the rapid increase of stocks, he will seldom see a season so unfavorable as to oblige him to purchase food for his bees, unless he chooses to buy a cheap article, to replace the choicer honey of which he has deprived them. As soon, however, as he commences a rapid multiplication of stocks, he must calculate upon feeding great quantities of honey to his bees. Before he attempts this on a large scale, let me once more give him a friendly caution, and if possible, persuade him to try very rapid multiplication with only a few of his stocks. In this way, he may experiment to his heart's content, without running the risk of seriously injuring his whole Apiary, and may not only gain the skill and experience which will enable him subsequently to conduct a rapid increase, on a large scale, but may learn whether he is so situated, that he can profitably devote to it, the time and money which it will inevitably require.

Before giving directions for feeding bees when a rapid increase of colonies is aimed at, I shall first show in what manner weak swarms may be fed in the Spring. If they are in the common hives, a small quantity of liquid sweets

may at once be placed among the combs in which the bees are clustered, by inverting the hives, and pouring in about a tea-cup full at once. The Apiarian can then see just where to put it, and need not fear that the bees will be hurt by it; they will lick each other clean, and will be no more hurt or displeased than a child, by the sweets which adhere to its hands and face, as it feasts upon a generous allowance of the best sugar candy. When the bees have taken up all that has been poured upon them, the hive may be replaced, and the operation repeated in a few days: the oftener it is done, the better it will suit them. With my hives, I can pour the honey into some empty comb, and then put the frame containing it, directly into the hive: or I can set a feeder, or honey in the comb, in the hive, and near the frames which contain the bees.

I have already stated, (p. 225,) that unless a colony can be supplied with a sufficient number of bees, it cannot be aided by giving it food. If the bees are not numerous enough to take charge of the eggs which the queen can lay, or at least, of a large number of them, they can seldom, unless they have a tropical season before them, increase rapidly enough to be of any value. If they are sufficiently numerous to raise a great many young bees, but too few to build new comb, they must be fed very moderately, or they will be sure to fill up their brood comb with honey, instead of devoting themselves to the rapid increase of their numbers. If the Apiarian can give them plenty of empty worker comb, he ought to supply them quite sparingly with honey, even when they are considerably numerous, that they may breed as fast as possible; not so sparingly, however, as to prevent them from storing up any honey in sealed cells; or they will not be encouraged to breed, as fast as they otherwise would. If he has no spare comb, and the

hive is populous enough to build new comb, it must be supplied moderately, and by all means, *regularly*, with the materials for doing this; as the object is to have comb building and breeding go on together, so as mutually to aid each other. If the feeding is not so regular, as to resemble the natural supplies, when honey is obtained from the blossoms, the bees will not use the food given to them, in building new comb, but chiefly in filling up all the cells previously built. If honey can be obtained regularly, and in sufficient quantities from the blossoms, the small colonies or nuclei will need no feeding, until the failure of the natural supplies.

In all these operations, the main object should be to make every thing bend to the most rapid production of *brood;* give me the bees, and I can easily show how they may be fed, so as to make strong and prosperous stocks; whereas if their numbers are small, every thing else will be in vain: just as a land where there are many stout hands and courageous hearts, although comparatively barren, will, in due time, be made to "bud and blossom as the rose," while a second Eden, if inhabited by a scanty and discouraged population, must speedily be overgrown with briars and thorns.

If strong stocks are deprived of a portion of their combs, so that they cannot from natural sources, at once begin to refill all vacancies, they too must be fed.

I have probably said enough to show the inexperienced, that the rapid multiplication of colonies, is not a very simple matter, and that they will do well not to attempt it on a large scale. By the time the honey harvest ordinarily closes, all colonies, except in the Apiaries of the skillful, ought to be strong, both in numbers and in stores; at least the *aggregate* resources of the colonies should be such, that when

an equal division is made among them, there will be enough for all. This may ordinarily be effected, and yet the number of the colonies be trebled in one season; and in situations where buckwheat is extensively cultivated, a large quantity of surplus honey, may even then be frequently obtained from the bees. Early in the month of October, or better still, by the middle of September, if the season of forage is over, and the colonies are sufficiently strong in numbers, I advise that if feeding is necessary to winter the bees, it should be thoroughly attended to. If delayed later than this, in the latitude of our Northern States, the bees may not have sufficient time to seal over the honey fed to them, and will be liable to suffer from dysentery, during the ensuing Winter. Unsealed honey, almost always, in cool weather, attracts some moisture, and sours in the combs, and if the bees are compelled to feed upon it, they are very liable to become diseased.

An interesting fact on this subject, has come under my notice. A colony of bees being fed for some time with suitable food, appeared to be in perfect health, flying in and out with great animation Their owner, on one occasion, before leaving for the day, gave them some molasses which was so *sour*, that it could not be used in the family. On returning, at evening, he was informed that the bees had been dropping their filth over every thing in the vicinity of the hive. On examining them, next day, they were all found dead on the bottom-board, and among the combs! The acid food had acted upon them as a violent cathartic, and brought on a complaint of which they all died in less than twenty-four hours; the hive was found to contain an ample allowance of honey and bee-bread.

If the Apiarian finds that some of his colonies have more than they need, and others not enough, his most prudent

course will be to make an equitable division of the honey. This may seem to be a very Agrarian sort of procedure, and yet it answers perfectly well in the management of bees. Those that were helped, will not spend the next season in idleness, relying upon the same sort of aid; nor will those that were relieved of their surplus stores, remember the deprivation, and limit the extent of their gatherings to a bare competency. With men, most unquestionably, unless they were perfect, such an annual division would derange the whole course of affairs, and speedily impoverish any community in which it might be attempted.

I always prefer to remove some honey from stocks which have too generous a supply, replacing it with empty worker-comb; as I find that when bees have too much honey in the Fall, they do not ordinarily breed as fast in the ensuing Spring, as they otherwise would. A portion of this honey should be carefully put away in the frames, and kept in a close box, safe against all intruders, and where it will not be exposed to frost; so that if some colonies in the Spring, are found to be in want of food, they may be easily supplied. The inexperienced should remove any surplus, in the Spring.

In the Spring examination, if any colonies have too much honey, a portion of it ought by all means to be taken away. Such a deprivation, if judiciously performed, will always stimulate them to increased activity. Every strong stock, as soon as it can gather enough honey to construct comb, ought to have one or two combs which contain no brood removed, and their places supplied with empty frames, in order that they may be induced to exert themselves to the utmost. An empty frame inserted between full ones, will speedily be replenished with comb, and often the combs removed will be so much clear gain. If at any time there is a sudden supply of honey, and the bees seem reluctant

to enter the boxes, or it is not probable that the supply will continue long enough to enable them to fill them, the removal of some of the combs from the main hive, so as to have empty ones filled, will often prove highly advantageous.

If, in the Fall, the bee-keeper finds that some of his colonies need feeding, and are not populous enough to make good stocks in the ensuing Spring, then instead of wasting time and money on them, he should at once, break them up, for they will seldom pay for the labor bestowed on them, and the bees will be much more serviceable, if added to other stocks. The Apiarian cannot be too deeply impressed with the important truth, that his profits in bee-keeping will almost always come from his *strong* stocks, and that if he cannot so manage as to have such colonies early, it will be better to let bee-keeping alone.

West India honey has for many years, been used to very good advantage, as a bee-feed. It should never be given in its raw state, as it is often filled with impurities, and is very liable to sour or candy in the cells, but should be mixed with about two parts of good brown sugar, to three of honey, and one of water, and brought to the boiling point; as soon as it begins to boil, it should be set to cool, and as all the impurities rise to the top, they may be skimmed off. If it is too thick, a little more water may be added to it; it ought, however, never to be made thinner than the natural consistence of good honey. Such a mixture will cost, for a small quantity, about seven cents a pound, and will probably be found, with the exception of dissolved sugar-candy, the cheapest liquid food which can be given to bees.

In my hives, the bee-keeper may feed his bees, without any feeder at all, or rather he may use the *bottom-board* of the hive as a feeder. On this plan, the bees should be shut

in, or fed at evening; to prevent the risk of their robbing each other. The hive which is to be fed, should have the front edge of its bottom-board elevated on a block, so as to slant *backwards*, and the honey should be poured through one of the holes of the spare honey-board. As the frames are kept about half an inch above the bottom-board, which is water tight, the honey runs under them, and is as safe as in a dish, while the bees stand on the bottom of the frames, and help themselves. The quantity poured in, should of course, depend upon the size and necessities of the colony; no more ought to be given at one time, than the bees can store up during the night; a good colony will easily take up a quart. It is desirable to get through the feeding as rapidly as possible, as the bees are excited through the whole process, and consume more than they otherwise would, to say nothing of the demand made upon the time of the Apiarian, by feeding in small quantities. If the bees cannot, in favorable weather, dispose of at least a pint at one time, the colony must be too small to make it worth while to feed them, if they are in hives by which they can be readily united to stronger stocks.

If the bees have not a good allowance of comb, it will not, as a general rule, pay to feed them. This will be obvious to any one who reflects that nearly 20 pounds of honey are often required to elaborate one pound of wax. I know that this estimate may to some, appear enormous; but it is given as the result of very accurate experiments, instituted on a large scale, to determine this very point. The Country Curate says, "Having driven the population of four stocks, on the 5th of August, and united them together, I fed them with about 50 pounds of a mixture of sugar, honey, salt and beer, for about five weeks. At that time, the box was only 16 pounds heavier than when the bees were put into it."

He estimates that at least 25 pounds of the mixture were consumed in making about half a pound of wax! No one who has once tried it, will undertake to feed bees for profit, when they are destitute both of comb and honey.

If the weather is cool when bees are fed, it will generally be necessary to resort to top feeding. For this, my hive is admirably adapted: a feeder may be put over one of the holes in the honey-board directly over the mass of the bees, into which the heat of the hive naturally arises, and where the bees can get at their food without any risk of being chilled. This is *always* the best place for a feeder, as the smell of the food is not so likely to attract the notice of robbing bees.

I shall here show how to make a very cheap and convenient feeder. Take any wooden box, which will hold at least two quarts. About two inches from one end, put a thin partition, not so deep by half an inch, as the box itself; cut a hole in the *bottom* of the small apartment thus partitioned off, so that when set over any hole leading to the spare honey boxes, it will admit the bees, and allow them to pass over the partition, into the other apartment which holds the food. Make all the joints honey-tight, by running into the corners, a mixture of melted wax and rosin, (p. 88); if the sides are brushed with the same hot mixture, the wood will absorb no honey, and the box be kept perfectly sweet. The lid which confines the bees to this feeder, should have a piece of glass set into it, which will show when it is empty, and a hole for pouring in the liquid food; which hole, when not in use, is closed in the same manner with the holes on the spare honey-board of my hive. To prevent the bees from drowning in the honey, fill the box to the depth of an inch with clean straw, cut short enough to sink readily as the bees consume the honey. No float can ever be made to answer

a better purpose than clean straw. With such a feeder, bees may be safely fed with dissolved sugar-candy, even in the depth of Winter; since it may be covered with thick cotton or wool, so as to retain the animal heat of the bees, which will freely ascend into it from the hive. The lid may have wire hinges, or slide in a groove, or simply lay on the box. For a water-feeder, in early Spring, this contrivance will be found to be very complete. It will probably be patented in due season. A drawing of this feeder, will be given on the plate representing the various Implements used in the Apiary.

Water is absolutely indispensable to bees when building comb, or raising brood. In the early Spring, they take advantage of the first warm weather, to bring it to their hives, and may be seen busily drinking around pumps, drains, and other moist places. As they are not noticed to frequent such spots, except in the early part of the season, many suppose that they need water only at this period. This is a great mistake, for they need and must have it, during the whole breeding season. But as soon as the grass starts, and the trees are covered with leaves, they prefer to sip the dew from them. If a few days of continued cold come on, after the bees have commenced breeding, preventing them from going abroad for water, a serious check will often be given to their operations. Even when the cold does not confine them to the hive, many become so chilled in their search for water, that they are unable to return.

The Apiarian should see that his bees have an abundant supply of water. If he has not some warm and sunny spot where he can safely obtain it, he will furnish them with shallow wooden troughs or vessels filled with floats or straw, from which, sheltered from cold winds, and warmed by the genial rays of the sun, they can drink without risk of drown-

ing. I believe that one reason why bees frequent barn-yards and drains, is not so much because they find any medicinal quality in the impure water, but that being *warm*, and near their hives, they can drink without being fatally chilled.

If the feeder previously described, is supplied with water, the bees are able to enter it when they cannot leave their hive, and thus breeding goes on, without interruption, and the lives of many are saved. The same end may be obtained, by pouring daily, a few table spoonsfull of water into the hive, through one of the holes leading to the spare honey-boxes.

When supplied with water in their hives, it is better to sweeten it a little. The bees prefer it, and it will stimulate them more powerfully to the raising of brood.

I come now to mention a substitute for liquid honey, the value of which has been extensively and thoroughly tested in Germany, and which I have used with great advantage. It was first introduced by the Rev. Mr. Weigel, of Silesia, and Dzierzon and other distinguished Apiarians, speak of its excellence, in the most decided terms. The article to which I refer, is *plain sugar-candy*. It has been ascertained that about four pounds of this candy, will sustain a colony during the Winter, when they have scarcely any honey in their hive! If it is placed where they can have access to it without being chilled, they will cluster upon it, and gradually eat it up. It not only goes further than double the quantity of liquid honey which could be bought for the same money, but is found to agree with the bees perfectly; while the former is almost sure to sour in the unsealed cells, exposing them to dangerous, and often fatal attacks of dysentery. I sometimes invert the old fashioned box hive, and push sticks of candy gently between the ranges of comb, in which the bees cluster. The bottom-board may then be replaced, and

if the hive is still upside down, and properly sheltered, the bees will have ready access to the candy, even in the coldest weather.

In my hives, the spare honey-board may be elevated on strips, about an inch and a half above the frames, and sticks of candy laid on the tops of the *central* frames, will then be always accessible to the bees, even in the coldest weather, if the outside of the honey-board is covered with cotton, or any warm packing. By sliding into the hive, under the frames, a few sticks of candy, I can in a moment feed a small colony, in Summer, without incurring the risk of tempting robbers, by the smell of liquid honey. If a small quantity of liquid food is needed in warm weather, loaf-sugar dissolved in water, as it has scarcely any smell, is the best.

"The use of sugar-candy for feeding bees," says the Rev. Mr. Kleine, "gives to bee-keeping a security which it did not possess before. Still, we must not base over-sanguine calculations on it, or attempt to winter very weak stocks, which a prudent Apiarian would at once unite with a stronger colony. I have used sugar-candy for feeding, for the last five years, and made many experiments with it, which satisfy me that it cannot be too strongly recommended, especially after unfavorable summers. Colonies well furnished with comb, and having plenty of pollen, though deficient in honey, may be very profitably fed with candy, and will richly repay the service thus rendered them."

"Sugar-candy dissolved in a small quantity of water, may be safely fed to bees late in the Fall, and even in Winter, if absolutely necessary. It is prepared by dissolving two pounds of candy in a quart of water, and evaporating, by boiling, about two gills of the solution; then skimming and straining through a hair sieve. Three quarts of this solution,

fed in Autumn, will carry a colony safely through the Winter, in an ordinary location and season. The bees will carry it up into the cells of such combs as they prefer, where it speedily thickens and becomes covered with a thin film, which keeps it from souring." (Bienenzeitung, 1854, page 145.)

Brown *Havanna* sugar makes the *best* candy for a bee-feed. Add water to the sugar, and clarify the syrup with an egg; then put about a tea-spoon full of cream of tartar, to twenty pounds of sugar, and boil until the water is evaporated. To know when it is done, dip your finger first into cold water, and then into the syrup; if what adheres is brittle when chewed, it is boiled enough. Pour it into pans slightly greased, so that it will be about one quarter of an inch thick. It may now be broken up in pieces, to suit the wants of the bee-keeper. After the syrup is boiled, lemon balm, peppermint, or any other odor agreeable to bees, may be given to it.

I have already shown how, by transferring some of the fullest honey-combs late in the Fall, to the centre of the hive, bees can be prevented from starving in empty combs, in the Winter. If none of the combs are sufficiently stored with honey, the colony may be confined to about six combs, and the others, after the cappings are sliced off, placed temporarily on the spare honey-board, so that the bees can remove their contents. If they are still deficient in supplies, they may be fed so as to have what is given them, placed in the center for winter use. Not only can there be no change in the relative position of the combs, in the common hive, but if such a hive is well stocked with bees, and only partially filled with comb, they will waste much of their food in adding to it.

The following is, I believe, an original and highly valuable

method of feeding weak stocks. Feed some of the strongest, which are best able to seal over the honey, and defend their stores, and then transfer the full frames to the weak stocks!

The question, how much honey will carry a colony safely through the perils of Winter, is one to which it is impossible to give an answer which will be definite under all circumstances. Much will depend on the warmth of their hive, and the forwardness of the ensuing Spring. It is frequently impossible, in the common hives, to form any reliable estimate of their resources, since the combs are often so heavy with bee-bread, as entirely to deceive even the most experienced bee-keepers.

I should always wish to leave at least twenty-five pounds of honey in a hive; and as each comb can be examined, it can always be known how much a colony has. If there is any reason to fear that their supplies may fail, a few pounds of sugar candy may be put where they can easily get access to it, in case of need. In my hive, the careful bee-keeper may not only know exactly the resources of each colony, in the Fall, but may, very early in the Spring, ascertain precisely how much honey is still on hand, and whether his bees need feeding, in order to preserve their lives.

Posel says that if a colony has suffered from hunger for twenty-four hours, the fertility of its queen will be greatly impaired, and never recovered. A fertile mother is certainly a great feeder, and if one is kept away from the bees, a very short time, she will solicit food, as soon as returned! This should be remembered, in all operations involving the temporary removal of queens, and care should be taken to give them honey, or better still, to put with them a few well fed workers. "From nothing, nothing comes;" and a mother

that is capable of laying thousands of eggs daily, must require much food for their development.

Feeding, to make a profit by selling the Honey given to the Bees.

For many years, Apiarians have attempted to derive profit from the feeding of bees on a large scale; but all such attempts must, from the very nature of the case, meet with no success. If large quantities of cheap West India honey are fed to the bees in the Fall, they are induced to fill their hives to such an extent, that in the Spring, the queen does not find the necessary accommodations for breeding; while if over-fed in the Spring, their condition is still worse. It must therefore be obvious that the feeding of cheap honey, can only be made profitable, where it replaces an equal quantity of choice honey taken from the bees. In the latter part of Summer, the Apiarian may take away from the main hive, some of the combs which contain the best honey, and replace them with others into which he has poured the cheaper article. If he takes away their full combs, giving them honey to enable them, first to replace, and then to fill them, the operation, for reasons already mentioned, will result in a loss, instead of a gain.

I am aware that persons have attempted to derive a profit from supplying the markets of some of our large cities, with an article claiming to be the best of honey, but in reality only cheap West India honey fed to the bees, and stored by them in new comb. This article has become so well known that it can now be scarcely sold at all; as purchasers, instead of paying 25 cents per pound for West India honey in the comb, much prefer to buy it, (if they want it at all,)

for six or seven cents, in a liquid state! It must be perfectly obvious that to sell an ill-flavored article at a high price, under the pretence that it is a superior article, is nothing less than downright cheating.

I am well aware that many persons imagine that if *any sweet* is fed to bees, they will quickly change it into the purest nectar; but there is no more truth in such a conceit, than there would be in that of a man who supposed that he had found the veritable philosopher's stone, by which he could transmute our copper and silver coins into the purest gold! Bees to be sure, can make white and beautiful *comb*, from almost any kind of sweet; because wax is a natural secretion, (see p. 77,) and can be made from any saccharine substance; just as fat can be put upon the ribs of an ox, by any kind of nourishing food.

"But," some of my readers may ask, "do you mean to assert that bees do not secrete honey out of the raw material which they gather, or which is furnished to them, just as cows secrete milk from grass and hay?" I certainly do mean to assert that they can do nothing of the kind, and no intelligent man who has carefully *studied their habits*, will for a moment venture to affirm that they can, unless for the sake of "filthy lucre," he is attempting to deceive an unwary community. What bee-keeper does not know, or rather ought not to know that the quality of honey depends entirely upon the sources from whence it is gathered; and that apple-blossom honey, white clover honey, buckwheat honey, and every other kind, each has its own peculiar flavor, which can readily be recognized by any good judge of the article.

When bees are engaged in rapidly storing honey in their combs, they may be seen, as *soon* as they return from the fields, or from the feeding boxes, putting their heads at once

into the cells, and disgorging the contents of their "honey-bags." That the contents of their sacs, undergo no change at all, during this short time, I will not absolutely affirm, because, through this whole treatise, I have endeavored to refrain from confident assertions, in the absence of positive evidence; but that they can undergo only a *very slight* change, must be evident from the fact that when thus stored up, the different kinds of honey or sugar, can be almost, if not quite, as readily distinguished as before they were fed to the bees. The only change which they appear to undergo in the cells, is to have evaporated from them, the excess of water which was added from ignorance, or the vain expectation that it would be just so much water sold for honey, to the defrauded purchaser! This evaporation of the water, by the heat of the hive, is about the only marked change that honey appears to undergo, from its natural state in the nectaries of the blossoms; and it is exceedingly interesting to see how unwilling bees are to seal it up, until brought to such a consistency that there is no danger of its souring in the cells. They are as careful in this matter, as the good lady of the house is, to have the syrup of her preserves boiled down to a suitable thickness, to keep them sweet.

Let all who for any purpose whatever, feed bees, keep this fact in mind, and never add more water than is absolutely necessary. Such conduct is as stupid as to pour a barrel of water into the sugar pans, for every barrel of sap from the maples, or juice from the canes! If a strong colony is set on a platform scale, it will be found on a pleasant day, during the height of the honey harvest, to gain a number of pounds; if examined again, early next morning, it will be seen to have lost considerably, during the night. This is owing to the evaporation from the freshly gathered honey, of the water which often runs down in a stream from the bottom-board.

Those who feed cheap honey to sell in the market, at a high advance over its first cost, are either deceivers or deceived; and if any of my readers have been defrauded by the plausible representations of ignorant or unprincipled men, I trust they will be able from these remarks, to see exactly *how* they have been deluded, and that they will no longer persist in an adulteration, the profits of which are small, and the morality of which can never be defended. A man who sells inferior honey, or sugar which he calls honey, to those who would never purchase if they once had a taste of it, is not a whit more honest, if he understands the nature of the article, than a person who counterfeits the current coin of the realm: for poor honey in white comb, is no less a fraud than eagles or dollars, golden to be sure, on their honest exterior, but containing a baser metal within! "The Golden Age" of bee-keeping, in which inferior honey can be quickly transmuted into such balmy spoils as are gathered by the bees of Hybla, has not yet dawned upon us; or at least only in the fairy visions of the poet, who saw

> "A golden hive, on a Golden Bank,
> Where golden bees, by alchemical prank,
> Gathered Gold instead of Honey."—*Hood.*

If a pound of West India honey costs about six cents, and the bees use, as they will, about one pound to make the comb in which it is stored, it costs the producer at least twelve cents a pound, and if to this, he adds enough to pay him for extra time and labor in feeding, then his inferior honey costs him almost as much as the market price of the very best honey, on the spot where it is produced! If the bee-keeper begins to feed, after he has harvested the produce from the natural supplies, the advance over the first cost will hardly pay for the trouble, even if it were honest to palm off as a first-rate article, such inferior honey; but if fed very

largely in the latter part of Summer, his colonies will fill up their hives before working in the spare honey boxes, and thus the production of brood will often be checked, at a season when it is important to have the hives well stocked with young bees.

If Apiarians desire large quantities of choice honey, let them manage their bees so as to have powerful stocks in the early Spring, and they will then be able to have both heavy purses and light consciences. I shall now show how *liquid* honey, exceedingly beautiful to the eye, and tempting to the taste, may be made to great advantage:

Dissolve two pounds of the purest white sugar, in as much hot water as will be just necessary to reduce it to a syrup; take one pound of the nicest white clover honey, (any other light colored honey of good flavor will answer,) and after warming it, add it to the syrup, and stir the contents. When cool, this compound will be pronounced, even by the best judges of honey, to be one of the most luscious articles which they ever tasted; and will be, by almost every one, preferred to the unmixed honey. Refined loaf-sugar is a perfectly pure and inodorous sweet, and one pound of honey will communicate the honey flavor, in high perfection, to twice that quantity of sugar; while the new article will be destitute of that smarting taste which pure honey so often has, and will often agree with those who cannot eat the clear honey with impunity. If desired, this compound may be made to resemble the classic honey of Mount Hymettus, by adding to it the fine aroma of the lemon balm, or wild thyme; or it may have the flavor of the orange groves, or the delicate fragrance of beds of roses washed with dew.

Bees may be made to store in *boxes*, a mixture of the whitest honey and loaf sugar; but the result shows a loss rather than a gain. The mixture, will cost about twelve

cents per pound; and at the furthest, not more than half of what is fed, can be secured in the comb, since it requires about a pound, to manufacture comb enough to hold a pound of honey. The actual cost of the honey in the comb, will therefore be as great as that of the nicest honey. Those who desire to have something very beautiful to the eye, and delicate to the taste, at a season when their bees are not storing up honey from the blossoms, and in situations where the natural supply is of an inferior quality, if they do not regard expense, can, by feeding this mixture, place upon their tables, an article which will often be pronounced by the best judges, superior to any thing they ever tasted before.

I have repeatedly spoken of the great care necessary to guard against bees being tempted to engage in dishonest courses, by getting a taste of forbidden sweets. The experienced Apiarian will fully appreciate the necessity of these cautions, and the inexperienced, if they neglect them, will be taught a lesson that they will not soon forget. Let it be remembered that the bee was intended to gather its sweets from the nectaries of flowers: in the exquisitely beautiful language of him whose inimitable writings supply us on almost every subject, with the richest thoughts and happiest illustrations, they were created to

> "Make boot upon the Summer's velvet buds,
> Which pillage they with merry march bring home
> To the tent royal of their 'empress:'
> Who, busied in 'her' majesty, surveys
> The singing masons, building roofs of gold."—*Shakspeare.*

When thus engaged, bees working in harmony with their natural instincts, have little disposition to meddle with property that does not belong to them; but if their incautious owner tempts them with liquid food, especially at times when they can obtain nothing from the blossoms, they be-

come so infatuated with such easy gatherings, as to lose all discretion, and will perish by thousands, if the vessels which contain the food are not furnished with floats, on which they can safely stand to help themselves.

As the fly was not intended to banquet upon the blossoms, but on substances in which it might easily be drowned, it alights most cautiously, on the edge of any vessel containing liquid food, and warily helps itself: while the poor bee plunges in headlong, and speedily perishes. The sad fate of their unfortunate companions, does not in the least, deter others who approach the tempting lure, from madly alighting on the bodies of the dying and the dead, to share the same miserable end! No one can understand the full extent of their infatuation, until he has seen a confectioner's shop assailed by thousands and tens of thousands of hungry bees. I have seen thousands strained out from the syrups in which they had perished; thousands more alighting even upon the boiling sweets; the floors covered, and windows darkened with bees, some crawling, others flying, and others still, so completely besmeared as to be able neither to crawl nor fly; not one bee in ten, able to carry home its ill-gotten spoils, and yet the air filled with new hosts of thoughtless comers!

Those engaged in the manufacture of candy and syrups, will find it to their interest, by fitting gauze wire windows and doors to their premises, to save themselves from constant loss and annoyance: for if only one bee in a hundred escapes with his load, the confectioner will be subjected, in the course of the season, to serious loss. I once furnished a candy-shop, with such protection, after the bees had commenced their depredations; who on finding themselves excluded, alighted on the wire by thousands, squealing with vexation and disappointment, as they vainly tried to force a passage

through the meshes. At last they were daring enough to descend the chimney, reeking with sweet odors, even although most who attempted it, fell with scorched wings into the fire, and it became necessary to put wire gauze over the top of the chimney also!

How often, as I have seen thousands of bees, in such places destroyed, thousands more deprived of all ability to fly, and hopelessly struggling in the deluding sweets, and yet increasing thousands blindly hovering over them, all unmindful of their danger, and apparently eager to share the same destruction, how often has the spectacle of their infatuation, appeared to be an exact picture of the woful delusion of those who surrender themselves to the fatal influences of the intoxicating cup. Even although they see the miserable victims of this degrading vice, falling all around them, into premature and dishonored graves, they still press on, madly trampling as it were, over their dead and dying bodies, that they too may sink into the same abyss of agonies, and that their sun also may go down in darkness and hopeless gloom. Even although they know that the next cup may send them, with all their sins upon their heads, to the dread tribunal of their God, that cup of bitter sorrows and untold degradation, they will drain, even to its most loathsome dregs.

The avaricious bee that despised the slow process of extracting nectar from "every opening flower," and plunged so recklessly into the tempting sweets, has ample time to bewail its folly. Even if it has obtained its fill, instead of paying the forfeit of its life, it returns home with all its beautiful plumage sullied and besmeared, and with a woe-begone look, and sorrowful note, in marked contrast with the bright hues and merry sounds, with which the industrious

bee returns, from its happy rovings amid "the budding honey flowers, and sweetly breathing fields."

Just so, has many a pilgrim from the golden shores of California and Australia, returned; enfeebled in body and mind, bankrupt often in character and happiness, if not in purse, and unfitted in every way, for the calm and sober pursuits of common industry; while thousands, yes, and tens of thousands too, shall never more behold their once happy homes. Bibles and Sabbaths, altars and firesides, parents and friends, wife and children, how often have all these been wantonly abandoned, in the accursed greed for gain, by those who were prosperous, and might have been happy, at home, but who wandered from its sacred precincts, only because they were determined to make the possession of wealth, the chief object of life, and whose bones now lie amid the coral reefs of the ocean, or moulder in the howling wastes of the "overland passage;" just as the bones of the unbelieving Israelites whitened the sands of the desert. Of those who have reached the "land of" golden "promise," how many have died in despair, or worse still, are living so besotted by vice, so lost to all power of virtuous resolutions, that they shall never more see the happy homes from which they so thoughtlessly wandered, never more hear the soft accents of loving friends; never again worship God, in a peaceful Sanctuary, or behold again an opened Bible!

"Gold! Gold! Gold! Gold!
Bright and yellow, hard and cold,
Molten, graven, hammer'd, and roll'd;
Heavy to get, and light to hold;
Hoarded, barter'd, bought, and sold,
Stolen, borrow'd, squander'd, doled:
Spurn'd by the young, but hugg'd by the old
To the very verge of the churchyard mould;

Price of many a crime untold;
Gold! Gold! Gold! Gold!
Good or bad a thousand-fold!
How widely its agencies vary—
To save—to ruin—to curse—to bless—
As even its minted coins express,
Now stamp'd with the image of Good Queen Bess,
And now of a Bloody Mary!"—*Hood.*

CHAPTER XVIII.

Honey—Pasturage—Overstocking.

THAT honey is not a natural secretion of the bee, but a substance obtained from the nectaries of blossoms, appears to have been well known to the ancient Jews. As the bee was classed among the unclean creatures, the eating of which was forbidden, one of their Rabbis asks: "Since we are not permitted to eat bees, why are we allowed to eat honey?" and replies: "Because the bees do not *make* (or *secrete*) honey, but only *gather* it from plants and flowers." The truth is well expressed in the lines so familiar to most of us from our childhood,

"How doth the little busy bee
Improve each shining hour,
And *gather* honey all the day
From every opening flower."

Bees gather honey not only from the blossoms, but often in large quantities, from what have been called honey-dews; "a term applied to those sweet, clammy drops that glitter on the foliage of many trees in hot weather." Two different opinions have been zealously advocated as to the origin of honey-dews. By some they are considered the natural ex-

udation from the leaves of trees, occasioned often by ill health, though sometimes a kind of perspiration, by which the plants resist the fervent heats to which they are exposed. Others insist that this sweet substance is discharged from the bodies of those aphides or small lice, which infest the leaves of so many plants. Unquestionably they are produced in both ways.

Messrs. Kirby and Spence, in their interesting work on Entomology, have given a description of the honey-dew furnished by the aphides.

"The loves of the ants and the aphides have long been celebrated; you will always find the former very busy on those trees and plants on which the latter abound; and if you examine more closely, you will discover that the object of the ants, in thus attending upon the aphides, is to obtain the saccharine fluid secreted by them, which may well be denominated their milk. This fluid, which is scarcely inferior to honey in sweetness, issues in limpid drops from the abdomen of these insects, not only by the ordinary passage, but also by two setiform tubes, placed one on each side, just above it. Their sucker being inserted in the tender bark, is without intermission employed in absorbing the sap, which, after it has passed through these organs, they keep continually discharging by these organs. When no ants attend them, by a certain jerk of the body, which takes place at regular intervals, they ejaculate it to a distance."

"Mr. Knight once observed," says Bevan, "a shower of honey-dew descending in innumerable small globules, near one of his oak-trees, *on the 1st of September;* he cut off one of the branches, took it into the house, and holding it in a stream of light, which was purposely admitted through a small opening, distinctly saw the aphides ejecting the fluid

from their bodies with considerable force, and this accounts for its being frequently found in situations where it could not have arrived by the mere influence of gravitation. The drops that are thus spurted out, unless interrupted by the surrounding foliage, or some other interposing body, fall upon the ground; and the spots may often be observed, for some time, beneath and around the trees affected with honey-dew, till washed away by the rain. The power which these insects possess of ejecting the fluid from their bodies, seems to have been wisely instituted to preserve cleanliness in each individual fly, and indeed for the preservation of the whole family; for pressing us they do upon one another, they would otherwise soon be glued together, and rendered incapable of stirring. On looking steadfastly at a group of these insects (*Aphides Salicis*) while feeding on the bark of the willow, their superior size enables us to perceive some of them elevating their bodies and emitting a transparent substance in the form of a small shower."

> "Nor scorn ye now, fond elves, the foliage sear,
> When the light aphids, arm'd with puny spear,
> Probe each emulgent vein, till bright below,
> Like falling stars, clear drops of nectar glow."
>
> *Evans.*

"Honey-dew usually appears upon the leaves as a viscid, transparent substance, as sweet as honey itself, sometimes in the form of globules, at others resembling a syrup; it is generally most abundant from the middle of June to the middle of July, sometimes as late as September."

"It is found chiefly upon the *oak*, the *elm*, the *maple*, the *plane*, the *sycamore*, the *lime*, the *hazel*, and the *blackberry;* occasionally also on the *cherry*, *currant*, and other fruit trees. Sometimes only one species of trees is affected at a time. The oak generally affords the largest quantity. At

the season of its greatest abundance, the happy, humming noise of the bees may be heard at a considerable distance from the trees, sometimes nearly equaling in loudness the united hum of swarming."—(Bevan.)

In some seasons, honey-dews yield such extraordinary supplies, that bees will often fill their hives in a few days. If furnished with empty combs, they will store a prodigious amount; but no certain reliance can be placed upon this article of bee-food, as in some years, there is very little, while it is abundant only once in three or four years. The honey obtained from this source, is generally good, though seldom as clear as that gathered from the choicest blossoms.

The quality of honey varies exceedingly, some is dark, and often bitter and disagreeable, while occasionally being gathered from poisonous flowers, it is very noxious to the human system.

An intelligent Mandingo African, informed a lady of my acquaintance, that in his country, they dare not eat *unsealed* honey, until it is first *boiled.* In some of the Southern States, unsealed honey is generally rejected. It appears to me highly probable that most of the noxious properties of the honey gathered from poisonous flowers, are evaporated while thickening in the cells, before it is sealed over by the bees. Boiling the honey, would seem to expel them much more effectually, as some persons who are not able to eat even the best honey with impunity, find it harmless after it has been boiled! Honey improves by age, and many are able to use with impunity, that which has been long in the hive, and which is much milder than any freshly gathered by the bees.

Honey, when taken from the bees, should be put where it will be safe from all intruders, and not exposed to so low

a temperature as to candy in the cells. The little red ant, and the large black ant are extravagantly fond of it, and they will soon carry off large quantities, unless it is placed beyond their reach. Paper should be pasted over all boxes, glasses, and other honey receptacles, to make them air tight, and they should then be carefully stored away for future use.

To drain pure honey from virgin combs, put them into a preserving kettle, and bring it to the boiling point; set it off to cool, and then remove the wax which will float upon the top. The honey may now be strained, and poured into bottles or jars, and tightly covered, to exclude the air; and should it candy, these may be set into cold water, and when brought to the boiling point, the honey will be as nice, as when first strained from the comb. If any of the combs contain bee-bread, they should be kept separate from the others, as the honey from them will be of an inferior quality. In Russia, and Germany, but little honey is sold in the comb, but in our country, its beautiful appearance induces many to keep it in this form, especially when intended for sale.

The prudent bee-keeper will preserve all empty comb which will be serviceable in the hive, or spare honey-boxes; all such as is useless for these purposes, may be put into water, and boiled, when the pure wax will float upon the top, and will harden if poured into cold water. It may now be melted again in a pan, and run into vessels slightly greased; the impurities which will settle to the bottom may be scraped off, when the cake grows hard. Old combs which have been long used by the bees for breeding, will not readily part with their wax, on account of the cocoons with which they are lined; these after being first boiled, should be put into a coarse woolen bag with a flat iron on top, to make it sink, and this bag boiled until the wax has strained through,

and risen to the top of the kettle. It should then be treated according to previous directions. *Very* old *brood* combs are not worth the trouble necessary to render out the wax; and are of no value except to be burned.

The surplus honey may be taken from the bees, in my hives, in a great variety of ways. (1st.) The hive may be made so long that the spare honey can be taken from the ends, on frames; and if these ends are separated by dividers or permanent partitions, from the main body of the hive, the purest honey will be deposited in them. The partitions should be kept about one quarter of an inch from the top and bottom, to allow the bees to pass freely into the ends; in winter these side apartments should be filled with straw.

A hive thus constructed, holding one dozen frames in the central apartment, and six in each of the end ones, will be found very cheap, and easy of construction. The side apartments may be rabbeted so as to receive short frames running from the ends to the partitions, or long ones from front to rear. The cover to this hive should be made of two thicknesses of boards, to protect the bees; and to prevent warping, the under boards should be so nailed, that the grain of the wood will run in a different direction from that of the upper ones.

(2d.) The surplus honey may be taken on frames inserted into a box of the same capacity with the main hive; it should have a partition in the centre, from front to rear, kept three-eighths of an inch from the top and bottom of the hive, to allow the bees to pass from one division to the other. The rabbets should be made so as to receive large frames, like those below, or two sets of short ones running from each end of the box to the partition.

When such a box is full, it may easily be removed and the bees driven from it with a little smoke, and the honey

may be sent in it to market more safely than in any other way, if the following directions are closely adhered to: Make the box of seven-eighths stuff; fasten with small nails, each frame to the rabbets, letting the nails project so that they may easily be drawn; between the bottom slats of the frames, slightly glue two small pieces of wood, to prevent the frames from swaying in the least, when the box is handled. Screw on a top to the box not less than three-fourths of an inch thick, and a bottom of the same thickness, with holes similar in size and number to those on the spare honey-board. The back of this box should have glass like the main hive, so that the Apiarian can see when it is full. Before putting in the frames, pour into the corners of the box a melted mixture, one-third bees-wax, and two-thirds rosin; by a little dexterity, the box may be held so that this mixture will run into all the corners, cooling as it runs, and making them perfectly honey-tight. Pour the same mixture through one of the holes, after screwing on the top and bottom, so as to make them tight. The box thus prepared, will hold only ten large frames, or sixteen small ones, as store combs should be further apart than those intended for brood, and it should be set on the hive in the place of the spare honey-board. The honey may be sold by the box, or the frames may be conveniently retailed, to accommodate small purchasers.

In a favorable season, I have taken two such boxes, holding over one hundred pounds, from a single non-swarming hive; and in very good locations, still larger returns may be realized. Two such boxes may be set over the main hive, and as the bees can pass into them, without being obliged to travel over the combs, the unusual height will not annoy them. The plan of all my hives is such as to allow any addition of top room, which the season or locality may ever require. The experienced bee-keeper well knows, that a colony will

make much more honey in a large box, than in several small ones whose united capacity is the same.

In small boxes, bees cannot so well maintain their animal heat; while in finishing them, so few can work, that much time is lost. The effective force of a colony is thus often wasted, at the height of the honey-harvest, when time is to the last degree precious to the bees.

I am not aware that the attention of Apiarians, has ever been called to the great loss necessarily incurred, by every attempt to compel bees to store their surplus honey, in small receptacles. By the use of my frames, the usual objections to large boxes are not only entirely obviated, but the honey may be removed from them even more conveniently, for sale or use, than from the small ones which have hitherto been regarded as best. The bee-keeper cannot afford to sell honey stored in small receptacles, except at a very considerable advance over its value in large boxes.

Persons accustomed to bees, if they use smoke, will need no metallic slides, for removing their surplus honey boxes. By blowing smoke into them, before they are taken off, most of the bees will retreat to the main hive, and if removed, early in the morning, or late in the afternoon, and placed on a sheet fastened to the hive, the bees, attracted by the hum of their companions, will speedily leave them, but not until they have swallowed all that they can hold. When gorged, they are very reluctant to fly, and this is the reason why they are so long in leaving, when the box is carried from the hive.

It sometimes happens that there is brood in the boxes thus removed, and this is a serious annoyance to the bee-keeper on the common plan, whereas, when frames are used, any containing brood may be returned to the hive, without at all interfering with the others. Many bees will utterly refuse to

forsake the box if their queen is in it, and when this occurs, she must be sought for, and returned to the hive. If the bees are reluctant to crawl on the sheet, from the boxes to the entrance of the hive, a few may be gently directed to it, with a spoon, when the others will speedily follow. The *sooner* the bees are driven out, the better; and the bee-keeper must keep a very watchful eye upon his treasures, or robber bees will scent them, and speedily convey them to their hives.

3d. Glass vessels of almost any size or form, will make beautiful receptacles for the spare honey; but they ought always to have a piece of comb fastened in them, and if the weather is cool, should be carefully covered with something warm, or they will part with their heat so quickly, as to discourage the bees from building in them.

Honey, when stored in quart tumblers, just large enough to receive one comb, has a most beautiful appearance, and may be easily taken out whole, and placed in an elegant form upon the table. The expense of such vessels is one objection to their use; the rapidity with which they part with their heat, another; but a more serious objection still, is the fact that while all small vessels waste the time of the bees, the shallow cells, so many of which must be made in a *round* vessel, require as large a consumption of time and materials for their covers, as those which hold more than twice their quantity of honey.

4th. If small boxes are used for surplus honey, the following mode of making them will be found the simplest, cheapest, and best. Let the inside dimensions be six inches in height and width, and five in length; and the thickness of the materials one-quarter of an inch. The top and bottom should project, about one-eighth of an inch beyond the sides, so that each end of the box, may receive a piece of glass, rest-

ing on the sides, and fastened with small tacks, or glazier's points, under the projecting top and bottom. A hole should be made in the bottom, of the same size with those on the spare honey-board, and three of my guides, five inches long, should be fastened to the top, so that the combs will be built by the bees, parallel with the glass ends. Such a box will hold three store combs, and by removing one glass, a comb may be cut out, without disturbing the others, and the glass fastened again in its place. The convenience of such a box will at once be obvious, to those who have had the usual vexatious experience with honey-boxes of the common form. Such a box will contain between four and five pounds of honey. The honey-board will receive nine boxes, and if a hole is made in their tops, as well as bottoms, another box may be set on each, and thus eighteen boxes be put upon the hive. By removing these as fast as they are filled, ample accommodation may be given to a non-swarming colony. A drawing of this box will be given among the other implements used in the Apiary.

If the bee-master has no spare comb, to put as a pattern into his honey-boxes, unless he can use my guides for comb-building, he will find that the bees often build quite irregularly; and that such crooked work, requires a great increase of time for its completion. In boxes of every kind, the work will be begun earlier, and carried forward more rapidly, if all the crevices are made air tight, by the melted mixture, before the boxes are given to the bees.

Boxes thus prepared, will not only spare the bees the severe labor of gathering and applying the propolis, but when their entrance is closed with tins of the same form that shut the holes in the spare honey-board, and then covered with the melted mixture, the honey may be transported to a great distance without any danger of leakage, even if the combs

are broken. All such boxes, however, should be very carefully packed, and the package furnished with handles, so that it can be lifted without the slightest jarring. Honey in virgin combs, requires to be handled with quite as much care as a tender infant.

In such boxes, honey may be safely removed from my hives, even by the most timid. Before removing a box, a thin knife should be carefully passed under it, to loosen, the attachments to the honey-board, without injuring the bees; then a small piece of tin or sheet-iron may be pushed under, to prevent the bees from coming up, when the honey is removed. The Apiarian should now rap gently on the box, and the bees in it, perceiving that they are separated from the main hive, will begin to fill themselves, in order to save as much as possible of their precious sweets. In about five minutes, having filled themselves, they will run over the combs, trying to get out, when the glass box may be taken off, and they will fly to the hive, with what they have been able to secure. Bees under such circumstances, *never* attempt to sting, and a child of ten years, may remove, with ease and safety, all their surplus stores. If a person is too timid to approach a hive, when any bees are flying, the honey may be removed towards evening, or early in the morning.

I would here strongly caution the bee-keeper, against needlessly opening the hives, which are relied on to produce surplus honey in boxes. Not unfrequently when a box only partially filled, is removed, and then returned, the bees will carry every particle of honey into the main hive! thus showing that they feel insecure in their possessions. Dzierzon asserts that the industry of his stocks, is not at all interfered with, however often he opens their hives; but while this may be true, if the honey is taken from the main hive, I am very confident that it is far from being the case, when

the spare honey is stored in boxes. Bees may undoubtedly become accustomed to interruptions, and I would much rather open a hive daily, than to disturb them only once in two weeks.

If the Apiarian wishes to remove honey from the interior of the hive, he must remove the combs, as directed on page 195, and shake the bees off, on a sheet, or directly into the hive.

PASTURAGE.

Some blossoms frequented by bees, yield pollen only, and others only honey; but most supply both. Since the discovery that rye flour is so admirable a substitute, early blossoms producing pollen alone, are not so important in the vicinity of an Apiary. Willows are among the most desirable trees to have within reach of the hives: some species put out their catkins very early, yielding an abundance of both bee-bread and honey. All the willows furnish a rich supply of food for the bees; and as there is considerable difference in the time of their blossoming, it is desirable to have such varieties as will furnish food, as long as possible.

The Sugar Maple yields a large supply of very delicious honey, and its graceful blossoms hanging in drooping fringes, will be all alive with bees. Apricot, Peach, Plum, Cherry, and Pear trees, are great favorites; but of all the fruit trees, none furnishes such a copious supply as the Apple.

The Tulip tree, (*Liriodendron*,) sometimes called White Wood, is one of the greatest honey-producing trees in the world. In rich lands this magnificent tree will grow over one hundred feet high, and when covered with its large bell-shaped blossoms of mingled green and golden yellow, it is one of the most beautiful trees in the world. The blossoms

expand in succession, often for more than two weeks, and a new swarm will frequently fill its hive from these trees alone. The honey, though dark in color, is of a rich flavor. This tree has been successfully cultivated as a shade tree, even as far North as Southern Vermont, and for the extraordinary beauty of its foliage and blossoms, deserves to be introduced wherever it can be made to grow.

The Linden or Bass Wood, (*Tilia Americana*,) yields large quantities of honey, white in color, and of delicious flavor. As this tree blossoms at a season when the colonies are strong, and the weather usually settled, and when other supplies are beginning to fail, it affords, unquestionably, one of the best supplies for bees. A correspondent of the Beinenzeitung, from Wisconsin, states that in 1853, several of his hives increased one hundred pounds each, in weight, while this tree was in blossom! Judge Fishback, of Batavia, Ohio, informed me that nearly all his surplus honey was gathered from the Bass Wood.

In most parts of New England, this tree is in such demand for cabinet making, that it has already become scarce, and many are unwisely felled when quite small. In some districts, the destruction of the Bass Wood, has done more than any thing else, to diminish the profits of bee-keeping. In vicinities where it abounds, swarms issuing as late even as the middle of July, are often able to fill their hives. This tree blossoms when quite young, and grows very rapidly. The European variety, besides being less elegant in appearance, is infested by worms, and is not so reliable in its honey-yielding qualities.

The American Linden blossoms soon after the white clover begins to fail, and a majestic tree covered with its yellow clusters, at a season when so few blossoms are to be seen, is a sight most beautiful and refreshing.

"Here their delicious task, the fervent bees
In swarming millions tend: around, athwart,
Through the soft air the busy nations fly,
Cling to the bud, and with inserted tube,
Suck its pure essence, its etherial soul."
Thomson.

The common locust, and the honey-locust, *(Gleditschia Triacanthus,)* are very desirable trees for the vicinity of an Apiary, yielding much honey, at a time when peculiarly valuable to the bees. In many sections, the setting out of large plantations of Locust and Bass Wood, would be highly profitable for the value of the wood, without any reference to Apiarian pursuits.

The blossoms of onions abound in honey, the odor of which, when first gathered, is very offensive, but before it is sealed over, this disappears. Hives in the vicinity of extensive beds of seed onions, will speedily become very heavy.

Of all the sources from which bees derive their supplies, white clover is the most important. It yields large quantities of very pure white honey, and wherever it abounds, the bee will find a rich harvest. In most parts of this country, it seems to be the chief reliance of the Apiary. Blossoming at a season of the year when the weather is usually both dry and hot, the bees as they gather the honey from it, after the sun has dried off the dew, find it so thick that it is ready to be sealed over almost at once. This clover ought to be much more extensively cultivated than it now is, and I consider myself as conferring a benefit not only on bee-keepers, but on the agricultural community at large, in being able to state on the authority of one of New England's ablest practical farmers and writers on agricultural subjects, Hon. Frederick Holbrook, of Brattleboro', Vermont, that the common white clover may be cultivated

on some soils to very great profit, as a hay crop. In an article for the New England Farmer, for May, 1853, he speaks as follows:—

"The more general sowing of white clover-seed is confidently recommended. If land is in good heart at the time of stocking it to grass, white clover sown with the other grass-seeds will thicken up the bottom of mowings, growing some eight or ten inches high, and in a thick mat, and the burden of hay will prove much heavier than it seemed likely to be before mowing. Soon after the practice of sowing white clover on the tillage-field commences, the plant will begin to show itself in various places on the farm, and ultimately gets pretty well scattered over the pastures, as it seeds very profusely, and the seeds are carried from place to place in the manure and otherwise. The price of the seed per pound in market is high; but then one pound of it will seed more land, than two pounds of red clover seed; so that in fact the former is the cheaper seed of the two, for an acre."

"Red-top, red clover and white clover seeds, sown together, produce a quality of hay universally relished by stock. My practice is, to seed all dry, sandy and gravelly lands with this mixture. The red and white clover pretty much make the crop the first year; the second year, the red clover begins to disappear, and the red-top to take its place; and after that, the red-top and white clover have full possession and make the very best hay for horses or oxen, milch cows or young stock, that I have been able to produce. The crop per acre, as compared with herds-grass, is not so bulky; but tested by weight and by spending quality in the Winter, it is much the most valuable."

"Herds-grass hay grown on moist uplands or reclaimed meadows, and swamps of a mucky soil, or lands not over-

charged with silicia, is of good quality; but when grown on sandy and gravelly soils abounding in silex, the stalks are hard, wiry, coated with silicates as with glass, and neither horses nor cattle will eat it as well, or thrive as well on it as on hay made of red-top and clover; as for milch cows, they winter badly on it, and do not give out the milk as when fed on softer and more succulent hay."

"The yield of honey by various plants and trees depends not only on the character of the season, but on the kind of soil in which they grow. Marshy meadows are inferior to those of a dryer soil, for bee-pasturage. White clover growing in the latter will be visited by bees, when that growing in the former is entirely neglected by them. Hence, when white clover is cultivated with a view to bee-pasturage, it is important that this fact be taken into consideration, in the selection of the land."—(Wagner.)

For years, I attempted in vain to procure a cross between the red and white clover, in order to get something with the rich honey and hay-producing properties of the red, and yet with a short blossom into which the domestic bee might insert its probosis. A variety answering all these desirable ends, has been originated in Sweden, and imported into this country, by Mr. B. C. Rogers, of Philadelphia. It grows as tall as the red clover, bears many blossoms on a stalk, in size resembling the white, and is said to be preferred by cattle to almost any other kind of grass, while it answers admirably for bees. It is known by the name of Alsike, or Swedish White Clover.

I am indebted to Mr. Wagner for the following interesting communication:

"The views of the value of Swedish White Clover, presented by reports from twelve different agricultural societies in the district of Dresden, are the result of careful experi-

ments, made in localities differing greatly in soil and exposure. We recapitulate the chief points.

"1. That Swedish White Clover is less liable to suffer from cold and wet weather, than the common red clover.

"2. That it is a less certain and less productive crop on dry sandy soil; and that, on such soils, it is less valuable than common white clover; but succeeds admirably on more loamy soils, and on such, surpasses either of the other kinds.

"3. That, in any rotation, it may safely follow the common red clover.

"4. That the yield, per acre, of the first mowing, is not inferior to that of the red clover; but that ordinarily the aftermath, or rowen, is not so abundant.

"5. That for soiling purposes, it should not be mown till it is in full blossom.

"6. That when cured, it is, as hay, a highly nutritious fodder, and is preferred, by cattle and milch cows, to that made from red clover.

"7. That the aftermath is followed by a dense and excellent growth, furnishing most valuable pasturage till late in the season.

"8. That it yields an abundance of seed, easily threshed out by flail or machine, three or four days after mowing.

"9. That Swedish White Clover is fed to most advantage after it has fully matured its blossoms; whilst red clover, if allowed to stand to this stage, will have already lost a considerable portion of its nutritive properties."

A perusal of the above mentioned facts, will at once convince the intelligent agriculturist, of the importance of this new variety of clover. The red clover often requires to be cut before the other grasses growing with it, are sufficiently mature; this very serious objection could be obviated by the introduction of the new variety.

Buckwheat furnishes an excellent Fall feed for bees; and often enables them to fill their hives with a generous supply against Winter. The honey being gathered either in the early part of the day, or when the atmosphere is moist, is often quite thin; the bees sweat out a large portion of its moisture, but still they do not exhaust the whole, and in wet seasons, it is somewhat liable to sour in the cells. Honey gathered in a dry season, is always thicker, and of course more valuable than that gathered in a wet one, as it contains much less water. Buckwheat is uncertain in its honey-bearing qualities; in some seasons, it yields next to none, and hardly a bee will be seen upon a large field, while in others, it furnishes an extraordinary supply. The most practical and scientific agriculturists agree that so far from being an impoverishing crop, it is on many soils, one of the most profitable that can be raised. Every bee-keeper should have some in the vicinity of his hives.

The following facts respecting the cultivation of buckwheat, were communicated to me by Mr. A. Wells, of Greenfield, Mass. He had a piece of land so exhausted by successive crops of corn and rye, that it would produce nothing but buckwheat, which he cultivated upon it for twelve or thirteen successive years. At the end of this time the land had recovered sufficiently to produce good corn! Each year, the weeds and self-sown buckwheat, which grew upon it, were plowed under, in seeding for the new crop, and the result proves, how erroneous are the common notions respecting the exhausting effects on the land, of this grain.

Dzierzon says: "In the stubble of winter grain, buckwheat might be sown, whereby ample forage would be secured to the bees, late in the season, and a remunerating crop of grain garnered besides. This plant, growing so

rapidly and maturing so soon, so productive in favorable seasons, and so well adapted to cleanse the land, certainly deserves more attention from farmers than it receives; and its more frequent and general culture would greatly enhance the profits of bee-keeping. Its long continued and frequently renewed blossoms, yield honey so abundantly, that a populous colony may easily collect fifty pounds in two weeks if the weather is favorable."

I am almost afraid to state that the Canada thistle yields copious supplies of very pure honey, lest some slothful bee-keeper should regard such a pest with too lenient an eye. If, however, the farmers will tolerate its growth, it is interesting to know that it can be turned to so good an account. It affords its pasturage after the white clover has begun to fail.

The raspberry is a great favorite with the bees, and furnishes a very delicious honey. In color and flavor it is decidedly superior to that from the white clover, while the comb is so delicate that it almost melts in the mouth. The sides of the roads, the borders of the fields, and the pastures of many of the hill-towns in New England, often abound with the wild red-raspberry; and in all such favored locations, numerous colonies of bees may be kept. I have often noticed that when it is in blossom, bees pay but little regard tn any other flower, holding even the the white clover in light esteem. Its drooping blossoms protect the honey from moisture, and the bees are able to gather from it, in weather too wet for them to obtain anything from the upright blossoms of the clover. As it furnishes a succession of flowers for some weeks, it yields a supply, almost if not quite, as lasting as the white clover. I regard it as the very best pasturage for bees with which I am acquainted, and as it is often superabundant in lands so precipitous and rocky, as to be

nearly worthless, if duly improved, it may effect as great a change in their value, as the cultivation of the grape on the vine-clad terraces of the mountain districts in Europe.

It will be observed that thus far, I have said nothing about cultivating flowers, to supply the bees with food. The little that can be done in this way, is of scarcely any account; and it would be almost as reasonable to expect to furnish food for a stock of cattle, from a small grass plat, as honey for bees, from garden plants. The cultivation of bee-flowers is more a matter of pleasure than profit, to those who like to hear the happy hum of the busy insect, as they walk in their gardens.

It hardly seems expedient to cultivate any field crops except such as are profitable in themselves, without any reference to bees. If, however, there is any plant of this kind which would justify cultivation, it is the Borage, (*Borago Officinalis.*) It blossoms in June, and continues in bloom until severe frost, and is always covered with bees, even in dull weather, as its pendant blossoms keep the honey from the moisture; the honey yielded by it, is of a superior quality. An acre of it would support a large number of stocks. If in a village those who keep bees would unite to secure the sowing of an acre, in their immediate vicinity, each person paying in proportion to the number of stocks kept, it might be found profitable. The plants should have about three feet of space every way, and after covering the ground, would need no further attention. They would come into full blossom, cultivated in this manner, about the time that the white clover begins to fail, and would not only furnish rich pasture for the bees, but would keep them from the groceries and shops in which so many perish.

If those who are engaged in adorning our villages and country residences with shade trees, would be careful to set

out a liberal allowance of such kinds as are not only beautiful to the sight, but attractive to the bees, in process of time the honey-resources of the country might be very greatly increased.

The fact that buckwheat, in some seasons, produces scarcely any honey, has already been noticed. It is not, however, peculiar in this respect. The yield of honey depends upon a very great variety of causes, many of which often elude our closest scrutiny. It is well known to sugar-makers that the flow of sap from the maple is uncertain, and that often it suddenly ceases, and as suddenly begins again, when they are able to assign no reason for such variations. So in some seasons blossoms will superabound in honey, while in others, the supply is extremely deficient. I have known bees to neglect the white clover, and suffer for want of food, when the fields have been almost white with its blossoms!

Sometimes a change in the supply of honey in the nectaries of the blossoms will take place so suddenly, that in a few hours, hives will pass from idleness to great activity. The bee-keeper should be thoroughly acquainted with the honey-resources of his district, and should know at what time the various supplies may be duly expected; for if ignorant in such matters, he can never manage his bees to the best advantage.

The Golden Rod, (*Solidago*,) affords a late and valuable bee-pasturage. There are many varieties of this plant, so closely resembling each other that they are distinguished with difficulty; some of the earlier flowering kinds, are of no value for bees, but those which blossom in September, yield a large supply of honey. In some regions and seasons it forms an important part of the honey stored for winter use.

The numerous species of wild Asters, lining, in many

districts, the road sides and the borders of fields, are, almost if not quite, as valuable to the bees as the Golden Rod. Where these two last mentioned plants abound, bees should not be fed until they have passed out of bloom, as light but strong stocks, will often obtain from them a supply.

No danger, at present, of overstocking a district with Bees.

We have now come to a point of the very first importance to all interested in the cultivation of bees. If the opinions which most American bee-keepers entertain on the subject of overstocking, are correct, then the keeping of bees, in this country, must always remain an insignificant pursuit. I confess that I find it difficult to repress a smile, when the owner of a few hives, in a district where as many hundreds might be made to prosper, gravely imputes his ill success, to the fact that too many bees are kept in his vicinity! If in the Spring, a colony of bees is prosperous and healthy, it will gather abundant stores, even if hundreds equally strong, are in its immediate vicinity, while if it is feeble, it will be of little or no value, even if it is in "a land flowing with milk and honey," and there is not another swarm within a dozen miles of it.

Success in bee-keeping requires that a man should, in some things, be a very close imitator of Napoleon, who always aimed to have an overwhelming force, at the right time, and in the right place; so the bee-keeper must have strong colonies, just at the time when numbers can be turned to the best account. If the bees are not numerous, until the honey-harvest is almost over, numbers will then be of as little account, as were many of the famous armies against which "the soldier of Europe" contended; which, after the

fortunes of the campaign were decided, only served to swell the triumphant spoils of the mighty conqueror. A bee-keeper with feeble stocks in the Spring, which become strong only when they can do nothing but eat up the little honey that has been previously gathered, is like a farmer who, after suffering his crops to rot upon the ground, hires, at great expense, a number of stalworth laborers, to idle about his premises, and eat him out of house and home!

I do not believe that there is a *single square mile* in this whole country, which is overstocked with bees, unless it is one so unsuitable for bee-keeping, as to make it unprofitable to attempt it at all. Such an assertion may seem very unguarded; but I am happy to be able to cofirm it, by reference to the experience of the largest cultivators in Europe. The following letter from Mr. Wagner, I trust will show our bee-keepers, how mistaken they are in their opinions on this subject, and also what large results might be obtained from a more extensive cultivation of bees.

York, March 16, 1853.

Dear Sir:

In reply to your enquiry respecting the *overstocking* of a district, I would say that the present opinion of the correspondents of the Bienenzeitung, appears to be that it *cannot readily be done.* Dzierzon says, in practice at least, "*it never is done;*" and Dr. Radlkofer, of Munich, the President of the second Apiarian Convention, declares that his apprehensions on that score were dissipated by observations which he had opportunity and occasion to make, when on his way home from the Convention. I have numerous accounts of Apiaries in pretty close proximity, containing from 200 to 300 colonies each. Ehrenfels had a thousand

hives, at three separate establishments, indeed, but so close to each other that he could visit them all in half an hour's ride; and he says that in 1801, the average net yield of his Apiaries was two dollars per hive. In Russia and Hungary, Apiaries numbering from 2000 to 5000 colonies are said not to be unfrequent; and we know that as many as 4000 hives are oftentimes congregated, in Autumn, at one point on the heaths of Germany. Hence I think we need not fear that any district of this country, so distinguished for abundant natural vegetation and diversified culture, will very speedily be overstocked, particularly after the importance of having stocks populous early in the Spring, comes to be duly appreciated. A week or ten days of favorable weather, at that season, when pasturage abounds, will enable a *strong* colony to lay up an ample supply for the year, if its labor be properly directed.

Mr. Kaden, one of the ablest contributors to the Bienenzeitung, in the number for December, 1852, noticing the communication from Dr. Radlkofer, says, "I also concur in the opinion that a district of country cannot be overstocked with bees; and that, however numerous the colonies, all can procure sufficient sustenance if the surrounding country contain honey-yielding plants and vegetables, in the usual degree. Where utter barrenness prevails, the case is different, of course, as well as rare."

The Fifteenth Annual Meeting of German Agriculturists was held in the city of Hanover, on the 10th of September, 1852, and in compliance with the suggestions of the Apiarian Convention, a distinct section devoted to bee-culture was instituted. The programme propounded sixteen questions for discussion, the fourth of which was as follows:

"Can a district of country embracing meadows, arable

land, orchards, and forests, be so overstocked with bees, that these may no longer find adequate sustenance, and yield a remunerating surplus of their products?"

This question was debated with considerable animation. The Rev. Mr. Kleine, (nine-tenths of the correspondents of the Bee-Journal are clergymen,) President of the section, gave it as his opinion that "it was hardly conceivable that such a country could be overstocked with bees." Counsellor Herwig, and the Rev. Mr. Wilkens, on the contrary, maintained that "it might be overstocked." In reply, Assessor Heyne remarked that "whatever might be supposed possible as an extreme case, it was certain that as regards the kingdom of Hanover, it could not be even remotely apprehended that too many Apiaries would ever be established; and that consequently the greatest possible multiplication of colonies might safely be aimed at and encouraged. At the same time, he advised a proper distribution of Apiaries.

I might easily furnish you with more matter of this sort, and designate a considerable number of Apiaries in various parts of Germany, containing from twenty-five to five hundred colonies. But the question would still recur, do not these Apiaries occupy comparatively isolated positions? and at this distance from the scene, it would obviously be impossible to give a perfectly satisfactory answer.

According to the statistical tables of the kingdom of Hanover, the annual production of bees-wax in the province of Lunenburg, is 300,000 lbs., about one half of which is exported; and assuming one pound of wax as the yield of each hive, we must suppose that 300,000 hives are annually "*brimstoned*" in the province; and assuming further, in view of casualties, local influences, unfavorable seasons, &c., that only one half of the whole number of colonies maintained, produce a swarm each, every year, it would require a

total of at least 600,000 colonies, (141 to each square mile,) to secure the result given in the tables.

The number of square miles stocked even to this extent, in this country, are, I suspect, "few and far between." It is very evident, that this country is far from being overstocked; nor is it likely that it ever will be.

A German writer alleges that "the bees of Lunenburg, pay all the taxes assessed on their proprietors, and leave a surplus besides." The importance attached to bee-culture, accounts in part for the remarkable fact that the people of a district so barren that it has been called "the Arabia of Germany," are almost without exception in easy and comfortable circumstances. Could not still more favorable results be obtained in this country under a rational system of management, availing itself of the aid of science, art and skill?

But, I am digressing. My design was to furnish you with an account of bee-culture as it exists *in an entire district of country*, in the hands of *the common peasantry*. This I thought would be more satisfactory, and convey a better idea of what may be done on a large scale, than any number of instances which might be selected of splendid success in isolated cases. Very truly yours,

SAMUEL WAGNER.

Rev. L. L. Langstroth.

I am persuaded that even in the poorest parts of New England, there are but few districts which could not be made to yield as large returns as the Province of Lunenburg, even if the old-fashioned plan of management was adhered to. Indeed, the more experience I have of the ignorance, carelessness, and indifference of the great mass of bee-keepers, in this country, the more firmly am I con-

vinced that the less they depart from the old system, the larger will be their profits. The most successful Apiarians, are those who intelligently use improved systems of management; next to them are the dogged adherents of the old box, and the brimstone match.

The following remarks from Oetle, on overstocking, page 298, are much to the purpose: "When a large flock of sheep is grazing on a limited area, there may soon be a deficiency of pasturage. But this cannot be asserted of bees, as a good honey-district cannot readily be overstocked with them. To-day when the air is moist and warm, the plants may yield a superabundance of nectar; while to-morrow, being cold and wet, there may be a total want of it. When there is sufficient heat and moisture, the saccharine juices of plants will readily fill the nectaries, and will be quickly replenished, when carried off by the bees. Every cold night checks the flow of honey;* and every clear warm day reopens the fountain. *The flowers expanded to-day must be visited while open, for if left to wither, their stores are lost* The same remarks will apply substantially in the case of honey-dews. Hence bees cannot, as many suppose, collect to-morrow what is left ungathered to-day, as sheep may graze hereafter on the pasturage they do not need now. Strong colonies and large Apiaries, are in a position to collect ample stores when forage suddenly abounds, while by patient, persevering industry, they may still gather a sufficiency, and even a surplus, when the supply is small, but more regular and protracted."

The same able Apiarian whose *golden rule* in bee-keeping is, to keep none but *strong colonies*, says that in the lapse of twenty years since he established his Apiary, there has not occurred a season in which the bees did not procure adequate

* The same is true of the flow of sap from the sugar maple.

supplies for themselves, and a surplus besides. Sometimes indeed, he came near despairing, when April, May and June were continually cold, wet and unproductive; but in July, his strong colonies speedily filled their garners, and stored up some treasure for him; while in such seasons, small colonies could not even gather enough to keep them from starvation.

M. A. Braum states in the Bienenzeitung, September 1854, that he has a mammoth hive furnished with combs containing at least 184,230 cells,* and placed on a platform scale that its weight may readily be ascertained at stated periods. On the 18th of May it gained eighteen pounds and a half. On the 18th of June a swarm weighing seven pounds issued from it; and the following day it gained over six pounds in weight. Ten days of abundant pasturage, would enable such a colony to gather a large surplus; while five times the number of equally favorable opportunities, would be of small avail to a feeble stock.

The Island of Corsica paid to Rome an annual tribute of 200,000 lbs. of wax, which presupposes the production of from two to three million pounds of honey yearly. The island contains 3790 square miles.

According to Oetle, (p. 389,) Bohemia contained 160,000 colonies in 1853, from a careful estimate, and he thinks the country could readily support four times that number. The kingdom contains 20,200 square miles.

In the province of Attica, in Greece, containing forty-five square miles, and 20,000 inhabitants, 20,000 hives are kept, each yielding, on an average, 30 pounds of honey and two pounds of wax. One hive to every man, woman and child!

East Friesland, a province of Holland, containing 1,200

* Such a hive would hold about three bushels.

square miles, maintains an average of 2,000 colonies per square mile! (Heubel, Beinenzeitung, 1854, p. 11.)

Doubtless in these districts where honey is so largely produced, great attention is paid to the cultivation of crops which, while in themselves profitable, at the same time afford abundant pasturage to the bees.

The question, how far bees will fly in search of food, has been very differently answered by different Apiarians.* I am satisfied that they will fly over three miles, but believe that if their food is not within a circle of about two miles in every direction from the Apiary, they will be able to store but little surplus honey. If pasturage abounds within a quarter of a mile from their hives, so much the better; but there is no great advantage in having it close to them, unless there is a great supply, as bees when they leave the hive, are seldom seen to alight upon the adjoining flowers. The instinct to fly to some considerable distance, was unquestionably given them to prevent the great loss which would result, if they wasted their time in prying into flowers already despoiled of their sweets, by previous gatherers.

In all my arrangements, I have aimed to save *every step* for the bees that I possibly can, economizing to the utmost their time, that it may all be transmuted into honey; an inspection of the Frontispiece of this treatise, will exhibit the

* "Mr. Kaden, of Mayence, thinks that the range of the bees' flight does not usually extend more than three miles in all directions. Several years ago, a vessel laden with sugar, anchored off Mayence, and was soon visited by the bees of the neighborhood, which continued to pass to and from the vessel from dawn to dark. One morning, when the bees were in full flight, the vessel sailed up the river. For a short time the bees continued to fly as numerously as before; but gradually the number diminished, and in the course of half an hour, all had ceased to follow the vessel, which had meanwhile sailed more than four miles."—*Bienenzeitung*, 1854, *p.* 83.

general aspect of the alighting board of my hives, and show how readily bees will enter such a hive, even in very windy weather. By such arrangements, they will be able to store more honey, even if they have to go a considerable distance for it, than they can in many other hives, from pasturage nearer at hand. Such considerations are entirely overlooked, by many bee-keepers, who seem to imagine that they are matters of no importance. By their utter neglect of any kind of precautions to facilitate the labors of their bees, you might suppose that they imagined these delicate insects to be possessed of nerves of steel, and sinews of iron or adamant; or else that they took them for miniature locomotives, always fired up, and capable of an indefinite amount of exertion. A bee *cannot* put forth more than a certain amount of physical exertion, and if a large portion of this is spent in contending against difficulties, from which it might easily be guarded, it is obvious that a great loss must be sustained by its owner.

If some of these thoughtless bee-keepers, returning home with a heavy burden, were compelled to fall down stairs half a dozen times, before they could get into the house, or to squeeze through narrow and crowded passages, they might perhaps think it best to protect their industrious workers from such discouraging accidents. If bees are tossed violently about by the winds, as they attempt to enter their hives, they are often fatally injured, and the whole colony so *discouraged*, to say nothing more, that they do not gather near so much as they otherwise would.

Just as soon as our cultivators can be convinced, by practical results, that bee-keeping, for the capital invested, may be made a most profitable branch of rural economy, they will see the importance of putting their bees into suitable hives, and doing all they can, to give them a fair chance;

until then, the mass will follow the beaten track, and attribute their ill success, not to their own ignorance, carelessness or stupidity, but to their want of "luck," or to the overstocking of the country with bees. I hope, before many years, to see the price of good honey so reduced that the poor man can feast upon it, as one of the cheapest luxuries within his reach.

"It is by no means easy to devise a rule for estimating the profits of bee-culture, whether we regard the number of colonies, or the number of square miles. He is not the best Apiarian who obtains the largest yield from a single hive, but keeps only one or two. By very judicious and careful management, a hundred colonies might yield a large profit, yet fall far short of what three hundred would have yielded in the same location and same season, with much less supervision and attention. He is not the most successful farmer who produces the most extraordinary yield from a single rod of ground; but he who secures the amplest crops from an extensive area well cultivated. The swarming system may be very advantageous in certain localities, in spite of its manifest wastefulness, though in other localities, it would, because of that unavoidable wastefulness, render bee-keeping a decidedly losing business, since the system involves a vast expenditure of honey for the production and maintenance of brood, which scarcely matures before it is doomed to the brimstone pit, leaving to its owner often a smaller quantity of honey than the swarm would have produced if taken up three weeks after it was hived.*

"Confine the queen of an artificial swarm, so as to prevent

* Not only does the old fashioned bee-keeper, by delaying to take up his bees until Fall, lose often a large amount of honey, but even if he loses nothing in quantity, he often permits the bees to consume for themselves, the larger part of the best honey, gathered early in the

her from depositing eggs in the combs, and the colony will in a short time in the gathering season, accumulate much larger stores of honey, than one whose queen is left at liberty, though equal in age and populatiou. Thus also, a colony having a very prolific queen, will even in favorable seasons, lay up much less honey, unless ample store room is given them, than one whose queen lays fewer eggs. From these and similar facts which might be enumerated, it is evident, that a very large number of particulars must be taken into consideration, when endeavoring to form some general rule for estimating the profits of bee-culture." (Wagner.)

On page 22, a statement was given of Dzierzon's experience as to the profits of bee-keeping. The section of country in which he resides, is regarded by him as unfavorable to Apiarian pursuits. I shall now give what I consider a safe estimate for almost any section in our country; while in unusually favorable locations it will fall far below the results which may be attained. It is based upon the supposition that the bees are kept in properly constructed hives, so as to be strong early in the season, and that the increase of stocks is limited to one new one, from two old ones. Under proper management, on an average of years, about ten dollars worth of honey may be obtained for every two stocks wintered over. The worth of the new colonies, I set off as an equivalent for labor of superintend-

season, and has for himself, chiefly an inferior, late gathered article. It will be seen that much judgment is requisite, in order to know, even on the old plan, when it is most profitable to kill the bees. An intimate acquaintance with the honey-resources of the district, is absolutely necessary to decide the question. If bees are smothered, it will be found decidedly advantageous to remove and destroy their queens, at least three weeks before taking their honey; in this way the production of brood and consumption of honey will be checked, and the combs will be in a much better condition for melting.

ence, and interest on the money invested in bees, hives, fixtures, &c.

A careful man who will enter into bee-keeping moderately at first, and extend his operations only as his skill and experience increase, will, by the use of my hives, find that the preceding estimate is not too large. Even on the ordinary mode of bee-keeping, there are many who will consider it rather below than above the mark. If thoroughly careless persons are determined to "try their luck," as they call it, with bees, I advise them by all means, in mercy to the bees, to adopt the old plan. Improved methods of management with such persons will be of little or no use, unless you can improve their habits, and very often their brains too! Every dollar that they spend upon bees, unless with the slightest possible departure from the old-fashioned plans, is a dollar worse than thrown away. In those parts of Europe where bee-keeping is conducted on the largest scale, the mass adhere to the old system; this they understand, and by this they secure a certainty, whereas in our country, thousands have been induced to enter upon the wildest schemes, or at least to use hives which could not furnish them the information absolutely necessary for their successful management. A simple box furnished with my frames, will enable the masses, without departing materially from the common system, to increase largely the yield from their bees. (See p. 240.)

The Government of Norway has appropriated $300 per annum, for three years, towards diffusing a knowledge of Dzierzon's method, in that country, having previously despatched Mr. Hanser, Collector of Customs, to Silesia, to visit Dzierzon, and acquire a practical knowledge of his system of management.

The Prussian Government, through its Department of Agriculture, furnishes annually a number of persons from different sections of the kingdom, with the means of acquiring a practical knowledge of Dzierzon's system; while the Bavarian Government has prescribed instruction in the theory and practice of bee-culture, according to Dzierzon's system, as a part of the regular course of studies in the Teachers' Seminaries of that country.

The time has hardly come when the attention of any of our State authorities can be attracted to the importance of bee-culture. It is only of late that they have seemed to manifest any peculiar interest in promoting the advancement of agricultural pursuits. A Department of Agriculture ought to have been established, years ago, by the National Government at Washington. A National Society to promote the agricultural interests of the country, has recently been established, and much may be hoped from its wisdom and energy. Until some disinterested tribunal can be established, before which all inventions and discoveries can be fairly tested, honest men will suffer, and ignorance and imposture will continue to flourish, Lying advertisements and plausible misrepresentations of brazen-faced impostors, will still drain the purses of the credulons, while thousands, disgusted with the horde of impositions which are palmed off upon the community, will settle down into a determination to try nothing new. A society before which every thing, claiming to be an improvement in rural economy, could be fairly tested, would undoubtedly be shunned by ignorant and unprincipled men, who now find it an easy task to procure any number of certificates, but who dread nothing so much as honest and intelligent investigation. The reports of such a society, after the most thorough trials and examinations, would in-

spire confidence, save the community from severe losses, and encourage the ablest minds to devote their best energies to the improvement of agricultural implements.

The following catalogue of bee-flowers, is taken from Nutt, an English Apiarian.

" Alder tree, Almond tree, Althea frutex, Alyssum, Amaranthus, Apple tree, Apricot tree, Arbutus Ash tree, Asparagus, Aspin, Aster. Balm, Bean, Beech tree, Betony, Blackberry, Black currant tree, Borage, Box tree, Bramble, Broom, Bugloss (viper's), Buckwheat, Burnet. Cabbage, Cauliflower, Celery, Cherry tree, Chestnut tree, Chickweed, Clover, Cole or Coleseed, Coltsfoot, Coriander, Crocus, Crowfoot, Crown Imperial, Cucumber, Currants, Cypress tree. Daffodil, Dandelion,* Dogberry tree. Elder tree, Elm tree, Endive. Fennel, Furze. Golden Rod,† Gooseberry tree, Gourd. Hawthorn, Hazel tree, Heath, Holly, Hollyhock (trumpet,) Honeysuckle, Honeywort (cerinthe,) Hyacinth, Hysop. Ivy. Jonquil. Kidney bean. Laurel, Laurustinus, Lavender, Leek, Lemon tree, Lily (water,) Lily (white,) Lime tree, Linden (Bass Wood,) Liquidamber, Liriodendron, or Tulip tree, Lucerne. Mallow (marsh,) Marigold (French,) Marigold (single,) Maple tree, Marjoram (sweet,) Mellilot, Melons, Mezereon, Mignionette, Mustard. Nasturtium, Nectarine tree, Nettle (white.) Oak tree, Onion, Orange tree, Ozier. Pars-

*The Dandelion is worthy of a prominent rank among honey-producing plants; it blossoms after the yield from fruit trees is nearly over, and furnishing abundant supplies of pollen and honey, at a critical period of the year, is often of great service to the honey-bee.

†The Golden Rod has been so productive this month, (Sept. 1856,) that strong stocks with empty combs, have amassed from it a winter's supply!

nip, Pea, Peach tree, Pear tree, Peppermint, Plane tree, Plum tree, Poplar tree, Poppy, Primrose, Privet. Radish, Ragweed, Raspberry, Rosemary (wild), Roses (single,) Rudbeckiæ. Saffron, Sage, Saintfoin, St. John's wort, Savory (winter,) Snowdrop, Snowberry tree, Stock (single,) Strawberry, Sunflower, Sycamore tree, Squash. Tansy (wild,) Tare, Teasel, Thistle, (common,) Thistle (sow,) Thyme (lemon,) Thyme (wild,) Trefoil, Turnip. Vetch, Violet (single). Wallflower (single), Woad, Willow-herb, Willow tree. Yellow weasel-snout."

CHAPTER XIX.

The Anger of Bees—Remedies for their stings—Instincts of Bees.

If the bee was disposed to use its effective weapon, when not provoked, its domestication would be entirely out of the question. The same remark, however, is equally true of the ox, the horse, or the dog. If these faithful servants of man, were respectively determined to use, to the very utmost, horns, heels, and teeth, to his injury, he could never have subjected them to his peaceful authority. The gentleness of the honey-bee, when kindly treated, and managed by those who understand its instincts, has in this treatise been frequently spoken of, and I do not hesitate to say that it is more easily and completely subject to human control, than any other living creature which man has attempted to domesticate. Whenever they are gorged with honey, they will allow any amount of handling which does not hurt them, without the slighest show of anger. For the gratification of

others, I have frequently taken them up, by handfulls, suffered them to run over my face, and even smoothed down their glossy backs, as they rested on my person! Standing before the hives, I have, by a rapid sweep of my hands, caught numbers of them at once, just as though they were so many harmless flies, and allowed them, one by one, to crawl out, by the smallest opening, to the light of day; and I have even gone so far as to imitate many of the feats which the celebrated English Apiarian, Wildman, was accustomed to perform; who having once secured the queen of a hive, could make the bees cluster on his head, or hang, like a flowing beard, in large festoons, from his chin. Wildman, for a long time, made as great a mystery of his wonderful performances, as the charlatan spirit-rappers of the present day, do of theirs; but at last, he was induced to explain his whole mode of procedure; and the magic control which he possessed over the bees, and which was, by the ignorant, ascribed to his having bewitched them, was found to be owing entirely to his superior acquaintance with their instincts, and his uncommon dexterity and boldness.

"Such was the spell, which round a Wildman's arm,
Twin'd in dark wreaths the fascinated swarm;
Bright o'er his breast the glittering legions led,
Or with a living garland bound his head.
His dextrous hand, with firm yet hurtless hold,
Could seize the chief, known by her scales of gold,
Prune 'mid the wondering train her filmy wing,
Or o'er her folds the silken fetter fling."

M. Lombard, a skillful French Apiarian narrates the following interesting occurrence, to show how peaceable bees are in swarming time, and how easily managed by those who have both skill and confidence.

"A young girl of my acquaintance," he says, "was

greatly afraid of bees, but was completely cured of her fear by the following incident. A swarm having come off, I observed the queen alight by herself at a little distance from the Apiary. I immediately called my little friend that I might show her the queen; she wished to see her more nearly, so after having caused her to put on her gloves, I gave the queen into her hand. We were in an instant surrounded by the whole bees of the swarm. In this emergency I encouraged the girl to be steady, bidding her be silent and fear nothing, and remaining myself close by her; I then made her stretch out her right hand, which held the queen, and covered her head and shoulders with a very thin handkerchief. The swarm soon fixed on her hand and hung from it, as from the branch of a tree. The little girl was delighted above measure at the novel sight, and so entirely freed from all fear, that she bade me uncover her face. The spectators were charmed with the interesting spectacle. At length I brought a hive, and shaking the swarm from the child's hand, it was lodged in safety, and without inflicting a single wound."

The indisposition of bees to sting, when swarming, is a fact familiar to every practical bee-keeper: as far as I know, no previous Apiarian has discovered the philosophy of this fact, by noticing that when bees are filled with honey, they lose all disposition to volunteer an assault, and that this curious law is the foundation of an extensive and valuable system of practical management. It was only after I had thoroughly tested its universality and importance, that I began to feel the desirableness of obtaining a perfect control over each comb in the hive; for it was only then that I saw that such control might be made available, in the hands of any one who could manage bees in the ordinary way. The effect of my whole system, is to make the bees unusu-

ally gentle, so that they are not only peaceable when any necessary operation is being performed, but at all other times. Even if the hives could be opened at pleasure, still if such liberties resulted in leaving the bees in an unusually irritable state, it would avail but little.

Persons who have much to do with bees, unless they use a bee-dress, will incur a risk which necessarily attaches to every system of bee-culture. If an Apiary is approached, thousands and tens of thousands of bees will continue their busy pursuits, without interfering with those who do not molest them. But frequently a few cross bees will come buzzing around our ears, appearing determined to sting without the very slightest provocation. From such lawless assailants no person, without a bee-dress, is absolutely safe. By repeated examinations, I have ascertained that *disease* is generally the cause of such unusual irritability. I am never afraid that a healthy bee will attack me, unless provoked; and am always sure as soon as I hear one singing about my ears, that it is incurably diseased. Such a bee when dissected, will exhibit unmistakable evidence that a peculiar kind of dysentery, has already fastened upon its system. In the first stages of this complaint, the insect is very irritable, refuses to labor, and seems unable or unwilling to distinguish friend from foe. As the disease progresses, it becomes stupid, its abdomen is distended with a great mass of yellow matter, and the insect unable to fly, crawls on the ground, in front of the hive, and speedily perishes. I have never been able to ascertain the cause of this singular malady, nor can I suggest any remedy for it. I hope that some scientific Apiarians will investigate it closely, for if it could be remedied, we might have hundreds of colonies on our premises and in our gardens, and yet incur scarcely any risk of being stung.

A person thoroughly acquainted with the leading principles of bee-culture, as they are set forth in this Manual, will *never under any circumstances*, find it necessary to provoke to fury a colony of bees. Let it be remembered that nothing can be more terribly vindictive than a family of bees when thoroughly aroused by gross abuse, or unskillful treatment. Let their hive be suddenly overthrown, or violently jarred, or the bees provoked by the presence of a sweaty horse, or any offensive animal, so that the anger at first manifested by a few, is extended to the whole community, and the most severe and sometimes dangerous consequences may ensue. In the same way the animals most useful to man, may by ignorance or abuse, be roused to a state of frantic desperation; limbs may be broken, and often lives destroyed, and yet no one possessed of common sense, attributes such calamities, except in rare instances, to any thing else than carelessness or want of skill. Even the most peaceable stock of bees can, in a very few days, by abusive treatment, be taught to look on every living thing as an enemy, so as to sally forth with the most spiteful intentions, as soon as any one approaches their domicile. How often does it happen that the vicious beast, which its owner so passionately beats, is far less to blame for its obstinacy, than the equally vicious brute who so unmercifully belabors it!

A word here to those timid females, who are almost ready to faint, or to go into hysterics, if a bee enters the house, or approaches them in the garden or fields. Such alarm is entirely uncalled for. It is only in the vicinity of their homes, and in resistance to what they consider an evil design upon their very altars and firesides, that these insects ever volunteer an attack. Away from home, they are as peaceably inclined as you could desire. If you attack them, they are much more eager to escape, than to offer you any

annoyance, and they can be induced to sting, only when they are compressed, either by accident or design.

Let none of my readers imagine that they have even a slight encouragement, from this conduct of the bee, to reserve all their sweet smiles and honied words, for the world abroad, while they give free vent, in the sacred precincts of home, to cross looks and ill-tempered language; for towards the occupants of its honied dome, the bee is all kindness and affection. In the experience of many years I never saw an instance in which two bees, members of the same family, ever seemed to be actuated by any but the very kindest feelings towards each other. In their busy haste they often jostle against each other, but as every thing is well meant, so every thing is well received; tens of thousands all living together in the sweetest harmony and peace, when often where there are only two or three children in a family, the whole household is tormented by their constant bickerings and contentions. Among the bees, the good mother is the honored queen of her happy family; all waiting upon her steps with unbounded reverence and affection, making way for her as she moves over the combs, smoothing and brushing her beautiful plumes, offering her food from time to time, and in short doing all that they possibly can to make her perfectly happy; while too often children treat their mothers with irreverence or neglect, and instead of striving with loving zeal to lighten their labors, and save their steps, they treat them more as though they were servants hired only to wait upon their whims, and humor their caprices.

I am aware that bees show no mercy to any, even of their own colony, who from sickness or injury, become unfit to perform their proper share of labor. All such are remorselessly seized and hurried out of the hive, being often carried to a distance to die alone, that the stench of their dead

bodies may not be offensive to their pitiless companions. There is nothing, however, in the nature of a bee to be benefitted by nursing the sick, or waiting upon the crippled, while often the very noblest traits of humanity, are most beautifully developed by the incessant care and self-denial, required by the weak and helpless of the human family. "The heathen in their blindness," may, like the bees, expose their feeble children and aged parents, but it is the glory of man's nature to imitate Him who not only "went about doing good," but who "bare our sorrows and carried our sicknesses," that we who are strong, might learn from his Godlike example, to lighten the burdens of those who are weak.

Let us pause for a moment, and contemplate further the admirable arrangement by which the instinct of the bee which disposes it to defend its treasures, is made so perfectly compatible with the safety both of man, and the domestic animals under his care. Suppose that away from home, bees were as easily provoked, as they are in the immediate vicinity of their hives, what would become of our domestic animals, among the clover fields, or on the hill-side pastures? A tithe of the merry gambols they now so safely indulge in, would speedily bring about them a swarm of these infuriated insects. In all our rambles among the green fields, we should ourselves be in constant peril; and no jocund mower could ever whet his glittering scythe, or swing his peaceful weapon, unless first clad in a dress impervious to their stings. In short, the bee, instead of being the friend of man, would be one of his most vexatious enemies, and as in the case of savage wild beasts, unceasing efforts would be made for its utter extermination.

The sting of a bee often produces very painful, and upon some persons, dangerous effects. I am persuaded, from the result of my own observation, that the bee seldom stings

those whose systems are not sensitive to its venom, while it seems to take a special and malicious pleasure in attacking those upon whom its poison produces the most painful effects! It may be that something in the secretions of such persons, both provokes the attack, and causes its consequences to be more severe. I should not advise those on whom the sting of a bee produces the most agonizing pain, and violent, if not dangerous symptoms, to devote any attention to the practical part of an Apiary.

I once met with an individual, whose breath, shortly after he was stung, had the same odor with the venom of the enraged insect! The smell of the poison resembles almost perfectly that of a ripe banana. It produces a very irritating effect upon the bees themselves; for if a minute drop is extended to them, on a stick, they at once manifest the most decided anger. This is the reason why after one has inflicted a sting, others are so ready to follow suit.

On one occasion, after being stung several times on the back of the same hand, I wet it with honey, and met with no further annoyance. I should very much prefer, in my own practice, protecting my hands in this way, to using gloves which often prove an incumbrance.

The smell of the poison, like the warning blast of the martial trumpet, is a signal to all within reach of its pungent odor, to be ready for using their tiny, but much dreaded weapon. Bees often thrust out their sting, in a threatening manner, even when they do not make an attack; when extended from its sheath, it exhibits a minute drop of poison on its point, the odor of which is quickly perceived, and some of it is occasionally flirted into the eye of the Apiarian, causing considerable itching.

It is well known that bees are lovers of sweet odors, and that unpleasant ones are very apt to excite their anger. And

here I may as well speak plainly, and say that they have a special dislike to persons whose habits are not neat, and particularly to those who bear about them, a perfume not in the very least resembling those of which the poet so beautifully discourses:

"Sabean odors
From the spicy shores of Araby the blest."

Those who belong to the family of the "great unwashed," will find to their cost that bees are decided foes to most of their tribe.

The peculiar odor of some persons, however cleanly, may account for the fact that the bees have such a decided antipathy to their presence, in the vicinity of their hives. It is related of an enthusiastic Apiarian, that after a long and severe attack of fever, he was never able to take any more pleasure in his bees; his secretions seem to have undergone such a change, that the bees assailed him, as soon as he ventured to approach their hives.

Nothing is more offensive to bees than the impure breath exhaled from human lungs; it excites them at once to fury, Would that in their hatred of impure air, human beings displayed some portion of the sagacity exercised by bees! It would not be long before the thought of breathing air, not only deficient in oxygen, but loaded with all manner of impurities from human lungs and skins, would excite unutterable loathing and disgust.

The smell of a sweaty horse is very offensive to bees, and it is never safe to allow these animals to go near a hive, as they are sometimes attacked and killed by the furious insects. Those engaged in bee-culture on a large scale, will do well to surround their Apiaries with a strong fence, so as to prevent cattle from molesting the hives. If the Apiary is enclosed by a high fence, with sharp and strong pickets, and

has a door furnished with a strong lock, it will prevent the losses which are so common, in some localities, from human pilferers. A neighborhood, however, in which the stealing of honey and fruit, is practiced by any except those who are candidates for the felon's cell, is in a fair way of being soon considered as a very undesirable place of residence.

If owners of Apiaries, gardens and orchards, could be induced to pursue a more liberal policy, and not be so meanly penurious as they often are, I am persuaded that they would find it conduce very highly to their interests. The honey and fruit expended with a cheerful, hearty liberality, would be more than repaid to them in the good will secured, and in the end would be cheaper than bars and bolts. Reader! do not imagine that I have the least idea that a thoroughly selfish man, can ever be made to practice this or any other doctrine of benevolence. Demonstrate it again and again, until even to his narrow and contracted view, it seems almost as clear as light, still he will never find the heart to reduce it to practice. You might almost as well expect to transform an incarnate fiend into an angel of light, by demonstrating that "Wisdom's ways are ways of pleasantness," as to attempt to stamp upon a heart encrusted with the adamant of selfishness, the noble impress of a liberal spirit.

Of all the senses, that of smell in the bee, seems to be the most perfect. Huber has demonstrated its exceeding acuteness, by numerous interesting experiments. If honey is placed in vessels from which the odor can escape, while the honey cannot be seen, the bees will soon alight upon them and eagerly attempt to find an entrance. It is by this sense, unquestionably, that they recognize the members of their own community, although it seems to us very singular that each colony should have its own peculiar scent. Not

only can two colonies be safely united by giving them the same odor, but in the same way any number of colonies may be made to live in perfect peace. If hundreds of hives are all connected by wire gauze ventilators, so that the air passes freely from one to another, the bees will all live in absolute harmony, and if any bee attempts to enter the wrong hive, it will not be molested. The same result can often be attained by feeding colonies from a common vessel. I have seen hundreds of thousands of bees which had acquired the same odor, by being fed together, and which were always gentle towards each other, while if a single bee from a strange Apiary, lit upon the feeder, it was sure to be killed.

I have already described the use which I make of peppermint, in order to prevent bees from quarreling when they are united. The Rev. Mr. Kleine, in a recent number of the Bienenzeitung, says that the most convenient and effectual mode of arresting and repelling the attacks of robbers, is, to impart to the attacked hive some intensely powerful and unaccustomed odor. He effects this most readily, by placing in it a small portion of *musk*, late in the evening, when all the robbers have retreated. On the following morning, the bees, (provided they have a healthy queen,) will promptly and boldly meet their assailants, and these in turn are non-plussed by the unwonted odor, and if any of them enter the hive and carry off some of the coveted booty, they will not be recognized nor received at home on their return, on account of their strange smell, but will be at once seized as strangers, and killed by their own household. Thus the robbing is speedily brought to a close.

In combination with my blocks, this device might be made very effectual. When the Apiarian perceives that a hive is being robbed, let him shut up the entrance: before dusk he

can open it and allow the robbers to go home, and then put in a small piece of musk; the entrance next day may be kept so contracted that only a single bee can pass at once.

In the union of stocks, musk might be used advantageously. A short time before the process is attempted, each colony might receive a small dose tied up in a little bag, and they would then be sure to agree. I prefer, however, in most cases, the use of scented sugar-water.

From some recent experiments, I am persuaded that bees can often recognize strangers, by their *actions*, even when they have the same scent! It is well known that bees when frightened have a certain cowed look, and shrink into the smallest possible compass. In the attempt to unite stocks, where the bees of one colony are left on their *own stand*, and the others are suddenly introduced, the latter, (even when both have the same smell,) are sometimes so frightened, that they are at once discovered to be strangers, and instantly killed. This may be prevented by removing both colonies, during the operation, to a new stand, and shaking them all out together upon a sheet, so that one colony may have no advantage over the other.

By using my double hives, and putting a small piece of gauze-wire in the partition, the two colonies having the same scent will always agree; this will be very convenient where they are compelled to live as such near neighbors, and enables the Apiarian at any time to unite them, and appropriate their surplus stores. These double hives are admirably adapted to the wants of those who prefer the smallest possible departure from the old system, as they need make no change, except to unite the stocks in the Fall, instead of killing the bees.

I have already remarked that nothing should ever be done,

which excites a whole colony to a pitch of ungovernable fury. Such operations are *never* necessary; and a skillful Apiarian will, by availing himself of the principles laid down in this Treatise, both easily and safely do everything required in the whole range of bee-keeping.

When bees are improperly dealt with, they will "compass" their assailant "about," with the most savage ferocity, and woe be to him if they can creep up his clothes, or find on his person a single unprotected spot! On the contrary, when not provoked by foolish management or wanton abuse, the few who are bent on mischief, appear still to retain some touch of grace, amid all their desperation. Like the thorough bred scold, who by the elevated pitch of her voice, often gives timely warning to those who would escape from the sharp sword of her tongue, a bee bent upon mischief raises its note almost an octave above the peaceable pitch, and usually gives us timely warning, that it means to sting, if it can. Even then, unless the whole colony has been maddened by accident or injudicious treatment, it will seldom proceed to extremities, unless it can leave its sting somewhere upon the face of its victim, and usually as near as possible to the eye; for bees, like all other members of the stinging tribe, seem to have, as it were, an intuitive perception that this is the most vulnerable spot upon the "human face divine." If the head is quietly lowered, and the face covered with the hands, they will often follow a person for some rods, all the time sounding their war note in his ears, taunting him for his sneaking conduct, and daring him, just for one single moment, to look up and allow them to catch but a glimpse of his coward face!

If a person is suddenly attacked by angry bees, no matter how numerous or vindictive they may be, not the slightest attempt should ever be made to act on the offensive. If a

single bee is violently struck at, a dozen will soon be on hand to avenge the insult, and if the resistance is still continued, hundreds and at last thousands will join in the attack. The assailed party should quickly retreat from the vicinity of the hives, to the protection of a building, or if none is near, he should hide himself in a clump of bushes, and lie perfectly still, with his head covered, until the bees leave him. If no bushes are near at hand, the bees will generally give over the attack, if the assailed party lies flat on the grass, with his face to the ground, keeping perfectly quiet.

Many persons erroneously imagine that they are quite safe, if they stand at a considerable distance from the bees, when in reality they are often more liable to be stung, than those who are prying directly into the hives. If any cross bees are about, they will be pretty sure to attack those whose more distant position, makes them, to such long-sighted creatures, so much better a mark than persons who are actually touching the hives! The use of a bee-dress will, in all cases, give such a sense of security, as to enable the most timid to take pleasure in the management of bees.

Remedies for the sting of a bee.

If only a few of the host of cures, so zealously advocated, could be made effectual, few persons would have much reason to dread being stung. Unfortunately, most remedies, instead of being of any use, like the prescriptions of the quack, only aggravate the original complaint.

The first thing to be done after being stung, is to pull the sting out of the wound *as quickly as possible.* When torn from the body of the bee, the poison bag and all the muscles which control the sting, accompany it, and are in such active operation, that it penetrates deeper and deeper into the

flesh, injecting continually more and more of its poison into the wound. Every Apiarian, (unless he wears a bee-dress,) should have about his person, a small piece of looking-glass, so that he may be able with the least possible delay, to find and remove a sting. In most cases, if extracted at once, it will produce no serious consequences; whereas if suffered to empty all its vials of wrath, it may cause great inflammation and severe suffering. After the sting is removed, the utmost possible care should be taken, not to irritate the wound by the very *slightest rubbing*. However intense the smarting, and of course the disposition to apply friction to the wound, *it should never be done*, as the poison will at once be carried through the circulating system, and severe swelling may ensue. As most of the popular remedies are rubbed in, they are of course worse than nothing. The moment that the blood is put into a violent and unnatural circulation, the poison is quickly diffused over a considerable part of the system. On the same principle, the bite of a mosquito, even after the lapse of several days, may, by strong friction, be made to swell again.

Mr. Wagner says, "The juice of the ripe berry of the common coral honeysuckle (*Lonicera Caprifolium*) is the best remedy I have ever used for the sting of bees, wasps, hornets, &c. The berries or expressed juice may be preserved in a bottle well closed, and will keep their efficacy more than a year."

Common sticking plaster, moistened with spittle and applied with the least possible pressure, after the sting has been removed, has been found with some an effectual remedy.

The milky juice of the white poppy, is also highly recommended. An old German writer states, that its application will instantaneously allay the pain and prevent swelling.

Others recommend the juice of tobacco, as the sovereign panacea for bee-stings. Unquestionably, relief has been found, by different persons, from each and all of these remedies, and there is no good reason to conclude, that the same remedy will in all cases answer, for the poison of the bee, any more than that the same medicine will cure all persons affected with a common disease.

If the mouth is applied to the wound, very unpleasant consequences may ensue. While the poison of venemous snakes and many other noxious animals, affecting only the circulating system, may be swallowed with entire impunity, the poison of the bee acts with equal power, on the organs of digestion. The most distressing headaches are often produced by it.

From my own experience, I recommend *cold water* as the very best remedy with which I am acquainted, for a bee-sting. It is often applied in the shape of a plaster of mud, but may be better used by wetting cloths and holding them gently to the wound. The poison of the bee being very volatile, is quickly dissolved in water; and the coldness of the water has also a powerful tendency to check inflammation, and to prevent the virus from being taken up by the absorbents and carried through the system. The leaves of the plantain, crushed and applied to the wound, will answer as a very good substitute when water cannot at once be procured. Bevan recommends the use of spirits of hartshorn, applied to the wound, and says that in cases of severe stinging its internal use is beneficial.

Whatever remedy is applied, should be used if possible, *without a moment's delay*. The immediate extraction of the sting, will alone prove much more efficacious, than any remedy that can be applied, after it has been allowed to remain and discharge all its venom into the wound.

It may be some comfort to those who desire to keep bees, to know that after a while the poison will produce less and less effect upon their system. When I first became interested in bees, a sting was quite a formidable thing, the pain being often very intense, and the wound swelling so as sometimes to obstruct my sight. At present, the pain is usually slight, and if the sting is quickly extracted, no unpleasant consequences ensue, even if no remedies are used. Huish speaks of seeing the bald head of Bonner, a celebrated practical Apiarian, lined with bee stings which seemed to produce upon him no unpleasant effects. Old bee-keepers, like Mithridates, king of Pontus, appear almost to thrive upon poison itself. The Rev. Mr. Kleine advocates a truly heroic remedy, advising beginners to suffer themselves to be stung so frequently, as to accustom their systems to the effect of the poison! He assures them that two seasons will be sufficient to accomplish this, as any one who tries it in earnest, may readily ascertain.

I have met with a highly amusing remedy, very gravely propounded by an old English Apiarian. I mention it more as a matter of curiosity, than because I imagine that many of my readers will be likely to make trial of it. He says, let the person who has been stung, catch as speedily as possible, another bee, and make it sting on the same spot! It requires some courage, even in an enthusiastic disciple of Huber, to venture upon such a singular homeopathic remedy; but as this old writer had previously stated, what I had verified in my own experience, that the oftener a person was stung, the less he suffered from the venom, I determined to make trial of his prescription. Allowing a sting to remain until it had discharged all its venom, I compelled another bee to insert its sting, as near as possible, in the same spot. I used no remedies of any kind, and had the

satisfaction, in my zeal for new discoveries, of suffering more from the pain and swelling, than I had previously done for years.

An old writer recommends a powder of dried bees, for distressing cases of stoppages; and some of the highest medical authorities have recently prescribed for violent strangury, a tea made by pouring boiling water upon bees; while the homeopathic physicians employ the poison of the bee, which they call *apis*, for a great variety of maladies. That it is capable of producing intense head-aches any one who has been stung, or who has tasted the poison, very well knows.

Timid Apiarians, and all who are liable to suffer severely from the sting of a bee, should by all means furnish themselves with the protection of a bee-dress. The great objection to gauze-wire veils or other materials of which such a dress has been usually made, is that they obstruct clear vision, so highly important in all operations, besides producing such excessive heat and perspiration, as to make the Apiarian peculiarly offensive to the bees. I prefer to use what I call a *bee-hat*, of entirely novel construction. It is made of wire cloth, the meshes of which are too fine to admit a bee, but coarse enough to allow a free circulation of air, and to permit distinct sight. The wire cloth should be first fastened together in a circular shape, like a hat, and made large enough to go very easily over the head; its top may be of cotton cloth, and it should have the same material fastened around its lower edge. If the top is made of sole-leather, it will serve a better purpose. A piece of wire cloth one foot wide, by two and a half feet long, will make a good fit for most persons; although persons with noses or necks unusually long, will require a larger size. It ought slightly to rest upon the crown of the head. A drawing of it is given in the plate

of implements.* Leather gloves may then be drawn over the hands, or better still, India Rubber gloves, such as are now in very common use, may be worn; these gloves are impenetrable to the sting of a bee, and yet do not very materially interfere with the operations of the Apiarian. As soon, however, as the bee-keeper acquires confidence and skill, he will much prefer to use nothing but the bee-hat, even at the expense of an occasional sting on his hands.

I strongly object to the use of woolen gloves or stockings, as every thing rough or hairy, has an extremely irritating influence upon bees. This is probably owing to the fact, that in a state of nature, bears, foxes, and other hairy animals, are their principal enemies. No sooner do they feel the touch of anything rough or hairy, than they instinctively dart out their stings.

Instincts of Bees.

The attentive reader cannot have failed to notice, the numerous proofs which have been given in the preceding parts of this work, of the refined instincts of the honey-bee. It is impossible always to draw the line between instinct and reason, and very often, some of the actions of animals and insects appear to be the results of a process of reasoning, apparently almost the same with the exercise of the reasoning faculty in man. "There is this difference," says Mr. Spence, "between intellect in man, and the rest of the animal creation. Their intellect teaches them to follow the lead of their senses, and to make such use of the exter-

* When this hat, which is rapidly coming into fashion among bee-keepers, is put on, and the cape carefully tucked under the coat, which should then be buttoned up, the Apiarian may operate upon his bees, without any risk of being stung, except on his hands.

nal world as their appetites or instincts incline them to, and *this is their wisdom:* while the intellect of man, being associated with an immortal principle, and connected with a world above that which his senses reveal to him, can, by aid derived from Heaven, control these senses, and render them obedient to the governing power of his nature; and *this is his wisdom.*"

The point of distinction between man and the lower orders of creation, has seldom been more happily expressed than by Mr. Spence; it is not that man reasons and they do not, but that, being "made in the image of God," he has a moral and accountable nature, while they have nothing of the kind.

"It will be evident," says Bevan, "that though I make a distinction between the instinct and the reason of bees, I do not confound their reason with the reason of man. But to obviate all possibility of misconception, I will at once define my meaning, when I use the terms insect reason and instinct.

"By *reason*, I mean the power of making deductions from previous experience or observation, and thereby of adapting means to ends. *Instinct* I regard as a disposition and power to perform certain actions in the same uniform manner, depending upon nice mechanism and having no reference either to observation or experience; operating on the means, without anticipation of the end, incited by no hope, controlled by no foreboding. Those who have attended to this subject, will be aware that *insect reason*, as above defined, is more restricted in its functions than *the reason of man;* to which is superadded the power of distinguishing between the true and the false, and, according to some metaphysicians, between right and wrong. Reason, in man, has a regular growth and a slow progression; all the arts he practices evince skill and dexterity, proportioned to the pains which

have been taken in acquiring them. In the lower links of creation, but little of this gradual improvement is observable; their powers carry them almost directly to their object. They are perfect, as Bacon says, in all their members and organs from the very beginning."

"Far different Man, to higher fates assign'd,
Unfolds with tardier step his Proteus mind,
With numerous Instincts fraught, that lose their force
Like shallow streams, divided in their course;
Long weak, and helpless, on the fostering breast,
In fond dependence leans the infant guest,
Till reason ripens what young impulse taught,
And builds, on sense, the lofty pile of thought;
From earth, sea, air, the quick perceptions rise,
And swell the mental fabric to the skies."

Evans.

"There are facts," says Bevan, "recorded in the younger Huber's researches respecting the Amazon Ants, which exhibit a power of acquiring habits and characters which cannot well be regarded as merely instinctive. The Amazons, to relieve themselves from labor, enslave, by a *coup de main*, a feeble colony of ants of another species, and transporting them to their own domicile, impose upon the captives, the task of collecting provisions, rearing the young, repairing their habitation, besides other labors of the formicary."

"Dr. Darvin," (I quote again from Bevan,) "in his *Zoonomia*, relates an anecdote of apparent reasoning in a wasp, which had caught a fly nearly as large as itself. Kneeling down, he saw the wasp dissever the head and tail from the trunk of the fly, and attempt to soar with the latter; but finding, when about two feet from the ground, that the wings of the fly carried too much sail, causing its prize and itself to be whirled about, by a little breeze that had arisen, it dropped upon the ground with its prey, and sawed off with its mandibles, first one wing and then another; having thus removed these impediments, the wasp flew away with its

booty, and experienced no further molestation from the wind."

"A German artist of strict veracity, states, that in his journey through Italy, he was an eye witness to the following occurrence. He observed a species of *Scarabæus* busily engaged in making, for the reception of its egg, a pellet of dung, which when finished, the insect rolled to the summit of a hillock, and repeatedly suffered it to tumble down the slope, apparently for the purpose of consolidating the pellet, by the adhesion of earth to it in its rotating motion. During this process, the pellet unluckily fell into a hole, out of which the beetle was unable to extract it. After several ineffectual attempts, the insect went to an adjoining heap of dung, and soon returned with three companions. All four applied their united strength to the pellet, and at length succeeded in pushing it out, when the three assistant beetles left the spot, and returned to their own quarters." (Kirby and Spence.)

In one of my observing hives, admitting of only a single comb, I once fastened a piece of comb, on the *bottom* instead of the top, to serve as a guide for the bees. In carrying up this comb towards the roof of the hive, the bees soon became aware of a serious difficulty resulting from its unusual position. In building combs *downwards*, (which they invariably do, unless in some way prevented,) as their works hang plumb, to secure them against the risk of falling, they have only to make their attachments sufficiently firm; but in building *upwards*, it is next to impossible to prevent a new comb, heavy with honey, bees, brood and pollen, and softened by the animal heat of the workers, from losing its perpendicular position, and falling against the sides of the hive. To guard against such a catastrophe, my bees in enlarging

their works, speedily begun to run out waxen *braces* from the comb to each side of the glass, and by continuing this device until they could make an attachment to the roof, they met with no mishap. The work when completed presented a curious specimen of wise adaptation of means to a special end. The most of those braces were subsequently removed. Could our most skillful master-builders contrive, under similar circumstances, a better mode of procedure ?

I shall finish what I have to say on this subject by narrating an instance of sagacity which seems to approach as near to human reason, as any thing in the bee which has ever fallen under my notice. I once placed a swarm of bees, temporarily into a small model hive, which I had constructed to test the feasibility of some new plans for facilitating the storing of surplus honey in small tumblers. The bees soon filled the hive, and stored about a dozen glasses with honey. I was called away from them, for a few days, and was much surprised, on my return, to find that the honey which had been stored in the hive and *sealed* for Winter use, was all gone, and that the cells which had contained it, were filled with eggs and young worms ! The hive stood in a covered bee house, and the bees had built a large quantity of comb on the *outside* of the hive, into which they had transferred the honey taken from the interior. This very laborious and unusual procedure, was manifestly adopted to give the poor queen a place *within the hive*, for laying her eggs : for this purpose they deliberately uncapped and emptied all the cells so carefully sealed over, instead of using the new comb on the *outside*, for the brood.

> " Shall then proud sophists, arrogant and vain,
> Spurn all the wonders of the honey'd reign,
> And bid alike one mindless influence own
> The social bee and crystalizing stone ?

Each link they trace in animations round,
Dashes their poison'd chalice to the ground.
Deem not, vain mortal, that reserved for thee
Hangs all the ripening fruit on Reason's tree;
E'en bees, the tiniest tenants of thy care,
Claim of that Reason their apportioned share."
Evans.

CHAPTER XX.

On the proper size, shape, and materials for Hives—Observing Hives.

NOTWITHSTANDING all the experiments which have been made, and the volumes written, to determine the best size, shape and materials for bee-hives, the ablest practical Apiarians, are still at variance on these points. In our country, it is pretty generally agreed, that hives holding less than a bushel, in the main apartment, are not profitable, in the long run, although those having the capacity of a cubic foot, may, for the first season, yield a greater return of surplus honey. As regards the room which a colony will need, for the storage of spare honey, so much depends on seasons and localities, and on whether the bees swarm or not, that no general rule can be given, that will be applicable to all cases. The present season (1856) has been, with me, so extraordinary for its superabundant yield of honey, that I have found non-swarming colonies, able to occupy, to good advantage, two bushels of surplus storage room. As the construction of all my hives, admits of their being enlarged and again contracted, without any destruction or alteration of

existing parts, the size of the main apartment, as well as the space for surplus stores, may be varied to suit the necessities of every bee-keeper.

Being able to remove any surplus, at pleasure, I prefer to make the interior of my hives considerably larger than a bushel. Many hives are so small, that they would not contain one-quarter the bees, comb and honey, which, in a good season, may be found in my large hives; while their owners wonder that they are able to obtain so little profit from their bees. A good swarm of bees, put, in a good season, into such a diminutive hive, may be compared to a powerful team of horses, harnessed to a baby wagon, or a noble fall of water, wasted in turning a petty water-wheel. (See pp. 231–2–3.)

Hives may be divided, as respects their shape, into Tall, Low and Broad, and Long and Broad. A hive tall, in proportion to its other dimensions, has some very obvious advantages. As bees are disposed to carry their stores as far as possible from the entrance, they will fill the upper part of such hives with honey, and use nearly all the lower part for brood; thus escaping the danger of being caught, in cold weather, among empty ranges of comb, while they still have honey unconsumed. If the top of this hive, like that of an old-fashioned churn, is made, (on the Polish plan,) considerably smaller than the bottom, it will be still better adapted to a cold climate, besides being more secure against high winds. Such a hive is evidently deficient in top surface, for the proper storing of surplus honey in boxes, and it would be impossible to use my frames in it, to any advantage; but to those who prefer to keep bees on the old plan, I recommend this shape, made to hold not less than a bushel and a half, as decidedly the best.

It is instructive to see how the very first departure from the olden way, proves the truth, in bee-culture at least, of the hackneyed quotation,

> "A little learning is a dangerous thing;
> Drink deep or taste not the Pierian spring."

Even so simple an improvement as the use of top boxes, will, in the hands of most bee-keepers, eventually cause the ruin of their Apiaries. Taking it for granted, that bees will never fill these boxes, until their main hive is well provisioned, in years when the latter part of the season is very unfavorable, they often remove the honey which is absolutely essential to the life of their bees. Although the owner of a patent hive, I would again and again endeavor to impress upon all who cannot or will not study the habits of bees, the wisdom of confining themselves to the simple box. If they are too humane to destroy their bees, let them subdue them, by the use of smoke, and cut out from the hives what honey they can spare.

It would seem from Aristotle that in his time hives were thus deprived of their surplus stores.* Killing bees for their honey, was one of the appropriate inventions of the dark ages, when the human family had lost, in Apiarian pursuits, as well as in other things, the skill and knowledge of the past.

The very low and broad square hive, has the least to recommend it; it gives, to be sure, a larger amount of top surface, in proportion to its internal capacity, than any other shape, but it necessarily prevents the bees from concentrating their heat to the best advantage, and is of all other forms the

* Aristotle says that when smoked for this purpose, "they are greatly disturbed, and completely gorge themselves with honey!" He did not, however, notice the connection between this cramming and their subsequent docility.

worst for winter use. In very warm countries, it might, however, be used to considerable advantage.

A hive long from *front* to *rear*, and moderately low and narrow, seems, on the whole, to unite the most advantages. I am indebted to Mr. M. Quinby, of St. Johnsville, New York, for some valuable suggestions as to the peculiar advantages he has derived from hives of this form. He thinks, from his experience, that bees will winter as well in them, as in the tall hives; giving as a reason, that when the combs are built from front to rear, the brood is kept near the entrance and the honey stored in the back end of the hive. In Winter the bees, receding from the entrance, must draw back among their *stores;* just as they draw up among them, when, in the tall hives, they ascend to the top.

Such a hive, indeed, resembles a tall one, laid upon its side, and while affording ample top surface for storing surplus honey, it also facilitates very greatly the easy handling of frames, besides diminishing their number, and the cost of their construction.

I recommend that hives constructed in this way, be, in the clear, at least twenty-four inches from front to rear; twelve from side to side; and ten in height. There should be eight frames, running from front to rear, each having a partition so adjusted, that the bees may pass from one comb to another, without being chilled in winter. If this division strip is made so as to allow about two-thirds of the frame for breeding, the back part will usually contain pure honey, which may at any time be cut out, without at all mutilating the brood comb.

I have a hive of this pattern in operation, and thus far am so highly pleased with it, that I anticipate a decided gain from its use, over any other mode of construction. If this style of hives is adopted, I should always recommend that they

be built for two colonies, so as to economize to the very utmost, the cost of construction and labor of superintendance, while at the same time they occupy the least space in the Apiary, and afford the largest amount of protection to the bees.

The common Dzierzon-hive is long and flat, but as the combs run from side to side, instead of from front to rear, the bees, unless the hive is uncommonly well protected, will suffer from cold, in winter. As the German Apiarian uses slats, instead of frames, it would be difficult for him safely to remove any very long combs from his hive. As a general rule, the fewer the number of combs in a hive, the straighter will they be built by the bees.

The variety of opinions respecting the best *materials* for hives, has been almost as great, as on the subject of their proper size and shape. Virgil recommends the hollowed trunk of the cork tree, than which, no material would be more admirable, if it could only be easily and cheaply procured. Straw hives have been used for ages, and are warm in Winter and cool in Summer. The difficulty of making them take and retain the proper shape for improved bee-keeping, is an insuperable objection to their use. Hives made of wood, are, at the present time, fast superseding all other kinds. The *lighter* and more *spongy* the wood, the poorer will be its power of conducting heat, and the warmer the hive in Winter, and the cooler in Summer. Cedar, bass-wood, poplar, tulip-tree, and soft pine, afford excellent materials for bee-hives. The Apiarian must be governed, in his choice of lumber, by the ease and cheapness with which any suitable kind, can be obtained, in his own immediate vicinity.

A very serious disadvantage attaching to all kinds of wooden hives, is the ease with which they conduct heat,

causing them to become cold and damp in Winter, and, if exposed to the sun, so hot in Summer as often to melt the combs. The Winter inconveniences are greatly increased, if the hives are well painted, while if this is neglected, they cannot be exposed to sun or weather, without serious injury.

I have hitherto protected my hives, by making them of doubled wood or glass, so as to secure the advantages of a dead air space, and this in connection with another plan, partly original and partly the result of the experience of others, will, I am persuaded, give all the advantages both of straw and wood, without any of the inconveniences of either. In all hives, the bees will in chilly weather, avoid traveling over the cold sides, as they pass in and out; but they cannot escape contact with the bottom-board, and if the part projecting outside of the hive is painted, its surface will be too smooth for secure footing, besides being often, in cool weather, wet with condensed moisture, so as to prove exceedingly disagreeable to the bees. If the bottom-board is covered with heavy straw matting, which may be bought for about three cents per square foot, and this is tacked on, (with its finished edge outside,) so as to cover the *alighting-board*, the bees will find themselves, to all intents and purposes, in a straw hive. I should advise protecting the inside *front* of the hives, in the same way, rather than with the dead air space, as bees, in all working weather, are inclined to travel over this surface, if it is not too cool. Before nailing down the matting, it will be very desirable to place under it, five or six thicknesses of common straw wrapping paper, which, at next to no expense, will make it, almost if not quite, as warm again. That part of the matting, which lines the interior of the hives, should now be covered with a melted mixture,* one-third rosin and two-

* Straw-paper thus covered, might perhaps do as well as matting.

thirds bees-wax, applied, when quite hot, with a common shoe-brush; this will make it air-tight, by filling up all the crevices, and will prevent the straws from separating, or absorbing moisture. The *upper* * surface of the spare honey-board, may be fixed in the same way, and reversed in Winter, so as to present the straw side to the bees. When the bees are put into Winter quarters, most of the holes in this board, may, in hives thus thoroughly protected, be left open, and when it is covered loosely with straw, all excess of dampness in the main hive, will pass off into the top cover, from which it cannot possibly return, to annoy the bees. As soon as the bees begin to fly out, in the Spring, these holes should be carefully closed. If the spare honey-board is not covered with matting, it may have, for Winter use, the space between the clamps filled with straw, battened down, and may then be reversed and set on the hive.

I am aware that hives cannot be protected in this way, without some extra expense, but no *judicious* bee-keeper who once tries them, will ever be willing to return to the common kind. If by using such extra protection, his colonies, in the Spring, are only a week in advance † of those in common hives, he will, in all ordinary seasons, be repaid the extra cost, two or three times over.

I would here remark, that in order to make the movable-comb hives to the best advantage, it is absolutely necessary

* If the *under* surface is covered with the matting, the bees will be much more likely to fill the shallow chamber between it and the frames, with combs, thus making it more inconvenient to open the hives.

† "Only those swarms which came from the 1st to the 6th of June, 1853, gathered sufficient stores for the ensuing Winter. In this portion of the Palatinate, the difference between abundance and scarcity often depends on a very few days." (Werntz, Beinenzeitung, 1854.)

that the frames at least should be cut out by a circular saw, driven by steam, water or horse power. In buildings where such saws are used, these frames may be made from small pieces of lumber, which would seldom be of any use, except for fuel. They may be packed almost solid in a box, or in a hive which will afterwards serve for a pattern or a swarm. One frame in such a box, properly nailed together, will serve as a guide for the rest. The other parts of the hive can easily and cheaply be made by any one who can handle tools at all, and can never be profitably manufactured to be sent to any considerable distance, unless a large number are made at once where lumber is cheap, and the parts closely packed, to be put together after reaching their destination. Complete working drawings, with clear and full directions, will be furnished to purchasers, for making to the best advantage, by hand or machinery, every part of the hive.

The following recipe for a cheap and durable paint, is taken from the Bienenzeitung; it is said to be preferable on every account to ordinary oil paint: "Two parts, by measure, of fine sand, well sifted: one of best English cement:* one of curd from which the whey has been well expressed: one of buttermilk. These are to be thoroughly mixed. The paint is to be applied, amid repeated stirring, to the hives, by means of a common paint-brush. A second coat is to be given after the lapse of half an hour. When this has become thoroughly dry, which will be in two or three days, it is to be brushed over lightly with a thin coat of boiled linseed oil, to which any desirable color may be given. The boards to which the paint is to be applied should not be planed, but remain rough as the saw leaves them. No more of the paint should be prepared at any one time, than can be

* Roman, or common Hydraulic cement, I presume is meant, or would answer.

used in the course of half an hour, as it speedily hardens. The hive may be used for a swarm of bees as soon as the paint stiffens."

Movable-Comb Observing Hives.

Those who wish to study the Natural History of the honey-bee, to the best advantage, or to witness its wonderful works and instincts, will find extraordinary facilities for the most reliable investigations and examinations, furnished through the use of my observing hives. Each comb in these hives, as well as in all my others, being attached to a movable frame, admits of safe and easy removal. In this respect its construction differs entirely from that of all other observing hives. As both sides of every comb, in observing hives, admit of inspection, every bee can be seen, and all the wonders of the bee-hive may be exposed, not only to the full light of day, (p. 24,) but to the brightest glare of lamps or gas.

When bees are first put into such a hive and exposed to the light, they exhibit great uneasiness, making every effort to pass through the glass sides. This is all very natural, as in their wild state, having no knowledge of a transparent substance, the admission of light is equivalent to the admission of undue heat, cold and wet, all of which would be utterly destructive to their welfare.* They soon, however, become accustomed to the new order of things, and will then no more attempt to get through the glass sides of their hive, than an old denizen of Broadway or Chestnut Street, on one of those fashionable promenades, would mistake a plate-glass window, for a door.

* Some have imagined that darkness is necessary for the proper development of their young; but this is found to be a mistake.

In the common observing hive, experiments are conducted with great difficulty, and only by experts who are able to cut away parts of the comb, whereas in this, they can be performed by the simple removal of a frame; and if a colony becomes too much reduced in numbers, it may be recruited, in a few minutes, by helping it to maturing brood, from one of the other hives.

A very intelligent writer, in a description of the different hives exhibited at the World's Fair, in London, laments that no method has yet been devised to enable bees to cluster in cold weather, in an observing hive, so as to preserve them alive in Winter, even in the moderate climate of Great Britain. By the use of movable frames, this difficulty can be entirely obviated, as on the approach of cold weather, the Apiarian may transfer his bees from a hive unsuitable for winter use, to one of the warmest construction; and as soon as the weather, next season, is sufficiently auspicious, they may again be installed in a glass palace.

These observing hives may be constructed of sufficient size to accommodate a full swarm. I do not, however, prefer such a hive for ordinary purposes, but one holding only *a single frame*, and which while it affords great gratification to the curious, admits of easy control, and requires only a few bees to be diverted from the more profitable business of making honey in the common hives.

A hive of this form may be called a Parlor-Observing Hive, and may be conveniently placed in any room in the house; the alighting board being outside, and the whole arrangement such that the bees may be inspected at all hours, day or night, without the slightest risk of being stung. Two such hives may be placed before one window, and put up or taken down in a few minutes, without cutting or defacing the wood-work of the house. In one, the queen may al-

ways be shown, and in the other the process of rearing young queens, from worker-eggs. These miniature hives may be stocked by putting into them a comb containing eggs and hatching workers, taken with all the bees adhering to it, from any movable-comb hive ;* or a small after swarm may be hived in them. If the bees are brought from a distance, they need not be confined. Gardners having the movable-comb hives, might supply their patrons with observing hives, with profit to themselves, and great satisfaction to those who employ them.

An observing hive, where there is a family of children, will prove an unfailing source of pleasure and instruction ; and those who live in crowded cities, may enjoy it to the full, even if condemned to the penance of what the poet has so feelingly described as an "endless meal of brick." The nimble wings of these agile gatherers, will quickly waft them above and beyond "the smoky chimney pots," and they will bear back to their city homes, the balmy spoils of many a rustic flower, "blushing unseen," in simple yet bewitching loveliness. Might not their pleasant murmurings awaken in some the memory of long forgotten joys, when the happy country-child, listened to their soothing music, while intently watching them in that old homestead garden, as they bore to their hives the many colored pellets on their burnished thighs ; or roved with them amid pastures and hill-sides all redolent with the sweetest clover, gathering the flowers still rejoicing in their "meadow-sweet breath," or whispering of the precious perfumes of their forest home.

"To me more dear, congenial to my heart,
One native charm than all the gloss of art ;
Spontaneous joys, where nature has its play,
The soul adopts and owns their first-born sway ;
Lightly they frolic o'er the vacant mind,

* See directions for forming a nucleus, p. 216.

Unenvied, unmolested, unconfined.
But the long pomp, the midnight masquerade,
With all the freaks of wanton wealth array'd,
In these, ere trifiers half their wish obtain,
The toilsome pleasure sickens into pain;
And, e'en while fashion's brightest arts decoy,
The heart distrusting asks, IF THIS BE JOY."

CHAPTER XXI.

The Italian Honey-Bee.

ARISTOTLE, who flourished over 2200 years ago, speaks of three different species of the honey-bee, as well known in his time. The *best variety* he describes as "μικρὰ, στρογγύλη καὶ ποικίλη;" that is, small and round as to size and shape, and variegated as to color.

Virgil, in his 4th book of Georgics, speaks of two kinds as flourishing in his time; the better of the two he thus describes:

"Elucent aliae, et fulgore coruscant,
Ardentes auro, et paribus lita corpora guttis.
Hinc potior soboles; hinc-coeli tempore certo
Dulcia mella premes."

The better variety, it will be seen, he characterizes as spotted or variegated, and of a beautiful golden color.

Until quite recently, Apiarians have believed Virgil's description of the different kind of bees, to be quite as fabulous as his notions that the bees gathered their young from the leaves and flowers; but let us laugh as we will, at his physiological conceits, in such practical matters as came under his observation, he has left us rules upon which we cannot well improve. Strange to say, within a few years,

the attention of bee-keepers has been called, to the very variety of the honey-bee described by Aristotle and Virgil; and after the lapse of more than 2200 years, it is still found to exist, distinct and pure from the common kind, and to be as much superior to it, as a Durham ox, to one of the poorest breeds. The following letter from Mr. Wagner will show the importance attached to this species by some of the most skillful and successful Apiarians in Europe.

York, Pa., August 5, 1856.

My Dear Sir:

The first account we have of the Italian bees, as a distinct race or variety, is that given by Capt. Baldenstein in the Bienenzeitung, No. 4, 1848. Being stationed in Italy, during part of the Napoleonic wars, he noticed that the bees, in the Lombardo-Venitian, district of Valtelin, and on the borders of Lake Como, differed in color from the common kind, and seemed to be more industrious. At the close of the war, he retired from the army, and returned to his ancestral castle on the Rhœtian Alps, in Switzerland; and to occupy his leisure, had recourse to bee-culture, which had been his favorite hobby in earlier years. While studying the natural history, habits and instincts of these insects, he remembered what he had observed in Italy, and resolved to procure a colony from that country. Accordingly he sent two men thither, who purchased one and carried it over the mountain, to his residence, in September, 1843. About the same time, he became a subscriber to and correspondent of the Bienenzeitung, and speedily took a lively interest in the discussions then carried on in that Journal, respecting the impregnation of the queen, the sex and design of the drones, the age to which the queen and the workers respectively attain, &c., &c. This induced him to communicate to the

Bienenzeitung his observations on the Italian bees, with some suggestions as to the manner in which they might be employed to determine some of the points in dispute. His communication did not, at the time attract the attention it deserved, though it led Dzierzon to inquire whether the cells and combs built by the Italian bees differed in any respect from those constructed by the common kind. Baldenstein replied that there was no perceptible difference ; that he had frequently interchanged the combs, and never noticed that it caused any difficulty in either case, the cells of both being apparently of the same diameter and depth.

The controversy concerning the above-mentioned points continued to be waged with unabated ardor, and the ablest Apiarians of Germany engaged in it pro or con, without arriving at any satisfactory results ; at least, not any in which all felt willing to concur. In this state of affairs, Baldenstein sent another communication to the Bienenzeitung, (No. 11, 1851,) in which he adverts to his previous article, and expresses the opinion that no mode of determining those important questions, could be so practicable and reliable as the employment of the Italian bee for that purpose. He then states that for seven years he had possessed one colony, and only one, of the genuine Italian stock, which had with great difficulty, or rather by a fortunate chance, been preserved pure among a large number of bastard and common colonies. In all that time, he had not, despite of every precaution he could use, succeeded in keeping his young Italian queens from *mesalliance* with common drones, and consequently producing a bastard progeny.

His Italian colony retained, till May, 1847, the old queen which had been imported from Italy. She was then at least four years old, and had never failed to produce genuine Italian brood. In May, 1847, the colony began to show signs

of weakness, but suddenly recovered in the following month; and it was evident that it had supplied itself with a new queen, which had fortunately been impregnated by an Italian drone, as she produced genuine or pure brood. On the 15th of May, 1848, this queen issued with a swarm, and he hoped that, as he had placed the parent hive in a rather isolated location, her successor would be impregnated by an Italian drone. But in this he was doomed to disappointment; she produced a bastard progeny, while the emigrant queen produced genuine brood, as before. Similar disappointments awaited him from year to year, till the date of his second communication, (June, 1851,) when he possessed still only one colony of the pure stock.

Among the points which he considered as definitely established by his observations on the Italian bee, are the following:

1. The queen, if healthy, retains her proper fertility at least three or four years.

2. The Italian bee is more industrious, and the queen more prolific than the common kind; because, in a most unfavorable year, when other colonies produced few swarms, and little honey, his Italian colony produced three swarms, which filled their hives respectively with comb, and together with the parent stock, laid up ample stores for winter: the latter yielding besides a top box well filled with honey. The three young colonies were among the best in his Apiary.

3. The workers do not, at most, live longer than one year, for though the bees and brood in the parent hive, when the first swarm and old queen left, were of the Italian stock exclusively, few of this kind remained in the Fall, and none survived the Winter.

4. The young queen is impregnated soon after she is es-

tablished in a colony, and continues fertile during life. Were this not so, the genuine queens would not have continued to produce pure brood during those seven successive years.

5. The queen leaves the hive to meet the drones. If not, it would scarcely have happened, that all the young queens bred in those seven years, with only one exception, were impregnated by common drones, and produced bastard progeny.

6. The old queen regularly leaves with the first swarm, or the genuine Italian brood would not invariably have been the product of the swarm, but occasionally, at least, of the parent colony, which never happened in all that time.

These observations and inferences impelled Dzierzon to make an effort to procure the Italian bee; and by the aid of the Austrian Agricultural Society at Vienna, he succeeded in obtaining a colony from Mira, near Venice. Meanwhile, we have no further account of them in the Bienenzeitung, excepting that, in No. 1, 1853, Baldenstein, in reply to an inquiry from Dzierzon, stated that "the Italian bee is found immediately beyond the Alps, in the Southern valleys of the Grisons bordering on Italy, in Merox, in Pregell, in Prochiavo, and then in the entire Lombardo-Venitian district of Valtelin, in the district of Chiavenna, and on the borders of Lake Como." He does not doubt that it occurs also in other parts of Italy, but names those as places where he observed it himself, and is certain it may be found.

Dzierzon obtained his Italian colony, Feb. 19, 1853, and on the following day transferred the combs and bees into one of his own hives. When the season opened, he placed the hive on a stand in his Apiary, and screwed it fast, lest it be stolen. He never moved it during the ensuing Summer; but took from it combs with worker and drone brood, at reg-

ular intervals, supplying their place with empty comb. In this way he succeeded in rearing nearly fifty young queens, about one-half of which were impregnated by Italian drones and produced genuine brood. The other half produced a bastard progeny. He continued thus to multiply queens by the removal of brood, till several of his artificial colonies suddenly killed off their drones, and the original stock did so likewise on the 25th of June. The bees of the original colony still labored very assiduously, but gradually became less diligent,* till when the buckwheat came into blossom, it was surpassed in industry by many colonies of the common bees. But as young bees continued to make their appearance, he felt satisfied that the colony was in a healthy condition. Later in the season, he unfastened the hive, preparatory to putting it in winter quarters, and on attempting to lift it, found he was scarcely able to move it. He now discovered why it had so greatly fallen behind the other colonies in industry. Having early rid itself of drones, (as probably is done instinctively in Italy,) it had in consequence of its extraordinary activity, filled all the cells with honey in a very short time, and was thenceforward doomed to involuntary idleness. It had attained a weight which scarcely any of his colonies reached in the Summer of 1846, when pasturage was so superabundant; whereas the Summer of 1853 was certainly a very ordinary one in this respect.

It was thus, also, made manifest that frequent disturbance † had not produced any injurious effect. Until midsummer, Dzierzon not only removed a brood comb containing about 5000 cells, every other day, but had on numerous other occasions taken out comb after comb, several times a day, to find the queen and show her to bee-keeping friends who visited him, and who were anxious to see a queen thus dis-

* See page 201. † See page 381.

tinguished by her brighter colors. When, in consequence of such interruptions, the queen retreated to the opposite end of the hive, he usually found her, half an hour thereafter, on the same comb she had occupied before, engaged in laying eggs. Such disturbances, if the combs be not broken or materially damaged, he thinks, do no injury; but that, on the contrary, they not unfrequently produce a certain excitement among the bees, which impels them to issue in greater numbers, and labor with increased assiduity.

"The general diffusion of this species of bee," says Dzierzon, "will form as marked an era in the bee-culture of Germany, as did the introduction of my improved hives. The profit derived by the farmer from feeding stock, depends not alone on due attention to the habits and wants of the animals, but mainly on the character of the breed itself. So also with the bee. We find marked differences in point of industry, even among our common bees; but the Italian bee surpasses these in every respect. A chief difficulty in the way of a more general attention to bee-culture, arises from the almost universal dread of the sting of this insect. Many fear even the momentary pain which it inflicts, though no other unpleasant consequences follow; but in some persons it causes severe and long protracted swelling and inflammation. This, especially, deters ladies from engaging in this pursuit. All this can be avoided by the introduction of the Italian bee, which is by no means an irascible insect. It will sting only when it happens to be injured, when it is intentionally annoyed, or when it is attacked by robbing bees; then it will defend itself with undaunted courage, and such are its extraordinary vigor and agility, that it is never overpowered, so long as the colony is in a normal condition. Colonies of common bees may speedily be converted into Italian stocks, by simply removing the queen from each, and

after the lapse of two or three days, or as soon as the workers decidedly manifest consciousness of the deprivation, supplying them with an Italian queen. We are thereby also enabled to note the gradual disappearance of the old race, as it becomes supplanted by the new. Besides the increased profit thus derivable from bee-culture, this species also furnishes us with no small gratification in studying the nature, habits and economy of the insect, to greater advantage; because by means of it, the most interesting experiments, investigations and observations may be instituted, and thus the remaining doubts and difficulties be cleared up."

Busch ("Moot points of bee-culture, Gotha, 1855,") describes the Italian bee as follows:—"The workers are smooth and glossy, and the color of their abdominal rings is a medium between the pale yellow of straw and the deeper yellow of ochre. These rings have a narrow black edge or border, so that the yellow, (which might be called leather colored,) constitutes the ground, and is seemingly barred over by these slight black edges or borders. This is most distinctly perceptible, when a brood comb, on which bees are densely crowded, is taken out of a hive. The drones differ from the workers in having the upper half of their abdominal rings black, and the lower half an ochry-yellow, thus causing the abdomen, when viewed from above, to appear annulated. The queen differs from the common kind, chiefly in the greater brightness and brilliancy of her colors."

Dzierzon says, "It has been questioned, even by experienced and expert Apiarians, whether the Italian race can be preserved in its purity, in countries where the common kind prevail. There need be no uneasiness on this score. Their preservation could be accomplished, even if natural swarming had to be relied on, because they naturally swarm earlier

in the season than the common kind, and also more frequently. Capt. Baldenstien's want of success was most probably the result of a deficiency of drone comb in his Italian hives, as a consequence of which only few drones were produced." Dzierzon guarded against this by giving to a very large colony, which ordinarily produced drones in great numbers, a fertile queen very early in the season. Thousands of drones soon made their appearance, and he immediately formed an artificial colony by removing this queen with a sufficient number of workers, adding worker brood from other colonies. On the twelfth day following, he heard a young queen "*teeting*" in the parent hive, and to his surprise, a large swarm issued from it on the same day, though the weather was then cool and cloudy. This swarm came forth suddenly without any previous indication of its intention, just as after-swarms usually do. On a similar day, Dzierzon says he had never seen a first swarm of common bees leave. So cold was the weather, that some of the bees became chilled before the swarm was hived. As the swarm was unusually large, he divided it into two, as he was able to procure an additional queen from the parent hive. Both throve well, and each of the queens was impregnated by an Italian drone. From this occurrence he judged that these bees have an instinctive proclivity to swarm early. Our common kind would have lingered long, rather than swarm in weather so cold and cloudy.

The main thing to be attended to in any localities where common bees are found or kept, is to secure the production of drones in numbers overwhelmingly large; though Dzierzon is under the impression that where both kinds of drones exist in about equal numbers, the Italian queens will usually encounter Italian drones, both queens and drones being more active and agile than the common kind. Besides, the ner-

voures of the wings of both queens and drones are finer and more delicate than those of the common kind, and the sounds produced in flying are clearer and higher toned. Hence, probably, they are readily able to distinguish each other when on the wing.

If at the time when young queens are emerging, the bees and drones be tempted to sally out earlier than usual in the day, hours before the common drones come forth, by feeding them with diluted honey, the perpetuation of the genuine breed will the more probably be secured. But this end will the most certainly be attained, if measures be taken to have Italian queens and drones bred early in the season, before the common drones make their appearance; and again late, after the latter have been "killed off." This may readily be accomplished by means of the improved hive, and the application of certain known principles in bee-culture.

The Baron of Berlepsch, one of the most enthusiastic and skillful Apiarians, on a large scale, in Germany, says he can, from his own experience, confirm the statements of Dzierzon, in relation to the Italian bee.

1. That the Italian bees are less sensitive of cold than the common kind.

2. That their queens are more prolific.

3. That the colonies swarm earlier and more frequently, though of this he has less experience than Dzierzon.

4. That they are less apt to sting. Not only are they less apt, but scarcely are they inclined to sting, though they will do so, if intentionally annoyed and irritated.

5. That they are more industrious. Of this fact he had but one summer's experience, but all the results and indications go to confirm Dzierzon's statements, and satisfy him of the superiority of this kind *in every point of view.*

6. That they are more disposed to rob than common bees,

and more courageous and active in self-defence. They strive on all hands to force their way into colonies of common bees; but when strange bees attack their hives, they fight with great fierceness and an incredible adroitness.

From one Italian queen sent to him by Dzierzon, Berlepsch succeeded in obtaining, in the ensuing season, one hundred and thirty-nine fertile young queens, of which number about fifty produced pure Italian progeny.

In order to secure an early supply of drones, as the basis of his future operations, Berlepsch inserted empty drone combs on the third of March, between combs filled with worker brood, and fed the colony every evening, with diluted honey, somewhat warmed. The cells of these drone combs were speedily supplied with eggs, and on the 31st of March, the first drones issued. But in the first week of April the workers cast nearly all the drone brood out of the cells, and not more than about 150 drones survived. The weather had suddenly changed and become rough and cold, and at so early a period the bees do not regard drones with much favor. He proposes operating differently hereafter, by removing the queen from some strong colonies, as soon as drones emerge, and insert in their hives the comb containing drone brood, to be hatched there. The first young queen emerged on the 3d of April, and on the 11th, a beautiful Spring day, whilst drones were flying in great numbers, he had the gratification of seeing the queen return to her hive with evident marks of impregnation. This queen, and two others, soon proved to be fertile, producing Italian brood. On the 12th the weather became cold again, and so remained till the 23d, when the thermometer rose to 80° in the shade, and numbers of drones issued also from his hives of common bees. This undesired occurrence constrained him to transfer his Italian hives to another locality. But even there,

three-fifth of his young queens proved to be bastardized. He nevertheless continued his efforts steadily, though the proportion of bastardized queens continued to increase, until in July hardly one-tenth of the number bred proved to be of the pure Italian stock. This disproportion was a mystery to him till he observed that on very warm days, when the air is entirely calm, and the sky clear, the drones *circumvolate** to unusual distances, and probably the queen's excursions are on such occasions similarly extensive. At least, at this time, the queen of a colony in an Apiary three miles distant, must have been impregnated by a drone from his Apiary, for the progeny she produced was similar to that of a common queen, impregnated by an Italian drone. On the 20th of August, at which time all the common drones had disappeared, Berlepsch had 117 fertile young queens, but only 28 pure Italian. He preserved his Italian drones from destruction, by removing the queens from the colonies in which drones most abounded, and preventing the breeding of young queens by repeatedly destroying the royal cells constructed. Thenceforward he found it an easy task to produce Italian queens, because few common drones remained in other Apiaries, and those no longer made distant excursions, nor did the queens roam so far abroad. He had previously noticed that if late in the season, drones be induced to issue from their hives on fair days, at an earlier hour than they usually come forth, by feeding the colony with warm diluted honey, they will not fly far, and soon return to their domiciles. By resorting to this expedient, and injecting some such honey, by means of a syringe, into each hive having

* I think we shall have to introduce this word in bee-culture, to designate the drone's peculiar style of locomotion when on the wing. It seems to be "a flight in" pseudo-cycloidal "circles urged." Aristotle notices this peculiarity in their flight.

an unimpregnated young queen, and also into those hives which contained many drones, he caused the workers and drones to issue in great numbers, and among them the queens from several hives. These latter soon returned with evident marks of impregnation. This was continued till the 16th of September, when, after a few days absence, he found that the drones had been expelled from all his colonies, and an end thus put to his efforts for that season.

It is a remarkable fact that an Italian queen, impregnated by a common drone, and a common queen impregnated by an Italian drone do not produce workers of a uniform intermediate cast, or hybrids; but some of the workers bred from the eggs of each queen will be purely of the Italian, and others as purely of the common race, only a few of them indeed being apparently hybrids. Berlepsch also had several bastardized queens, which at first produced Italian workers exclusively, and afterwards common workers as exclusively. Some such queens produced fully three-fourths Italian workers; others, common workers in the same proportion. Nay, he states that he had one beautiful orange-yellow bastardized Italian queen, which did not produce a single Italian worker, but only common workers, perhaps a shade lighter in color. The *drones*, however, produced by a bastardized *Italian* queen, are uniformly of the Italian race, and this fact, besides demonstrating the truth of Dzierzon's theory, renders the preservation and perpetuation of the Italian race, in its purity, entirely feasible in any country where they may be introduced.

Considerable difficulty has been encountered, even by experienced Apiarians, in inducing a colony of common bees, deprived of its queen, to accept an Italian queen in her stead; and many failures have occurred, involving the loss of the offered queen, and causing grievous disappointment.

The safest course appears to be, to remove the queen several days before the substitution is intended to be made, and to destroy all the royal cells and embryo queens the day before the Italian queen is introduced. At the time of her introduction, the combs should again be thoroughly examined, and if any more royal cells have been started, they must likewise be destroyed. The Italian queen should be placed in a cage* for her protection, and a small quantity of pure honey in open cells should be put in the cage. The conduct of the workers will speedily show whether and when they will receive her. Mr. Lange advises that the Italian queen be introduced immediately after the bees of a deprived colony manifest undoubted consciousness of the loss they have sustained, and before they have started any royal cells, or made arrangements for doing so.

German Apiarians designate as *bastardized* such Italian queens as have been impregnated by common drones, and also such common queens as are impregnated by Italian drones. The progeny of each is termed *bastard*, and not *hybrid*, as they do not seem to constitute an intermediate breed, but are sometimes of the one kind, and sometimes of he other.

Truly yours,

SAMUEL WAGNER.

Rev. L. L. Langstroth.

Otto Radlkofer, Jr., of Munich, in a communication to the Beinenzeitung, July, 1856, says that a colony of Italian bees which he transferred in February, began to build new comb before the middle of March, and by the middle of April made more than 325 square inches; while his common bees had not, at the date of his communication, (the last of April,)

* See page 236.

begun to build any new comb. "Not only," says Mr. Radlkofer, "are the Italian bees distinguished by an earlier awakened impulse to activity and labor, but they are remarkable also for the sedulous use they make of every opening flower, visiting some on which common bees are seldom or never seen. They have also demonstrated their superior agility in self defence; nay, they would not tolerate the presence of other bees on comb that had been strewed with flour for their common use. In all these respects the palm of superiority must be awarded to the Italian bee."

An attempt was made last year by Mr. Wagner, to import this valuable variety of the honey-bee; unfortunately the colonies perished on the voyage. Another attempt will be made to introduce them, so as to have them in season for operations, the ensuing Spring.

The great obstacle to its more rapid diffusion in Germany, has been the difficulty under which even their most experienced Apiarians labor, in keeping the breed pure. From Mr. Wagner's letter it will be apparent that to bee-keepers on the old plan, the possession of an Italian queen could only serve to gratify their curiosity, as it would be next to impossible for them to multiply from it a pure breed. To those, however, who by using frames or slats have the command of each comb in a hive, such a queen might be made very valuable. By means of my *non-swarmer*, a whole Apiary, however large, may in a single season have all its colonies supplied with genuine Italian queens, all produced from a single one, and this can be accomplished not only with much more certainty, but with far less labor than is required by the German plan. As this is a subject which may soon be of great practical importance to our bee-keepers, I will give a brief sketch of the plan which I propose, for multiplying Italian queens.

Having one fertile Italian queen, in the Spring or early Summer, the Apiarian should proceed substantially as follows: Let him make a powerful stock of bees in a hive giving him the control of the combs, putting into the center some combs which contain a large number of drone cells. Deprive this transferred stock of its queen, as soon as they have repaired their combs, and with suitable precautions, introduce to them the Italian queen. When the drone cells are filled with capped brood, let nuclei be formed from this stock. Brood combs must not, however, be removed too often, unless the Apiarian can keep the parent stock strong, by supplying it from other hives with combs containing bees just ready to hatch. As soon as the queens in the nuclei begin to mature, adjust the non-swarmer to all the hives in the Apiary containing common drones, so as to *shut in* the drones, (p. 203,) but give free egress and ingress to queens and workers. In this way, the drones bred by the Italian queen having their liberty, all the young females will be fertilized by them.

As fast as the queen of any nucleus becomes fertile and has replenished the cells with eggs, remove her and give her to some strong stock of common bees, which has previously been deprived of its queen. The nucleus will now attempt to raise more, which before they hatch may be used for other colonies, one only being left behind. Soon after any strong stock with movable combs obtains a fertile Italian queen, nuclei may be formed from it, and in this way as many be raised as the necessities of the Apiary may require.

A portion of the Italian drone brood ought to be given to some of the nuclei, and more drone comb put in its place, in the hive having the original Italian queen, so that in case the drones are killed in this colony, others will still be on hand. The Apiarian should also, later in the season, remove the

original Italian queen from the hive and put her elsewhere, in order that, finding themselves without a queen, they may be disposed to tolerate the drones, as long as possible. If other Apiaries are near, to which he cannot apply the non-swarmer, the bee-keeper must remove his nuclei and hive with the Italian queen and drones, to some situation more remote. By substantially such methods of procedure, the season may be ended with none but Italian queens in the Apiary. Let the bee-keeper in his zeal for multiplying colonies with Italian queens, be sure not to forget my previous cautions. He should never, unless in latitudes where the Winter is mild and short, attempt to winter any but strong stocks. From these, with the comb procured in uniting several feeble families, he can safely form new ones the ensuing season, and with much less trouble and expense than would ordinarily be necessary to nurse feeble stocks through a very precarious existence.

Italian queens may be safely sent in my hives to any part of the country. A hive for this purpose should be made to hold only one comb, which ought to be *old* and very securely fastened. Into such a hive, suitably provisioned, an Italian queen may be introduced with a few hundred bees to keep her company, and if the frame containing the comb is properly secured, and sufficient ventilation given, they will bear a journey of many days. If received at a season unsuitable for rearing new queens, she may be given to some strong colony, transferred * to a suitable hive, and reserved for future operations.

* In the directions for transferring bees, I spoke of securing the old combs with cotton-twine, until the bees could fasten them to the frames. Quite recently a friend has contrived a much better way. He cuts out from bass or any other spongy wood, slats, three-eights of an inch wide, and one-eighth thick, and half an inch longer than

It is hardly necessary for me to say, that a species of the honey-bee so much more productive than the common kind, and so much less sensitive to cold, will be of very great value to all sections of our country. Its superior docility would make it worthy of high regard, even if in other respects it had no peculiar merits. Its introduction into this country, will, it is confidently believed, constitute a new era in bee-keeping, and impart an interest in its pursuit which will enable us ere long to vie with any part of the world in the production of honey.

If an intelligent farmer passing through a fertile district, should see vast fields of grass and grain rotting on the ground for want of gatherers, the sight would awaken the most painful emotions. To the well-informed Apiarian it is almost as painful a sight, to behold countless millions of blossoms, which if they do not "waste their sweetness on the *desert* air," exhale their luscious juices with but little benefit to man. Why should our land be deprived of the happy murmurs of these insect laborers, gathering up every wholesome * sweet, so that nothing may go to waste which the Bountiful Creator has made for the good of his creatures?

> "Bees work for man, and yet they never bruise
> Their master's flower, but leave it, having done,
> As fair as ever and as fit for use."
>
> *Herbert.*

the depth of the frames; these are fastened together with strings, in pairs, so as *just* to slide over the top and bottom of a frame, to hold the comb in its place. Two pairs will be needed on each frame, and they may easily be removed after the bees have made the proper attachments.

* The Ancients, we know, set a high value upon honey, recommending it, in *moderation*, as one of the most wholesome articles of food, and ascribing to it extraordinary medicinal virtues. The wise king has seen fit, in his book of Proverbs, to recommend its use by a special injunction! "My son, eat thou honey, for it is good."

CHAPTER XXII.

Bee-keeper's Calendar—Bee-keeper's Axioms.

I SHALL now furnish plain directions for each month in the year, so that the beginner may always know what to do, at any given season, in his Apiary; and as a full Alphabetical Index is given at the end of the book, he can easily refer to all that is said on any subject.

JANUARY.—In cold climates, bees, in this month, are usually in a state of repose. If the colonies have had proper attention in the Fall, nothing will ordinarily need to be done, that will excite them to an activity always more or less injurious. In very cold climates, however, when a severe temperature is of very long continuance, it will be necessary, if the hives are not most thoroughly protected, to bring them into a warm room, (p. 327,) to thaw out the ice, and allow the bees to get access to their supplies. If the holes in the spare honey-board are left open, (p. 435,) the hives may be set low, and if completely covered with snow, so much the better for the bees, if proper precautions are used to prevent the water from entering them, in case of a sudden thaw. In January there are occasionally, even in very cold latitudes, days so pleasant that bees can fly out to discharge their fæces; do not confine them, (p. 327,) even if some are lost on the snow. In this month clean the bottom-boards, (p. 327,) but disturb the bees as little as possible.

FEBRUARY.—This month is sometimes colder than January, and then the directions given for the previous month, must be

followed. In milder seasons, however, and in warmer regions, bees begin to fly quite lively in February, and in some locations they commence gathering pollen. The bottom-boards should be again attended to, as soon as the bees are actively on the wing, and if any hives are suspiciously light, sugar-candy (p. 358) should be given them. Strong colonies will now begin to breed considerably, but nothing should be done to excite them to premature activity.

MARCH.—In our Northern States, the inhospitable reign of Winter still continues, and the directions given for the two previous months will be applicable to this. If there should be a pleasant day when bees are able to fly briskly, seize the opportunity to remove the covers (p. 334); carefully clean out the hives, (p. 284), and learn the exact condition of every colony. See that your bees have a sheltered and sunny place for procuring water, (p. 357), and also that they are well supplied with rye-flour; (p. 94.) In this month weak stocks commonly begin to breed, while strong ones increase quite rapidly. If the weather is favorable, colonies which have been kept in a special winter depository, may now be put upon their proper stands, (p. 332).

APRIL.—Bees will ordinarily begin to gather much pollen in this month, and sometimes considerable honey. As brood is now very rapidly maturing, there is a largely increased demand for honey, and great care should be taken to prevent the bees from suffering, in the very least, for want of food. If the supplies are at all deficient, breeding will be checked, even if much of the brood does not perish, or the whole colony die of starvation. If the weather is propitious, feeding to promote a more rapid increase of young (p. 347), may now be commenced. If any colonies are too feeble in numbers, they must now be reinforced (p. 284), and should the weather continue cold, for several days at a time, the

bees ought to be supplied with water (p. 257) in their hives. In April, if not before, the larvæ of the bee-moth will begin to make their appearance, and should be carefully destroyed, (p. 367).

MAY.—As the weather becomes more genial, the increase of bees in the colonies is exceedingly rapid, and drones, if they have not previously made their appearance, begin to issue from the hives. In some locations the bees will now gather much honey, and it will often be advisable to give them access to the spare-honey receptacles; but in some seasons and locations, either from long and cold storms, or a deficiency of forage, stocks that are not well supplied with honey, will exhaust their stores and perish, unless they are fed. In favorable seasons swarms may be expected in this month, even in the Northern States. In Texas I have seen them issue early in March, and in some of the Southern States they are quite common in April. These May swarms often issue near the close of the blossoming of fruit trees, and just before the later supplies of forage, and will sometimes starve, if the weather becomes suddenly unfavorable, unless they are fed. Even if there is no danger of this, they ought to be fed when food is scarce, or they will make so little progress in comb-building and breeding as to be surpassed by much later swarms. The Apiarian should have hives in readiness to receive new swarms, however early they may issue or be formed. If new colonies are to be made by artificial processes, the proper methods should be taken to secure a seasonable supply of queens, (p. 190.) I ought previously to have stated that a queen nearly mature, may be known by having the wax removed by the bees from the extremity of her cell, so as to give it a very *brown* appearance.

JUNE.—This is the great swarming month in all our

Northern and Middle States. As bees keep up a high temperature in their hives, they are by no means so dependent upon the weather, for forwardness, as plants, and most other insects necessarily are. I have had as early swarms in Northern Massachusetts, as in the vicinity of Philadelphia. If bees do not swarm very soon after the fruit trees are in blossom, it is desirable to have them defer it, until later supplies furnish them with abundant forage. They seldom swarm if honey is not so abundant that they can gather more than they need for immediate consumption. Artificial colonies, therefore, should not be made, except at such seasons, unless the Apiarian expects to feed them.

In the Chapter on Artificial Swarming, I forgot to say that the bees may be driven up into the top box of my hive, by removing the honey-board, blowing smoke into the entrance, and drumming upon the outside of the hive. Inexperienced Apiarians may prefer this to opening the hive and lifting out the combs. I can easily stupify bees by fumigating them with puff-ball, or by pouring into their hive a little chloroform or ether, but it is far more troublesome to manage them in this way, than with the smoke of punk.

If the bee-keeper relies upon natural swarming, his Apiary, if not in full sight and sound, should be carefully watched. If this cannot be done, he should, after a short absence, carefully examine the neighboring bushes and trees, on some of which he will often find a swarm clustered, preparatory to their departure for a new home. As it may often be important to know from which hive the swarm has issued, after it has been hived and removed to its new stand, let a cup full of bees be taken from it and thrown into the air, near the Apiary; they will soon return to the parent stock, and may easily be recognized, by their standing at the entrance and fanning, like ventilating bees. Where the hives have glass

windows, the diminished number of bees will usually show which colony has swarmed.

As fast as they are filled,* and the cells capped over, the surplus honey-receptacles should be removed, and empty ones returned in their place. Careless bee-keepers often lose much, by neglecting to do this in season, thereby condemning their colonies to a very unwilling idleness. The Apiarian will bear in mind that all small swarms, which come off late in this month, should be either aided, doubled, or returned to the mother stock, (p. 163). With my hives the issue of such swarms may be prevented, by removing in season the supernumerary queen cells. During all the swarming season, and indeed at all other times when young queens are being bred, the bee-keeper must ascertain seasonably, that the hives which contain them, succeed in securing a fertile mother, (p. 294).

I have repeatedly observed that after-swarms build the most regular worker comb, and that if they lay up a sufficient supply of honey, they usually make the best stock hives. If, by further experiments, I ascertain that this is owing to their possessing a young queen, I shall judge it best, in making artificial swarms, to leave the old queen with the parent stock, and to supply the forced swarm with a young one, as soon as they manifest a consciousness of their loss.

JULY.—In some seasons and districts, this is the great swarming month, while in others, bees issuing so late, are of small account. In Northern Massachusetts, I have known swarms coming after the 4th of July, to fill their hives and make large quantities of surplus honey besides. In this month all the choicest spare honey should be removed from

* Mr. Quinby informs me, that he succeeds in making bees fill a double tier of small boxes, by placing one set on the hive first; when they have partially filled these, he puts the second set *under* the first.

the hives, before the delicate whiteness of the combs becomes soiled by the travel of the bees, or the purity of the honey is impaired by an inferior article gathered later in the season.

The bees should have a liberal allowance of air during all extremely hot weather, and if the stocks are strong, I often remove entirely the entrance blocks.

AUGUST.—In most regions there is but little forage for bees, during the latter part of July and the first part of August, and being on this account tempted to rob each other, the greatest precautions should be used in opening hives, (p. 342).

In districts where buckwheat is extensively cultivated, bees will sometimes swarm when it comes into blossom, and in some seasons extraordinary supplies are obtained from it. I had a buckwheat swarm this year (1856) as late as the 16th of September!

If any colonies are, in the expressive language of old Butler, "over fat," some of their full combs should now be removed, (p. 201). If the caps of the cells are carefully sliced off, with a very sharp knife, and the combs laid over a vessel, in some moderately warm place, and turned once, *most* of the honey will drain out of them, and they may be returned to the bees, to be filled again. I know of scarcely any more profitable operation in the whole range of bee-keeping, than this, when a fair price can be obtained for the liquid honey.

The bee-keeper who has queenless stocks on hand in August, must expect as the result of his ignorance or neglect, either to have them robbed by other colonies, or destroyed by the moth,* (p. 264).

* An attentive perusal, quite recently, of what Aristotle has written on the subject of the honey-bee, has impressed me with the extraordi-

SEPTEMBER.—This is often a very busy month with bees. The Fall flowers come into blossom, and in some seasons colonies which have hitherto amassed but little honey, become heavy and even yield a surplus to their owner. Bees are very reluctant to work in boxes, so late in the season, even if supplies are very abundant; but if empty combs are inserted in the place of full ones removed, they will fill them with astonishing celerity. These full combs may afterwards be returned, if the bees have not a sufficient supply without them. They can be profitably used for making new stocks, out of bees driven from hives condemned, by old-fashioned bee-keepers, to the sulphur pit.

If no Fall supplies abound, and any stocks are too light to winter with safety, then, in the Northern States, the latter part of this month is the proper time for feeding them. I have already stated (p. 36) that it is impossible to tell how much food a colony will require to carry it safely through the winter; it will be found, however, very unsafe to trust to a bare supply, for even if there is food enough, it may not always be readily accessible to the bees. For this reason I prefer to leave in all my hives a very generous supply, as I

nary knowledge possessed by him of their habits. Several important points which I have met with in no other work, and which I had supposed to be discoveries of my own, appear to have been familiar to this truly wonderful genius. Speaking of the larvæ of the bee-moth, he says: "Good bees expel them; but others from slothfulness, neglect their combs, which then perish." His *good bees* were evidently such as possessed abundant stores and a healthy queen; and his *bad ones* neglected to expel the worms, not from idleness, but from despair, (see p. 262). We learn from this remark of Aristotle, that the moth preyed upon queenless stocks, more than two thousand years ago, precisely in the same way as now. So, doubtless, it will continue to do in spite of all pretended moth-proof hives, as long as time shall endure.

can easily remove any surplus in the Spring. If the aggregate resources of the colonies are sufficient, those which have not enough, may be supplied from those having a superabundance. In some cases the bee-keeper may prefer, by uniting several destitute stocks, to save the labor and expense of feeding, (p. 315.) Great caution will still be necessary to guard against robbing, but if there are no feeble, queenless, or impoverished stocks, the bees, unless tempted by improper management, will seldom rob each other.

October.—Forage is now almost entirely exhausted in most localities, and colonies which are too light should be fed early in this month. If feeding is begun too early, in seasons when late forage is abundant, there will be a great waste of honey. In this month, at the very latest, the exact condition of every stock should be known, and if any are found in a queenless condition, they should be broken up. Small colonies should be united to others, and all the hives put into proper condition for wintering. Some full honey-combs should be put in the center of the hive, and holes, for easy intercommunication, be made in the combs; (pp. 323–4,). Since putting to press the remarks on wintering bees, I have succeeded in devising a very simple, cheap and efficient method, by which in new frames, the requisite winter passages will be left by the bees, so that movable frames may be safely used, without the necessity of opening the hives to make the holes, (p. 325.)

In describing the advantages of punk-smoke, for subduing bees, it ought to have been stated that no utensil of any kind will be needed for using it; the Apiarian being able to blow the smoke upon the bees with his mouth better than in any other way. I find that the punk from hard wood is the best.

Hives not made of doubled materials, if they are to winter out of doors, should be protected according to the

directions on pages 326 and 434. By the last of October, the glass hives should be thoroughly packed, between the outside cases and the glass, with cotton, or any other warm material.

NOVEMBER.—I take for granted that all necessary preparations for Winter, have, in our Northern States, been completed by the last of the previous month. If, however, the bee-keeper has been prevented from examining his stocks, he may, on warm days, in November, safely perform all necessary operations, the feeding with liquid honey, excepted. The entrances to the hives must now be secured against mice, and it will be well to give the roofs a new coat of paint. If the hives are to be exposed to the sun, at all seasons, no color is so good as a pure white; but if they are set under the shade of trees, (p. 301,) a dark color will do them no harm, in the hottest weather, while early in the season, before the leaves are expanded, by absorbing instead of reflecting the heat, it will prove highly advantageous to the bees.

By the latter part of November, in our Northern States, Winter usually sets in, and colonies which are to be kept in a special winter depository, should be properly housed. The later in the season that the bees are able to fly out and discharge their fæces, the better. The bee-keeper must regulate the time of housing his bees by the season and climate, being careful not to take them in, until cold weather appears to be fairly established, nor to leave them out too late. The necessity for the exercise of so much good judgment in this matter, is a serious objection to the use of winter quarters, by any except those who have considerable experience in their management. If colonies are carried in too early, and a spell of quite warm weather succeeds the first cold, it will sometimes be advisable to replace them on their summer stands.

DECEMBER.—In regions where it is advisable to house bees, the dreary reign of Winter is now fairly established, and the directions given for January are for the most part equally applicable to this month. It may be well, in hives out of doors, to remove the dead bees and other refuse from the bottom-boards, but neither in this month nor at any other time, should this be attempted with those removed to a dark and protected place. Such colonies must not, except under the pressure of some urgent necessity, be disturbed in the very least, (p. 116.)

I recommend to the inexperienced bee-keeper, to read this synopsis of monthly management, again and again, and to be sure that he fully understands and punctually discharges the appropriate duties of each month, neglecting nothing, and procrastinating nothing to a more convenient season; for while bees do not require a large amount of attention, in proportion to the profits yielded by them, they *must* have it at the *proper time* and in the *right way*. Those who complain of their unprofitableness, are often as much to blame as a farmer who, after neglecting to take suitable care of his stock, or to gather his crops in season, should denounce his employment as yielding only a scanty return, on a large investment of capital and labor.

BEE-KEEPER'S AXIOMS.

Under this head I shall briefly enumerate certain first principles which should regulate the whole management of bees, and ought therefore to be as familiar to every Apiarian, as the letters of his alphabet.

1st. Bees gorged with honey never volunteer an attack.

2nd. Bees may always be made peaceable, by inducing them to accept of liquid sweets.

3d. 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.

4th. Bees dislike any quick movements about their hives, more especially any motion which *jars* their combs.

5th. Bees dislike the offensive odor of sweaty animals, and will not endure impure air from human lungs.

6th. The bee-keeper will ordinarily derive all his profits from stocks, strong and healthy, in early Spring.

7th. 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.

8th. A moderate increase of colonies in any one season, will in the long run, prove to be the easiest, safest and cheapest mode of managing bees.

9th. Queenless colonies, unless supplied with another queen, will inevitably dwindle away, or be destroyed by the bee-moth or by robber bees.

10th. 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.

The very essence of all profitable bee-keeping may be condensed into Oetle's Golden Rule: KEEP YOUR STOCKS STRONG. If you cannot succeed in doing this, the more money you invest in bees, the heavier will be your losses; while if your stocks are strong, you will show that you are a *bee-master*, as well as a bee-keeper, and may safely calculate on generous returns from your grateful and industrious subjects.

APPENDIX.

On the impregnation of the eggs of the Queen.

It would seem, from reeent discoveries, that the spermatozoa do not simply come in contact with an egg, in impregnating it, but actually enter into it, through a small opening. In applying this discovery to bees, Prof. Siebold, of Germany, dissected a large number of worker-eggs, and found, in such as were not too much mutilated for proper examination, from one to three spermatozoa, while in dissecting drone-eggs, he could not find the slightest traces that they had been impregnated.

Dr. Donhoff reared, last Summer, a worker larva, from a drone-egg which he had artificially impregnated. I attempted this experiment, in 1852; but to my great disappointment, the bees removed or devoured all the eggs thus treated, owing, as I then supposed, to their unwillingness to raise workers in drone cells. By taking a piece of drone-comb in which eggs have just been deposited, and touching some of them with a fine brush, dipped in the diluted semen of drones, I believe that queens, workers and drones may be raised from these eggs, if the precaution, is taken to give them to bees having neither queen nor brood of any kind.

To those who deny that the human family could ever have sprung from a single pair, on account of the great physical diversities between the different races, I would respectfully submit the fact, which has been demonstrated in so many independent ways, that queens, workers or drones may be raised from the same kind of eggs. The differences between them, in size, shape, color and instincts, are confessedly much greater than any between the various races of men; and yet, in the one case, the changes are all produced in a few weeks, while in the other, they may have had many hundreds of years, for their gradual development.

On the secretion of Royal Jelly.

Some recent observations of Mr. P. J. Mahan, prove that bees when entirely confined to their hive and supplied with water, are able from the honey and pollen stored in their combs, to secrete royal jelly and rear perfect queens. The incessant attention bestowed upon the royal cells, (p. 69,) must, in part, be owing to the many visits required, for the workers to store in them the usual allowance of jelly.

On transferring bees from common, to movable comb hives.

On a cold day, in the latter part of December, a colony of bees in an old box, was transferred by Mr. P. J. Mahan, to a movable comb hive. About a dozen bees were killed in the transfer which was performed in a warm room. A month later this colony was examined in their new home, and their combs found to contain eggs, worms and sealed brood. It would seem from this experiment, that there is no day in the year, so cold, that experienced operators cannot safely transfer bees.

On the use of Grated Sugar-Candy as a Winter bee-feed. On the shape of hives.

The Rev. Mr. Kleine, uses grated sugar-candy, as a winter food for bees. He first dampens the empty combs with sweetened water, and after grating into them the candy, puts them where they will be most accessible to the bees. Increasing experience confirms the extraordinary merits of candy, as a winter bee-feed. It may be easily and safely given to needy stocks, in the coldest weather, if they are in movable-comb hives.

The shape for hives, recommended on page 432, will be found objectionable by those who desire to lift and manage

them, without any assistance. All hives designed to accommodate more than one colony, will, for the same reason, be unsuited to the wants of such cultivators. By making my hives about 18 inches, from front to rear, and varying the other proportions, I am able to combine a shape convenient for handling, with one well adapted for wintering bees in cold climates.

On Movable Bottom-Boards.

I find that the use of punk-smoke,* obviates some of the chief objections to movable bottom-boards. By blowing a little smoke into the mouth of the hive, the bees may be quickly driven up among the combs, so that the hive may be lifted and the bottom-board cleaned, without crushing a single bee.

By the use of movable bottom-boards, the bee-keeper can set one hive on top of another, making use of the upper one as a place of storage for the surplus honey. In hives of the simplest form, built in this way, a given quantity of honey may be secured on frames, in marketable order, at a very moderate outlay; I believe for as small a sum as in any kind of hive whatever. (See Pl. 1.)

On Wintering Bees in the Open Air.

In the previous part of this work, directions were given for furnishing proper intercommunications among the combs, and for allowing the dampness of the main hive to escape into the upper cover, by opening some of the holes in the spare honey board. To-day, (Jan. 9th 1857,) a number of colonies were examined, to which suitable winter communications between their combs, had been given, *all* the holes on their honey-boards being left open. The month of December was severely cold, the thermometer falling to 17°

* The use of smoke in subduing bees, is referred to by Aristotle, Columella, and Pliny. Bee-keepers who have never tried it, can hardly conceive how wonderfully it facilitates the management of bees.

below zero. The last three days, it has been about half of the time below zero, and never more than ten above, while the wind has blown almost a continuous gale. In none of the hives could I detect any frost or dampness, or any bees frozen by being caught away from the main body of the colony. In the upper covers, however, there was an abundance of frost, and it was easy to see where the dampness had escaped. In a few of my colonies in which none of the holes had been opened, the sides of the hive, many of the combs, and the surface of the honey board next to the bees, were coated with frost!

So long as it is too cold for the frost in the hives to thaw, it may subject the bees to little inconvenience, unless they need the food in the frosty combs; but as soon as a thaw sets in, the combs must become damp and the bees so drenched with wet, as to be exposed to disease. If the weather suddenly changes to severe cold, before the hive has time to dry, then the bees being wet, are liable to be entirely destroyed. In this way many colonies perished in the month of March, 1856. The Winter having been intensely cold, the hives were filled with frost, and in some the ice on the sides was nearly 1-4 of an inch thick. A few days of mild weather in which the frost began to thaw out, was followed by extreme cold and furious winds, during which many colonies which had abundant stores, perished. In many instances the bees which were still wet from the previous thaw, were frozen into an almost solid mass! I find, by experience, that in very cold climates, unless the dampness is allowed to escape from above, it is almost impossible to prevent such fatalities, in hives standing in the open air. The intense cold will defy any amount of protection which can be given, and the hives will be damp, the combs mouldy and the bees diseased, even where frost may be entirely excluded. Indeed the greater the protection given to hives that have no upward ventilation, the greater, often, the risk from dampness. A very thin hive, unpainted, so that it may easily absorb the heat of the sun, will dry inside, when the weather becomes mild enough to thaw, much sooner than one painted white, and in every way most thoroughly protected against cold. The first may be com-

pared to a garret, and the other to a cellar. While the one is annoyed with dampness for a short time only, the other may be so long in drying, as to injure if not destroy the bees.

In order to test this matter more thoroughly, I have removed some colonies from hives the best protected, into others less than an inch thick. Giving them the necessary openings to allow the dampness to escape, and exposing them to a temperature 10° below zero, I have found very little frost in their hives! It must not be inferred from these observations, that it is a matter of indifference to bees, whether their hives are well or ill protected, but that security against dampness, if the hives are well peopled and well provisioned, is more important than anything else.

In the experiments of this winter, some of my hives have been subjected to the severest tests. The honey-board has been entirely removed, and only a thin upper cover placed over the bees, so that the empty space above them was nearly as large as the main hive. On lifting this cover, it has been found coated with frost, while the main hive was dry, and the bees full of life and activity. In a temperature many degrees below zero, they would rush up from their combs, on the slightest jar of their hive, rapidly pouring through the intercommunications between the combs, and thus showing their ability to reach any of the stores in their hive.

It must not be forgotten, however, that when upward ventilation is given to the hives, the entrances should be most carefully sheltered from cold winds. In situations where this is difficult, they should be almost entirely closed, and this may be safely done in the thinnest hives, by making proper provision for the escape of dampness. Even if the hives should be buried in the snow, and the entrances entirely closed, the bees will not suffer for want of air, where they have free openings into the upper cover, but like the Esquimaux in their snow huts, will only be the more effectually protected against the cold. The upward ventilation of the hives in Winter, renders a ventilator on the bottom-board, (p. 325,) unnecessary.

If on the approach of Winter, a few thicknesses of common straw wrapping paper or old newspapers, are tacked on

the *under* side of the spare honey board, neither frost nor dampness will ever gather upon it, to annoy the bees. Holes for upward ventilation may be cut out in the paper; but I prefer to drive tacks into the four corners of the board,* so as to elevate it about half an inch. The paper should be removed and the honey-board shut down, in the Spring.

Since the chapter on Protection of Hives, went to the press, owing to a delay in printing the rest of the work, caused by the Author's ill health, an opportunity has been afforded for nearly two Winters, of experimenting further on the best mode of wintering bees. While the results of last Winter, taught me the need of upward ventilation, and a more free communication among the combs, the numerous experiments of this Winter, have convinced me that I have over-estimated the benefits to be derived from thoroughly protected hives. To-day, (Jan. 14, 1857,) I have opened three hives and carefully examined the combs, and find their condition to be as follows: (No. 1.) A good stock of bees, in a thin hive, with abundant upward ventilation, the spare honey-board being entirely removed. In the main hive there was a very little frost, (the thermometer this A.M. being $10\frac{1}{2}$ degrees below zero,) and the bees were dry and lively. The central combs contained eggs and unsealed worms. (No. 2.) A stock eqally strong, in a thin hive, long enough to hold 18 frames. The bees with their combs, occupied the eight central frames; the other frames had no combs. This hive had no upward ventilation, and contained much frost. The central combs had eggs and unsealed worms. (No. 3.) A hive most thoroughly protected by dead air spaces all around, and having upward ventilation, the holes in its honey board being all left open. This hive was about as frosty as No. 1, and its central combs had eggs and worms, a few of which were sealed over. It had a better stock of bees than the others, but appeared to have commenced breeding only a few days earlier.

The results of these examinations show, that where there

* To-day, (Jan. 16th,) the thermometer being below zero, I examined a stock in a thin hive, the honey-board being elevated, as above. The hive was free from frost, and the bees very lively.

is a good supply of food and bees, breeding commences* about the same time, being influenced very little by the thickness or thinness of the hives. Bees can only breed in such combs as they can densely cover, and, as was shown in No. 2, however large the cold and unoccupied space in their hive, they are able to develop their brood in these combs. No amount of protection which could possibly be given to the hive, would enable them to rear a single bee, except in the warm combs on which they are clustered. Bees kept in large garret-closets where their combs occupy but a small part of the enclosed space, are exposed often to a very severe temperature. In such situations, however, they are able to breed in the depth of winter, and I believe that they would thrive, even if their combs were hung in an open shed, and merely protected from the wind. I would sooner risk them in such a situation, than in a damp hive, however well-protected.

The grand essentials for successfully wintering bees in the open air, in cold climates, may be condensed into a very few words: plenty of bees; plenty of food; easy communications among the combs; upward ventilation for the escape of dampness; and the hive-entrance well sheltered from piercing winds.

Jan. 30th, 1857: This month, the coldest on record for more than 50 years, has furnished the most decisive proof of the correctness of the views advanced in this Appendix, on wintering bees in the open air. My colonies have been exposed to a temperature of 30° below zero, the mercury for two days never having risen above 6° below, and the wind blowing a strong gale the whole time! I have to-day carefully examined the thin hive, (No. 1, p. 474,) and find the bees to be very healthy. The central comb is almost entirely filled with sealed brood, nearly mature; the combs are free from any appearance of mould, and the interior of the hive is very dry. The spare honey-board was covered on its under side, with straw wrapping-paper, and elevated by tacks

* I examined a number of strong stocks Nov. 1st, and found that breeding had entirely ceased; Aristotle says that it ceases for about 60 days. This agrees with my own observations, as I found eggs in these stocks early in January.

on its corners about half an inch. In all my hives where I have adopted this arrangement, not a particle of dampness is found to settle over the bees. The value of the intercommunicating passages through the combs, has this Winter been most fully tested; and its importance can hardly be over-estimated. For the last few days a thaw has set in, which has not injured the hives having upward ventilation, although it has filled with dampness the few which were purposely left without it.

To-day, (Jan. 31st,) I have removed the upper cover and spare honey-board, from the thin hive mentioned above, exposing the bees to the full heat of the sun, the thermometer being 30° in the shade, and the atmosphere calm. The hive standing on the sunny side of the house, the bees were quickly in motion, and taking wing discharged their fæces. Very few were lost on the snow, and nearly all that alit upon it, (p.327,) took wing without being chilled. More bees were lost from other hives which were not opened, as few which left such hives were able to return; while in the one with the cover removed, the returning bees were able to alight at once among their warm companions. (p. 334.)

The Rev. J. C. Bodwell, of Framingham, Mass., put, at the commencement of the winter, a number of good stocks, in mov. comb hives, into a *very* dry cellar, leaving the spare honey-boards entirely off. In examining* one of these on the 17th of January, he found that the combs were perfectly dry and contained an abundance of eggs, worms and sealed brood. This is a highly important observation, proving as it does that bees in a suitable winter depositary, begin to breed at the usual period, even although their hives are in midnight darkness. In due time, the results of Mr. Bodwell's experiments, as compared with those obtained by others, from wintering colonies in the open air, will be communicated to the public.

* The careful reader will notice the very great facilities for experimenting, furnished by the mov. comb hive. It need hardly be added that all these winter examinations are injurious to bees.

On Propagating the Italian Bee.

The Baron of Berlepsch thinks that when a Queen is reduced to a torpid condition by cold, the contents of her spermatheca are injured, so that she is never after capable of laying worker eggs. It occurred to me that if his experiments on this point could be verified, it would be an easy matter, at any time, by refrigerating a queen, to change her into a drone-layer and thus have a supply of Italian drones for impregnating newly raised queens. Thus far, however, my experiments do not at all support the Baron's observations. Dr. Leidy has examined several refrigerated queens and found the contents of their spermatheca to be uninjured. One queen was reduced to a torpid condition and then restored, and after this process was repeated several times, she was returned to her colony. An examination of the sealed brood in this hive a few weeks later, showed that it was all regular working brood! I would propose a method by which drone laying queens can be easily obtained, at any time when they are wanted. Let a person receiving an Italian queen so late in the season that she does not incline to lay drone eggs, proceed as follows: Raise from her worker-eggs, a few queens, and confine them to their hives, by adjusting the entrances, for about twenty-four days. Their impregnation being thus delayed, (p. 39,) they will ever after produce only drones. As soon as these queens begin to lay, the proper steps may be taken to raise from the original Italian queen, others to be impregnated by these drones. A person receiving an Italian queen in July might thus succeed in replenishing his Apiary in September, with her progeny impregnated by Italian drones. In consulting the old Greek and Latin writers who have noticed the Italian bee, I find no mention made of its superior gentleness, except by Columella, who speaks of it as being "mitior moribus," that is, more peaceable in its behavior, than the common kind.

Feb. 14th. To-day, the thermometer being 45° in the shade, and the atmosphere calm and clear, the bees have filled the air with their happy hum, and although the ground has been covered with snow, very few have failed to return to their hives. A careful examination of my stocks shows

that they have wintered unusually well, notwithstanding the intense cold. The bees are very numerous and in perfect health. When upward ventilation is given them, I find no difficulty, even in the coldest weather, in getting them to eat sugar candy put on top of their frames. Mr. Wagner informs me that some of the Germans complain that hives thus ventilated, are so dry in Winter that the bees have not moisture enough for their brood. I have experienced no such difficulty in my hives this Winter, but if it should occur, it might easily be obviated by occasionally pouring a little luke-warm water among the bees. This would usually be advisable when the weather in February and March is such as to prevent the bees from flying out. I can speak very favorably of the plan of elevating the frames, (p. 327,) as I find that the bees have wintered best in such hives. Although I do not recommend disturbing bees in Winter, still I can, on any emergency, not only feed them, but thoroughly examine all their combs and transfer them to another hive, and this with the loss of only a few bees.

On Sweedish White Clover.

A correspondent of the "*Frauendorfer Blatter*," Nov. 16th, 1856, inquires:

"Does the new Sweedish Clover (*Trifolium hybridum*) deserve the high encomiums it receives, and in what does its superiority consist?"

To this, the editor, E. Furst, himself good authority, replies:

"The hybrid clover is really to be recommended; and though it is as yet but little cultivated, will doubtless in a few years, be very generally introduced. In both quality and quantity of product it is pre-eminently distinguished, and is especially valuable for the continued succulency of the stalk, even where the plant is in full bloom. It requires a less fertile soil than the red clover, and is less liable to be thrown out by frost in Winter. It also yields a heavier second crop than the common white clover. We add a report on its culture, received from a farmer in Smalcald, who says: "I sowed it with barley in a light soil with a dry subsoil. The

previous crop was tobacco, well manured. In the Fall, the hybrid clover had completely covered the ground. In 1854, it grew luxuriantly, attained a height of three feet, and threw out numerous side shoots where the heads or blossom buds were formed. It was much more succulent and produced a heavier first crop than the red clover growing by its side. It matured twelve days later. The second crop of the hybrid clover was however much lighter than that of the red. I had some of each cut and placed before my cattle, which left the red clover untouched, till they had eaten up the hybrid." (S. Wagner.)

On making artificial swarms adhere, like natural swarms, to their new location.

Dr. Donhoff says: "On an evening when the next day promises to be clear and warm, drive out a swarm, place the parent hive in a dark cellar, put the swarm in a shallow box, and set it in the place of the parent stock. Next day, when the temperature has become warm, pour a quantity of honey among the bees in the box, and in a few hours they will swarm, and may then be set in a new place and the parent hive restored to its former position." If the box was turned over, the bees would be more sure to leave it. By dividing one such swarm, or a natural swarm, or any swarm brought from a distance, into five or six parts, (pp. 223, 291,) as many artificial swarms may be easily made, if the Apiarian has suitable stocks from which to make them; these may be placed on the stands of the parent hives, which may be safely removed to a new position, by giving to them their proper share of the divided swarm.

EXPLANATION OF PLATES.

Description of Wood-Cuts of the various styles of movable comb hives, with bills of stock for making them.

These engravings, (with the exception of those which are in perspective,) are all on the scale of $1\frac{1}{2}$ inches to the foot, so that every $\frac{1}{8}$ of an inch, is an inch in a hive of the full size. All the measurements are inches or fractions of an inch. The thickness of stock used, is mostly $\frac{7}{8}$ths of an inch, but the measurements here given can be easily varied, to suit any thickness that may be most convenient. In making a lot of hives, there will be scarcely any waste, as pieces which otherwise would be refuse, are used for the frames. Good stock will prove much the cheapest in the end.

Those not accustomed to longitudinal and cross sections, will be greatly assisted by the perspective views. In the longitudinal sections, the hive is represented as sawed in two, from front to rear, and in the cross sections, from side to side. All the parts supposed to be cut by the saw, are marked by cross lines: the parts which though not cut can be seen after the cutting, are also represented in the engravings. Any measurement may be proved by applying an accurate rule to the sections.

The reader will bear in mind that those only who have purchased the patent right, (Ministers of the Gospel excepted,) can legally use these hives. For terms, see p. 12.

PLATE I. Figs. 1, 2 and 3, Hive No. 1.

Fig. 1 is a perspective view of a hive of the simplest form, the cover being removed to show one of the frames; Fig. 2 is a vertical longitudinal section, and Fig. 3, a vertical cross section of the same.

b Front of hive, 14⅛ by 8⅞ by ⅞; *b* rear, 14⅛ by 9⅜ by ⅞. *c c* Sides of hive, 19⅞ by 10 by ⅞. *d d* Strips on front and rear of hive, 15⅞ by 1½ by ⅞. *f* Movable cover to hive, 25½ by 18⅛ by ⅞. *g g* Clamps on cover, 25½ by ⅞ by ⅞. If a movable bottom-board is used, it may be made like the cover, and the rear and sides of the hive beveled, to avoid crushing bees, as shown in Figs. 1 and 2. Holes in the top cover may be made as in Fig. 21, and another hive of the same form set on it, to receive the spare honey in movable frames. In all the hives it is best to have the spare honey stored in frames; but boxes or any kind of receptacles may be set over the holes. For very hot climates the back of this hive may be made like the front, and by keeping both open in Summer, or the back covered with wire-gauze, the bees will have an abundance of air.

Hive No. 1 with changes and additions. Figs 1, 2 and 3.

b Front end of hive, 14⅛ by 8⅞ by ⅞. *b* Rear, 14⅛ by 10¼ by ⅞. *c c* Sides, 23⅞ by 10⅞ by ⅞. *d d* Strips on front and rear of hive, 15⅞ by 1½ by ⅞. Permanent bottom put in as in Hive No 2, 23 by 14⅛ by ⅞. *f* Movable Cover, 25½ by 18⅛ by ⅞. *g g* Clamps on cover, 25½ by ⅞ by ⅞. In this hive the alighting-board is sheltered, and the bottom board permanent; the spare honey may be taken as in the former hive.

Movable Comb-Frames, see Figs. 1, 2, 16, and 18.

t Top piece, 19⅛ by ⅞ by $\frac{5}{16}$. *t* Bottom piece, 17⅜ by ⅞ by ¼. *u* Triangular top comb-guide, coped at each end upon the triangular sides, 17⅜ by ⅞ by ⅞ by ⅞. *u u* Triangular sides cut off square at each end, 8⅝ by ⅞ by ⅞ by ⅞. *v* Winter passage* cut square on the bottom, and coped upon

* I have not yet experimented with this Winter passage sufficiently to enable me to feel certain that it will answer the ends proposed. In my own Apiary, I prefer to cut with a small knife, a hole in the combs after the bees have ceased gathering in the Fall. This winter passage may be put in the middle of the frame, (Fig. 2,) or further back, (Fig. 16.) The first position is probably the best.

the top triangular comb-guide, so as to set corner-wise in the frame, $8\frac{5}{8}$ by $\frac{5}{8}$ by $\frac{5}{8}$. A mortice, 4 by $\frac{1}{4}$ may be cut through two opposite corners of this piece, to allow the bees to pass from comb to comb in the Winter. This mortice may be cut out with a circular saw by holding (*v*), while pushing it down over the saw, in a groove formed in a piece of board such as is shown cut in (*a*), figs. 4 and 5. All the parts of the movable frames should be cut out by a circular saw, and the measurements should be exact, so that the frames when nailed together may be perfectly square. If they are not both *strong* and *square*, the proper working of the hive will be greatly interfered with. Frames for holding spare honey in the upper apartment, need no Winter passage. Ten frames equally distant from each other, are placed in the lower hive, and nine in the upper, for spare honey.

PLATE II. FIGS. 4 and 5 show the Gage-board for sawing the copings of the movable comb-frames.

Fig. 4 is a view, and Fig. 5, a cross section.

a Foundation board, 20 by 10 by $\frac{7}{8}$, with two grooves cut lengthwise in it, each making one half of a square that measures $\frac{5}{8}$ths. *b b* Guide strips for holding to be coped, the top triangular comb-guide (*u*) of the movable frames, 2 by $\frac{3}{4}$ by $17\frac{1}{2}$, beveled under on the inner edge, $\frac{7}{16}$. *c c* Gage stops for top triangular piece (*u*) of frame, so placed that said piece when the copings are sawed out, will be $17\frac{3}{8}$ths in length. *d d* Gage stops so fixed in the grooves cut in (*a*), that the winter passages (*v*) when coped shall be $8\frac{5}{8}$ths in length. *e* Guide block, in which block and the piece (*a*), the saw is guided in kerfs cut on an angle of 60° with the end. By the arrangement above described, the movable frames may be coped rapidly and accurately by hand. Coping the frames makes them very much stronger than mitering them ; it may be done with the circular saw.

PLATE II. FIGS. 6, 7 and 8, show the Gage-Block for fastening the movable frames together.

Fig. 6, is a view of the front of this block, Fig. 8 a view

of the back, and Fig. 7 is a cross section of the front and back.

a Foundation board, $21\frac{7}{8}$ by $9\frac{1}{8}$ by $\frac{7}{8}$. *b b* Guides for sides (*u u*), of frames fastened to (*a*) equally distant from its ends, and so as to leave $17\frac{3}{8}$ths between (*b b*) and $\frac{1}{4}$ of an inch from upper edge of (*a*) to ends of (*b b*). *c c* Buttons for holding sides of frames (*u u*), against (*b b*), $6\frac{1}{2}$ by $1\frac{1}{2}$ by $\frac{7}{8}$. Cut in one end of each button, a triangular groove corresponding to the shape of the sides of the frames. *d d* Guides for placing the Winter passage (*v*), 4 pieces, $\frac{7}{16}$ by $1\frac{1}{2}$ by $1\frac{1}{2}$. One end of each piece is cut to a miter, so that when fastened on (*a*), as shown in Fig 6, two sides of a $\frac{5}{8}$th square are formed. The upper edge of the upper guides is $1\frac{1}{8}$th from top edge of (*a*), and the lower edge of the lower guides is $\frac{5}{8}$ths from the bottom of (*a*). *f f* Guides in which the top triangular comb-guide is placed, in order to have the top strip (*t*) nailed thereto; each piece (*f*) is $21\frac{7}{8}$ by 2 by $\frac{3}{4}$, and they are beveled from one edge back, $\frac{7}{16}$, and are then fastened to (*a*), forming a triangular groove each side of which is $\frac{7}{8}$ths. Two triangular pieces $\frac{7}{8}$ by $\frac{7}{8}$ by $\frac{7}{8}$ by 3 are cut on a miter at one end and fastened, (Fig. 6,) at each end of the groove. *g* Guide-strip, $\frac{7}{8}$ by $\frac{5}{16}$ by $19\frac{1}{8}$. *h* Guide-strip $\frac{7}{8}$ by $\frac{5}{16}$ by $3\frac{3}{8}$, fixed on and across the pieces (*f f*) $\frac{1}{2}$ an inch from their ends. To nail the frames together, put the triangular comb-guide (*u*) in the groove formed by the pieces (*f f*); place the piece (*t*) on the top of (*u*) and against the guides (*g*) and (*h*), and nail it to (*u*) with two brads each about two inches from the end. Procced in this way until all the triangular guides are nailed to the top strips. Now turn over the gage-block and secure the vertical pieces (*u u*), against the guides (*b b*), by the buttons (*c c*), and nail the bottom (*t*) to (*u u*) with two brads at each end. Turn the gage-block, place the winter passage (*v*) in the guides (*d d*), glue the copings and place the top of the frame (*t*) which has before been nailed to the guide (*u*), in its proper position, and nail it to (*u u*) with two brads in each end, and to the Winter passage (*v*) with one brad. When the gage-block is turned for the next frame, put a brad through the bottom (*t*) into the Winter passage (*v*), before turning the buttons and removing the frame.

PLATE III. FIG. 10 shows the arrangement of the circular saw to cut the triangular comb-guides.

The first piece cut is waste; as fast as a guide is sawed, the piece from which it is cut, must be turned over, end for end.

PLATES III, V and VI. FIGS. 11, 12, 17 and 19 show the construction and position of the Entrance-Regulators.

Fig. 11, is a right angled triangle $\frac{7}{8}$ths thick by 4 by $5\frac{3}{4}$ by 7. Fig. 12, is a right angled triangle $\frac{1}{2}$ inch thick, by 7 by 4 by $5\frac{3}{4}$. In the bottom of the first piece, grooves are cut $\frac{1}{8}$ deep by $\frac{1}{8}$ an inch wide, as traps for the larvæ of the bee-moth, (p. 269.) On the face of the second piece, strips $\frac{5}{32}$ of an inch thick are placed, two of which are $\frac{1}{2}$ an inch wide and are placed as shown in Fig. 12, parallel with the 4 inch side, and so as to leave a space of $1\frac{1}{2}$ inches between them and the second and third piece, which last piece is a right-angled triangle. In the spaces between the strips just mentioned, cut Fig. 12 to a bevel of 45°. Now fasten *very securely* the two blocks, so that there will be no chance for any alteration of the $\frac{5}{32}$ inch passage, by warping or swelling. To test the accuracy of the $\frac{5}{32}$ inch strips, put four of them together and if they measure just $\frac{5}{8}$ths, they will answer for confining the queen, (p. 201.) If there is no desire to prevent swarming,* then Fig. 11 will answer, without the addition of Fig. 12. Two of these doubled blocks, made right and left are used for a hive. When Figs. 11 and 12 are fastened together, the corner made by the meeting of the 7 inch and $5\frac{3}{4}$ inch sides, should be very slightly clipped, so that the 7 inch side will measure a scant $\frac{1}{8}$ of an inch less than 7 inches. To confine the queen, turn over the blocks and place them with the 7 inch sides against the front of the hive, keeping them pushed up close to each other. To confine the drones (p. 455,) or to shut them out, (p. 202,) leaving the queen room to pass, put the blocks in the same position, only pushing them about $\frac{3}{16}$ of an inch apart. By varying the position of these blocks on the alighting-board, (see Fig. 17,

*The Author has not experimented sufficiently on this plan of preventing swarming, to be able fully to endorse it; (see p. 203.)

in which some of the positions are shown,) the size of the entrance to the hive, may be varied in a great many ways, and the bees always directed, by the shape of the blocks, to the entrance, without any loss of time in searching for it.

Movable Partition; (No Figure.)

One piece, 18⅛ by 9⅜ by ⅞, each end made ¼ inch beveling for easy adjustment; the bevels should be parallel to each other. One piece, ⅝ by ⅞ by 19¾, nailed on the first piece, like the top piece (*l*) of the movable comb frames. By this partition the size of any hive may be diminished at will.

PLATES III and IV. Figs. 9 and 13, Hive No. 2.

Fig. 9 is a vertical longitudinal section, and Fig. 13, a vertical cross section.

This hive is doubled on the front and rear, has a permanent bottom-board, a sheltered alighting board, and a top-cover over the spare honey-box. Glass may be put in the back, as in hive No. 4, or in the sides.

a Bottom-board, tongued and grooved, 24¾ by 14⅛ by ⅞. *b* Front and rear of body, four pieces, each 14⅛ long and ⅞ thick, by 10⅞, 9⅜, 9½ and 8⅞ wide. *c* Sides of body, two pieces, 25⅝ by 10⅞ by ⅞, one corner, 4 by 1⅞ cut out of each. *d* Ledges on body, two pieces, ⅞ by 2 by 22¾, and one piece, ⅞ by 1⅛ by 15⅞. *e* Roof of alighting board, 4½ by ⅞ by 19⅞, beveled on upper side from ½ an inch in thickness, back 3 inches; (see Figs. 9 and 20. *f* Board for supporting surplus honey-receptacles, 21⅝ by 17⅞ by ⅞. *g* Clamps for spare honey-board, two pieces, ⅞ by ⅞ by 21⅝. *h* Front and rear of spare honey-box, one piece 9⅜ by 14⅛ by ⅞; two pieces 1⅞ by 14⅛ by ⅞. *i* Sides of spare honey-box, two pieces, 19⅞ by 10 by ⅞. *j* Ledge around top of honey box, two pieces 17⅝ by 1½ by ⅞, and two pieces 19⅞ by 1½ by ⅞. *k* Cover for honey-box, 21⅝ by 17⅝ by ⅞. *l* Clamps for honey-box cover, two pieces, ⅞ by ⅞ by 17⅝. *m* Observing-glass in honey-box, 5½ by 14. *n* Strips against which the glass is fastened, two pieces, 14⅛ by ⅝ by ¼, and two pieces, 5⅛ by ⅝ by ¼. *o* Top of cover, tongued and grooved, 26⅜ by

$22\frac{3}{8}$ by $\frac{7}{8}$. *p* Front and rear of upper part of cover, two pieces, $8\frac{3}{4}$ by $19\frac{7}{8}$ by $\frac{7}{8}$. *q* Sides of upper part of cover, two pieces $8\frac{3}{4}$ by $22\frac{1}{8}$ by $\frac{7}{8}$. *r* Front and rear of lower part of cover, two pieces, 5 by $19\frac{7}{8}$ by$\frac{7}{8}$. *s* Sides of lower part of cover, two pieces, 5 by $22\frac{1}{8}$ by $\frac{7}{8}$. *w* Buttons for holding the upper and lower parts of cover together, four, 2 by 1 by $\frac{7}{8}$; the upper inside part of these buttons is beveled, to allow the upper part of the cover to set down readily on the lower part.

PLATE IV. Figs. 14 and 15, Hive No. 3.

Fig. 14 is a side view, and Fig. 15, a vertical cross section.

This hive is intended solely for observation; (p. 437.)

a Base-board, $24\frac{5}{8}$ by $4\frac{1}{4}$ by $\frac{7}{8}$. A $\frac{5}{8}$ of an inch entrance-hole is bored $3\frac{1}{2}$ inches deep into the end of (*a*), and two holes are bored in its centre, $\frac{7}{8}$ of an inch in diameter and $1\frac{1}{8}$ inches from center to center, the wood being cut out between them. *b* Bottom of hive, $2\frac{1}{4}$ by $18\frac{5}{8}$ by $\frac{7}{8}$. Make a rabbet at both upper corners, $\frac{3}{8}$ of an inch on, by $\frac{7}{16}$ deep. Start a $\frac{5}{8}$ of an inch hole, one inch from the end, and bore slanting, to meet entrance-hole in (*a*) and make a hole in the center, to match center hole in (*a*), for a ventilator, and cover with wire-gauze, on the inside. *c* Front and rear of hive, $1\frac{1}{4}$ by $2\frac{1}{4}$ by $10\frac{7}{8}$. Rabbet the inner corners, up and down, $\frac{1}{4}$ by $\frac{3}{8}$. Make a ventilator in each piece, like the one in (*a*). $\frac{5}{8}$ of an inch from the upper ends, cut in $\frac{7}{8}$ of an inch, and $\frac{7}{8}$ of an inch from the lower end, cut in $\frac{1}{4}$ of an inch. *d* Side strips, $\frac{3}{8}$ by 1 by $20\frac{5}{8}$; on one corner of each, rabbet on, $\frac{1}{4}$ of an inch and in, $\frac{1}{8}$ of an inch for the glass. *e* Movable cover, $21\frac{5}{8}$ by $4\frac{1}{4}$ by $\frac{1}{2}$; holes may be made in this cover, as in Fig. 21, over which glass receptacles for honey may be placed. *f* Glass, two panes, $9\frac{1}{2}$ by $18\frac{1}{2}$. *g* Alighting-board, 4 by $4\frac{1}{4}$ by $\frac{1}{2}$. *h* Clamps on base-board, $4\frac{1}{4}$ by 2 by $\frac{1}{2}$. *i* and *j* Clamps on cover, and ledges on hive, four pieces, $4\frac{1}{4}$ by $\frac{7}{8}$ by $\frac{1}{2}$.

PLATES V and VI. Figs. 16 and 18, Hive No. 4.

Fig. 16 is a vertical longitudinal section, and Fig. 18, a vertical cross section.

This hive has glass on the back, and being doubled on the

inside, affords uncommon protection against the weather. I have given no bill of stock for its construction, as I recommend those who want a doubled hive, to make the glass hive No. 5, the cost of which will not be very much greater. This hive can be built by applying an accurate rule to the engravings.

PLATES VI TO X. FIGS. 19, TO 23, HIVE NO. 5.

Fig. 19 is a perspective view with the cover down. Fig. 20 is a perspective view with the cover elevated, so as to show the working of the bees, both in the main hive and the upper honey-box. Fig. 21 is a plan of the lower part of the hive, showing the surplus honey-board, in place, and the holes made in it, to allow the bees to pass up into the surplus honey-receptacles. On this board receptacles of glass or wood, of any size or shape, may be set, instead of the upper box. Fig. 22 is a vertical longitudinal section, and Fig. 23, a vertical cross section. This hive has glass on four sides, and is admirably adapted to purposes of general observation. A cornice under the projecting roof of the cover, would improve its appearance.

a Main bottom of hive, tongued and grooved, 31 by $20\frac{3}{8}$ by $\frac{7}{8}$. *b* Outer* bottom of hive, $27\frac{7}{8}$ by $18\frac{1}{8}$ by $\frac{3}{8}$. *c* Rabbeted strips for outer bottom, two pieces, $29\frac{7}{8}$ by $1\frac{1}{2}$ by $\frac{7}{8}$, and two pieces, $17\frac{1}{8}$ by $1\frac{1}{2}$ by $\frac{7}{8}$. *d* Front and rear of lower outer case of hive, one rabbet in upper outer corner of each, $\frac{7}{16}$ by $\frac{7}{16}$; front, $11\frac{1}{4}$ by $20\frac{3}{8}$ by $\frac{7}{8}$; cut out of the centre of the lower edge, $14\frac{1}{8}$ by $\frac{1}{2}$; rear, $4\frac{1}{4}$ by $20\frac{3}{8}$ by $\frac{7}{8}$. *e* Sides of lower outer part, with rabbets the same as front and rear, (for form of this see Fig. 20,) two pieces, $31\frac{7}{8}$ inches long, by $\frac{7}{8}$ of an inch thick, $4\frac{1}{4}$ inches wide at one end, and $12\frac{1}{8}$ inches wide at $4\frac{7}{8}$ inches from the other end, where a notch is cut out, $1\frac{5}{16}$ inches deep, by 4 inches long. *f* Roof of alighting-board, $23\frac{1}{8}$ by $4\frac{1}{2}$ by $\frac{7}{8}$; $\frac{7}{8}$ of an inch thick in rear, and $\frac{1}{2}$ of an inch thick in front. *g* Board under which bees pass into the hive, $14\frac{1}{8}$ by 4 by $\frac{1}{2}$. *h* Front posts of lower hive, two pieces, $9\frac{1}{8}$ inches long by 4 by $\frac{7}{8}$. *i* Rear posts of

* This outer bottom may be dispensed with.

lower hive, two pieces, with tenon, $\frac{7}{8}$ by $\frac{7}{8}$ by $\frac{7}{8}$, on one end, 10 inches long, by $1\frac{3}{4}$ by $\frac{7}{8}$. *j* Front and rear strips of lower hive, in which the frames hang, two pieces, $15\frac{7}{8}$ by $1\frac{3}{4}$ by $\frac{7}{8}$, with rabbet, $\frac{7}{8}$ by $\frac{5}{8}$, and notch, $\frac{5}{8}$ by $\frac{7}{8}$, cut at each end from upper side. *k* Side strips from post to post, in lower hive, $21\frac{5}{8}$ by $\frac{5}{8}$ by $\frac{5}{8}$, with notch, $\frac{1}{4}$ deep by $1\frac{3}{4}$, cut in under side of each end. *l* Spare honey-board $17\frac{7}{8}$ by $21\frac{5}{8}$ by $\frac{7}{8}$, nine holes bored $1\frac{3}{8}$ inches in diameter, by $\frac{1}{8}$ of an inch deep, and then bored through with a $1\frac{1}{4}$ inch bit. These holes when not in use are covered with pieces of tin, cut out with a punch. They may be bored plain and covered with pieces of glass or wood. *m* Front and rear of lower part of cover, $6\frac{3}{4}$ by $20\frac{3}{8}$ by $\frac{7}{8}$, rabbets (Fig. 22,) $\frac{7}{16}$ by $\frac{7}{16}$, on both upper and lower edges. *n* Sides of lower part of cover, two pieces, $27\frac{7}{8}$ inches from front to rear, by $6\frac{3}{4}$ by $\frac{7}{8}$, with rabbets $\frac{7}{16}$ by $\frac{7}{16}$; for shape of these pieces, see Fig. 20. *o* Front and rear of upper part of cover, one piece, $5\frac{5}{8}$ by $20\frac{3}{8}$ by $\frac{7}{8}$, and one piece, $13\frac{1}{2}$ by $20\frac{3}{8}$ by $\frac{7}{8}$. *p* Sides of upper part of cover, two pieces, each $5\frac{5}{8}$ and $13\frac{1}{2}$, by $27\frac{7}{8}$ by $\frac{7}{8}$, with rabbets, $\frac{7}{16}$ by $\frac{7}{16}$; for shape, see Fig. 20.

q Top of cover, tongued and grooved from front to rear, and rain-grooved on top, (Figs. 19 and 23,) $24\frac{5}{8}$ by $30\frac{3}{8}$ by $\frac{7}{8}$. *r* Honey-box cover, $21\frac{3}{8}$ by $19\frac{5}{8}$ by $\frac{7}{8}$. *s* Clamps for honey-box cover, two pieces, $21\frac{3}{8}$ by $\frac{7}{8}$ by $\frac{7}{8}$. 1. Division-board in honey-box, (shown only in Fig. 23,) $8\frac{7}{8}$ by $18\frac{1}{8}$ by $\frac{7}{8}$. Such a board may be used in the surplus honey-boxes of all the hives, and enables the bee-keeper to get his spare honey on small frames, (when these boxes are ledged on the sides, as well as the front and rear,) or on large ones, or on part small and part large. 2. Triangular cheeks to hold the cover when elevated, two pieces, $1\frac{3}{4}$ by $1\frac{3}{4}$ by $2\frac{1}{4}$ by $\frac{7}{8}$. 3. Four buttons, $1\frac{1}{2}$ by 2 by $\frac{7}{8}$. *w* Posts of honey-box, four pieces, $1\frac{3}{4}$ by $8\frac{1}{8}$ by $\frac{7}{8}$. *x* Front and rear bottom-strips of honey-box, two pieces, $1\frac{3}{4}$ by $15\frac{7}{8}$ by $\frac{5}{8}$. *y* Side-bottom strips of honey-box, two pieces $21\frac{5}{8}$ by $\frac{5}{8}$ by $\frac{7}{8}$. *x* and *y* are halved together at ends. *z* Front, rear, and side top pieces of honey-box, made up of two strips, $1\frac{3}{4}$ by $\frac{5}{8}$ by $17\frac{5}{8}$, two strips $1\frac{3}{4}$ by $\frac{5}{8}$ by $21\frac{5}{8}$, halved together at ends; and two strips, $17\frac{5}{8}$ by $\frac{7}{8}$ by $\frac{5}{8}$, two strips, $19\frac{7}{8}$ by $\frac{7}{8}$ by $\frac{5}{8}$. 4. Clamps for spare honey-board, two pieces, $21\frac{5}{8}$ by $\frac{7}{8}$ by $\frac{7}{8}$. Glass,

two pieces, 14 by 9, four pieces 18 by 9, and two pieces, 4 by 8, for the double glass of lower hive; two pieces 18 by 8, and two pieces 14 by 8, for the spare honey-box.

DESCRIPTION OF IMPLEMENTS USED IN THE APIARY.

PLATE XI, FIGS. 24 TO 30.

Fig. 24 is a box for storing surplus honey, (p. 379.)
Fig. 25 is a Bee-Hat, (p. 423)
Fig. 26 is a box for feeding bees, (p. 356.)
Fig. 27 is an India Rubber Glove, (p. 424.)
Fig. 28, shoemaker's pincers, a convenient tool for many operations in the Apiary.
Fig. 29 is a knife for cutting the combs from a box-hive.
Fig. 30 is a scraper for cleaning the bottom-board, (p. 327.)

DESCRIPTION OF WOOD-CUTS OF BEES AND COMBS ILLUSTRATING THE NATURAL HISTORY OF THE HONEY-BEE.

PLATE XII, FIGS. 31 TO 36.

Figs. 31, 32, Queen of magnified and natural size.
Figs. 33, 34, Drone of magnified and natural size.
Figs. 35, 36, Worker of magnified and natural size.
These illustrations may be found in "Bagster on Bees."

PLATE XIII. FIGS. 37 TO 46.

Fig. 37 shows the scales of wax, (highly magnified,) as they exude from the wax-pouches, (p. 77.)
Fig. 38 is the abdomen of a worker-bee, magnified, and showing the exuding scales of wax.
Fig. 39 is a section of a magnified cell, showing an egg in the position in which it is usually deposited by the queen.

Fig. 42 is a worker-larva fully grown and ready to envelop itself in a cocoon, (p. 49.)

Fig. 43. Worker-Nymph or Pupa, (p. 49.)

Fig. 44 shows the eggs of the bee-moth, of natural and magnified size.

Fig. 45 is a larva of the bee-moth, fully grown and ready to envelop itself in a cocoon, (p. 245.)

Fig. 46 is a web or gallery of the kind often spun by the larva of the bee-moth, in which its protects itself from the bees, (p. 248.)

These illustrations have been taken principally from the works of Swammerdam, Reaumer and Huber.

PLATE XIV. Fig. 47.

This Plate, (see p. 73) was copied with some important additions, from a wood-cut in Cotton's "My Bee-Book."

b A queen-cell from which the inmate has not yet emerged.

a A queen-cell, with the cap or lid as it often appears, just after the young queen has come out.

d A queen-cell whose inmate has met with a violent death, (p. 148.)

c The remains of a queen-cell which the bees have nearly demolished, (p. 149.)

n A cell in which the bees have just begun to rear, artificially, a young queen, (p. 73.)

e Cells containing honey, some full and sealed over, and others only partially sealed.

f Cells with eggs, larvæ and hatching bees.

g Drone-cells containing brood capped over by the bees.

p A hole in the comb showing its depth.

PLATE XV. Figs. 48, 49, and 50.

Fig. 48 is a piece of honey-comb with cells of the size of nature. Those on the right hand, are of drone, and those on the left, of worker size. The five-sided cells between them, show how bees pass from one size of cell to another.

This accurate and beautiful representation of comb, was drawn from nature, by M. M. Tidd, of Boston, Mass., and engraved by D. T. Smith of the same city.

Fig. 40 shows a number of worker-larvæ of different ages.

Fig. 41 is a section of a magnified cell, showing the position of the larva in the cell, (p. 48.)

Fig. 49 is a queen-cell, of the natural size.

Fig. 50 is a queen-cell cut open to show the position of the unhatched queen. At its base may be seen the royal jelly; (p. 70.)

PLATE XVI. Figs. 51 and 52.

Fig. 51 shows the Proboscis of a worker-bee, highly magnified; (Swammerdam.) The central tube(*a*) is used for sucking up the honey, and the other parts for pushing aside the petals of flowers, and for various other purposes.

Fig. 52 shows the abdomen of a worker, magnified.

PLATE XVII, Figs. 53 and 54.

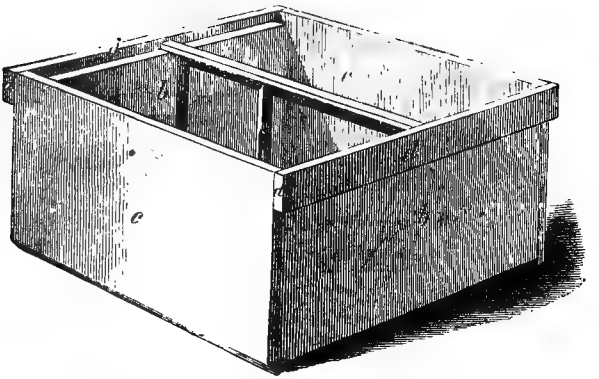
Fig. 53 Shows the magnified sting of a worker; (Swammerdam.) (*a*) is the poison bag. The muscles on each side of the sting serve to drive it into the wound, and all the parts represented, are torn from the body of the bee, when she loses her sting, (p. 62.)

Fig. 54, (Reaumur,) shows the honey-bag(*a*), stomach(*b*), intestines(*c*), and rectum(*o*), of a worker. The honey-bag is not entirely filled.

PLATE XVIII. Fig. 55, Ovaries of the Queen.

(*h*) and (*g*) are the two ovaries (p. 38) uniting in a common oviduct (*e*). *d* is the spermatheca; an egg is represented as passing through the oviduct, by the mouth of this seminal reservoir, to be impregnated. *r* is the rectum, and (*a*) the poison-sack. The sting is more curved than that of the worker.

Fig. 1.



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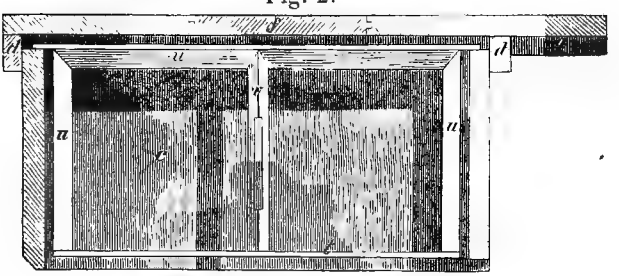

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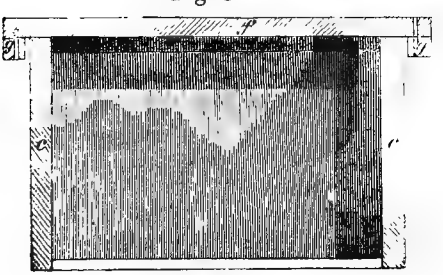

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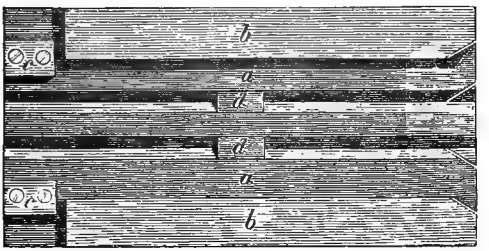

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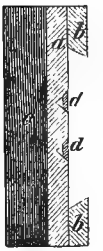

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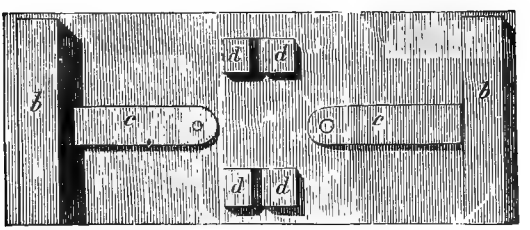

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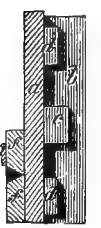

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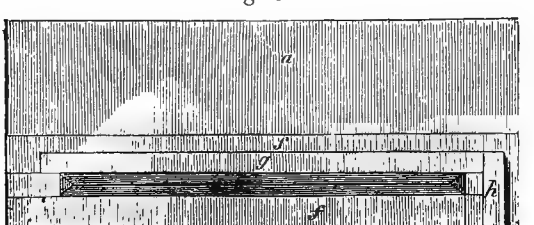

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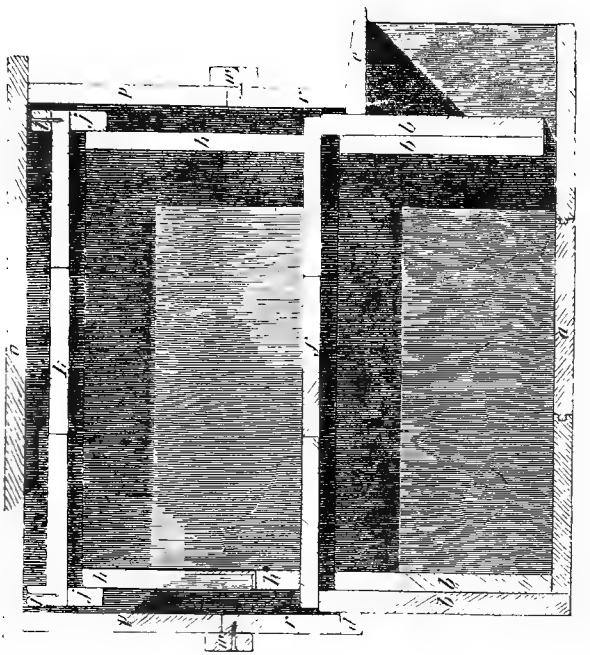

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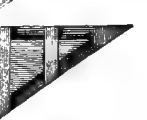

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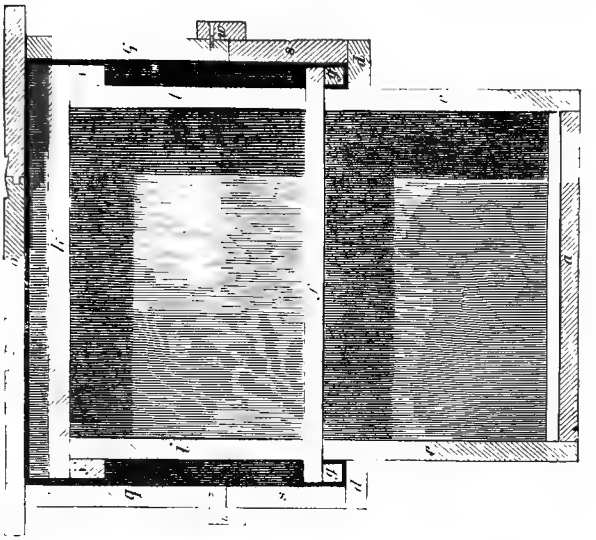

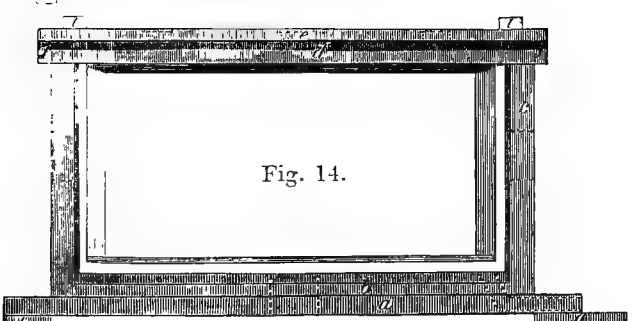

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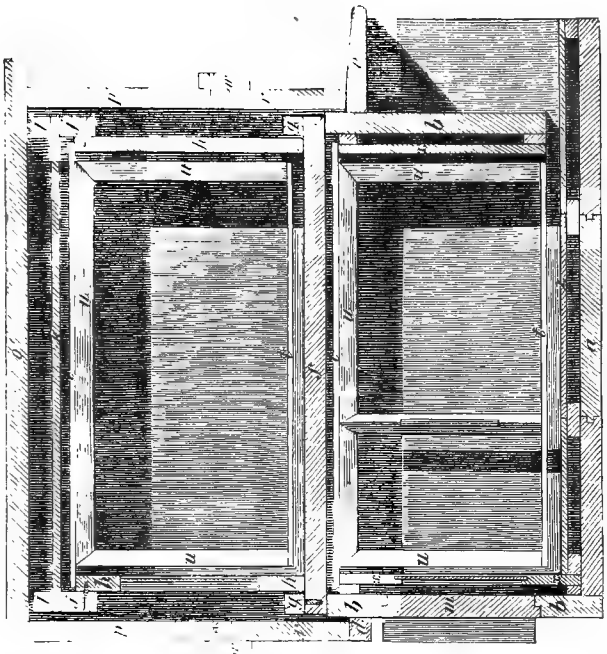

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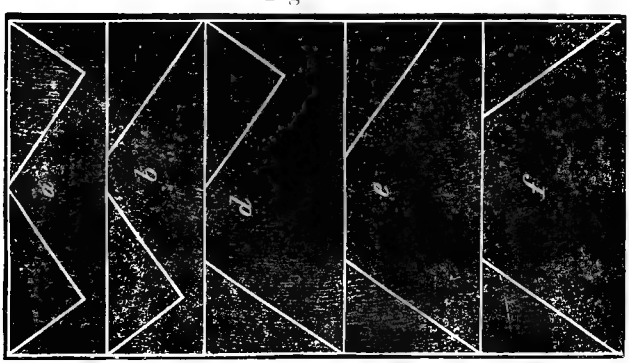

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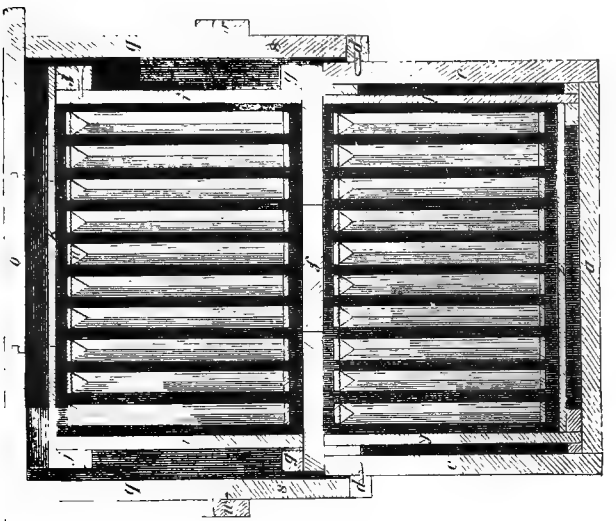

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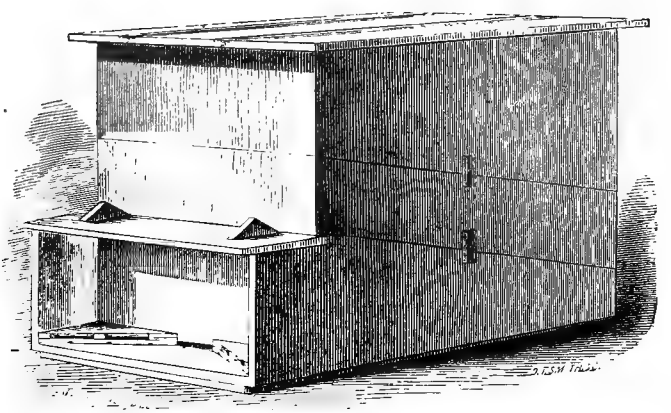

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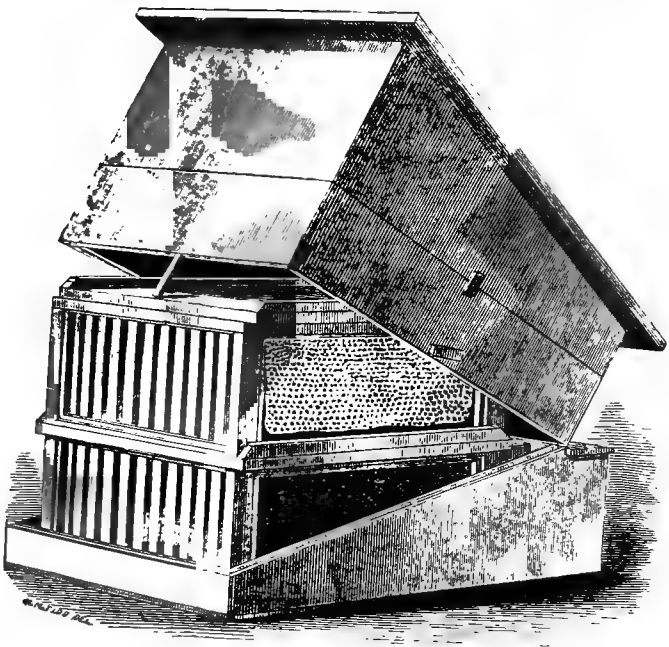

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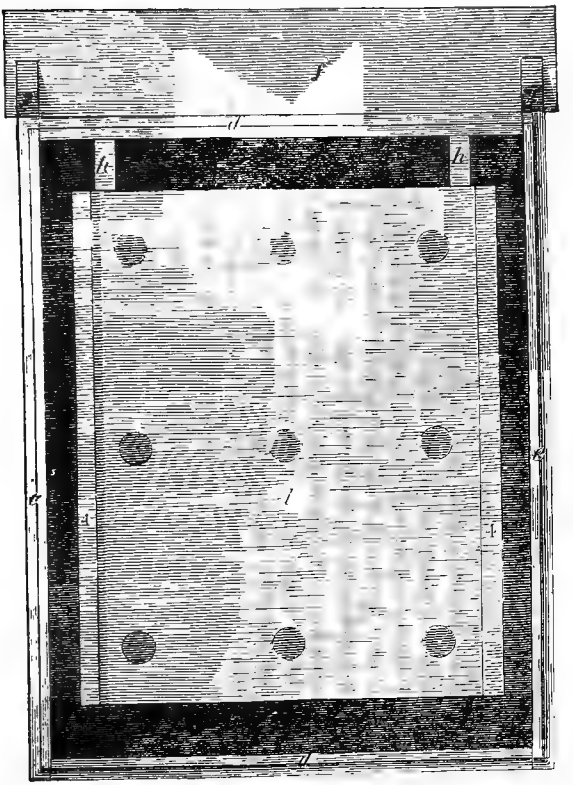

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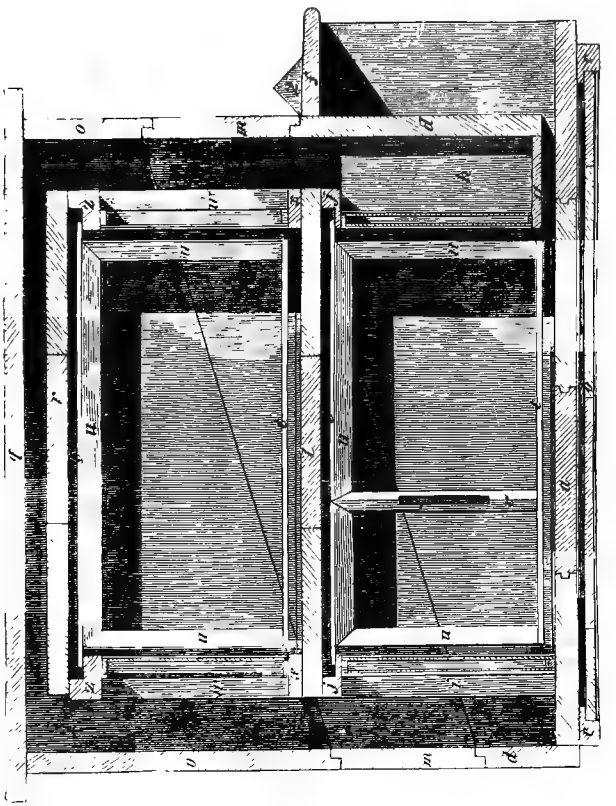
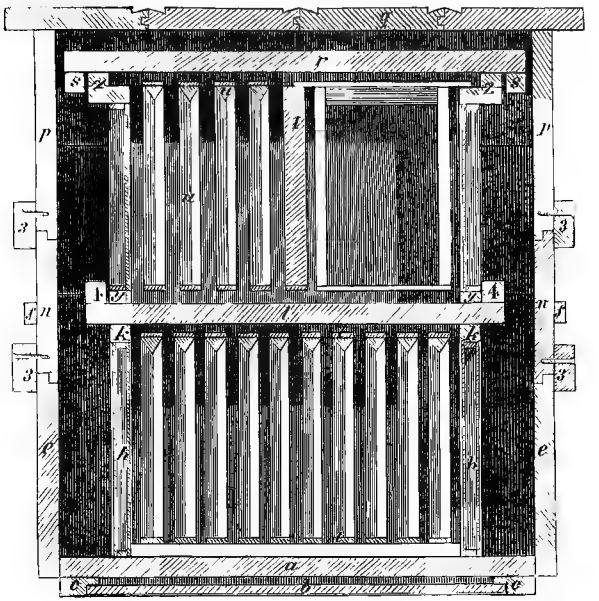


Fig. 23. PLATE X.



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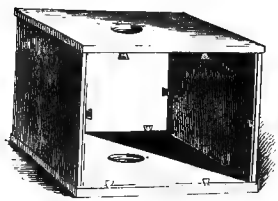

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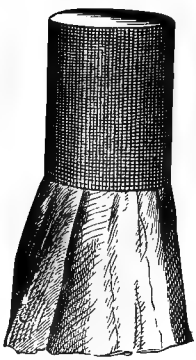

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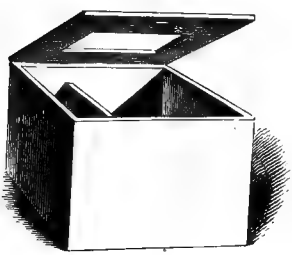

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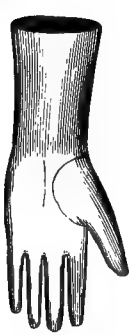

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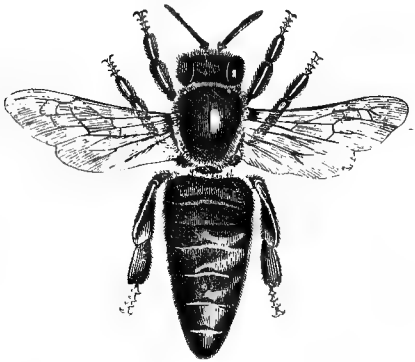

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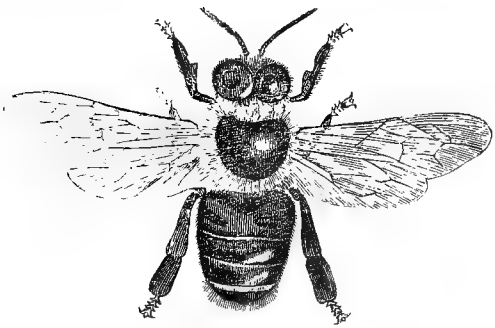

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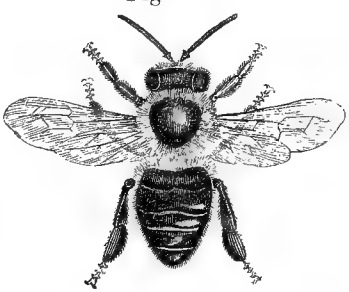

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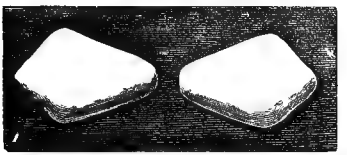

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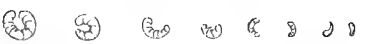

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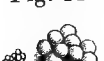

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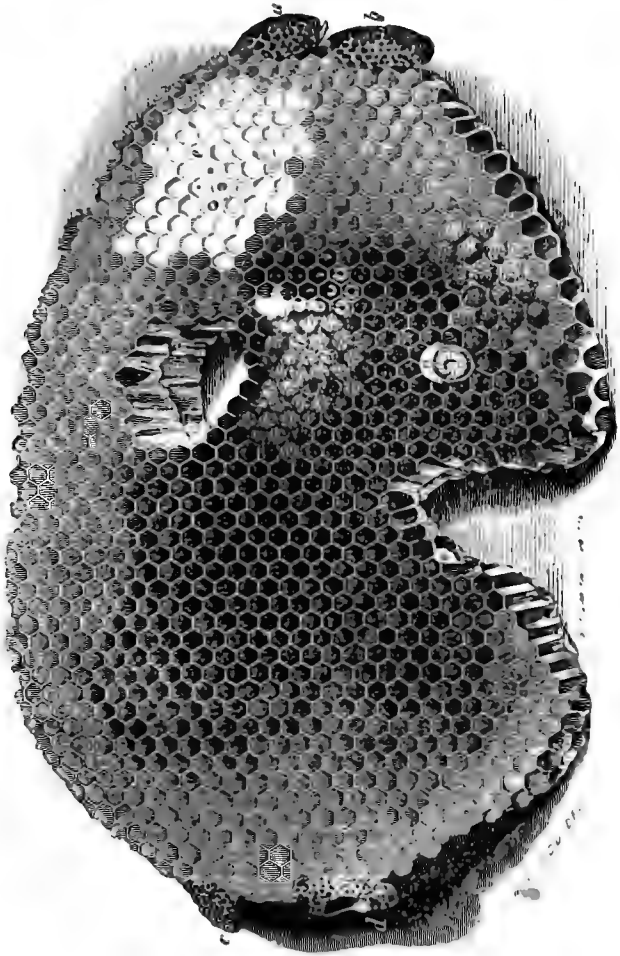
Fig. 47. PLATE XIV.



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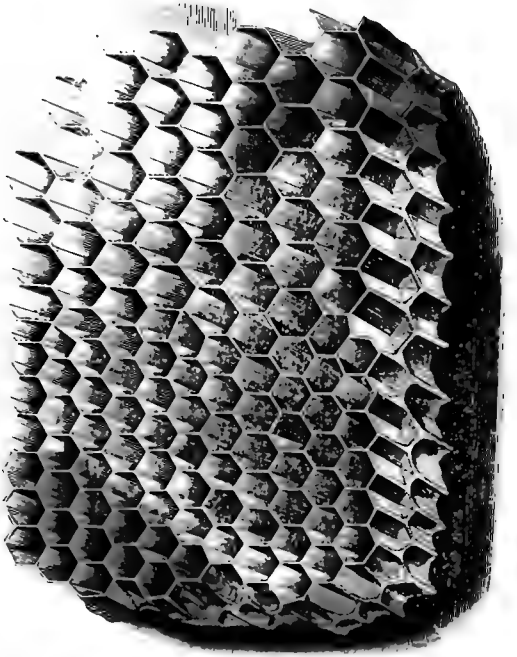

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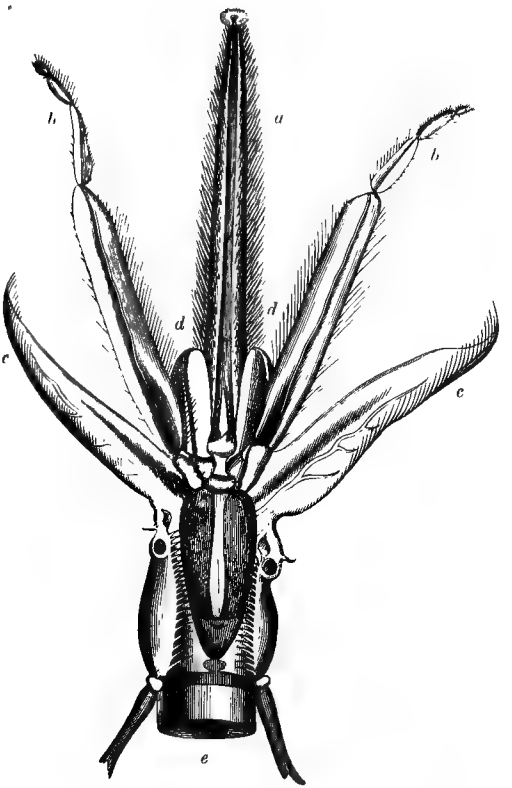
Fig. 51. PLATE XVI.



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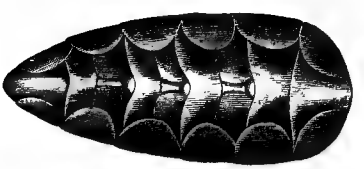

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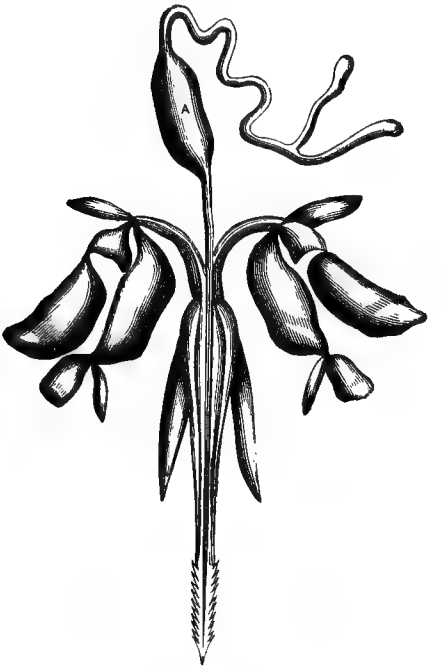

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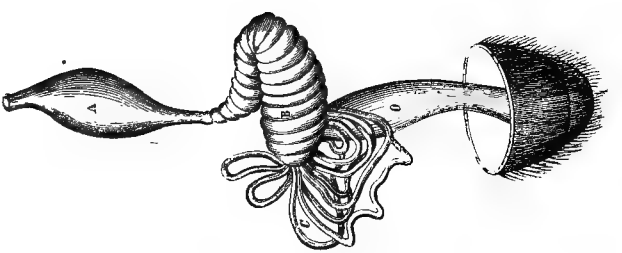

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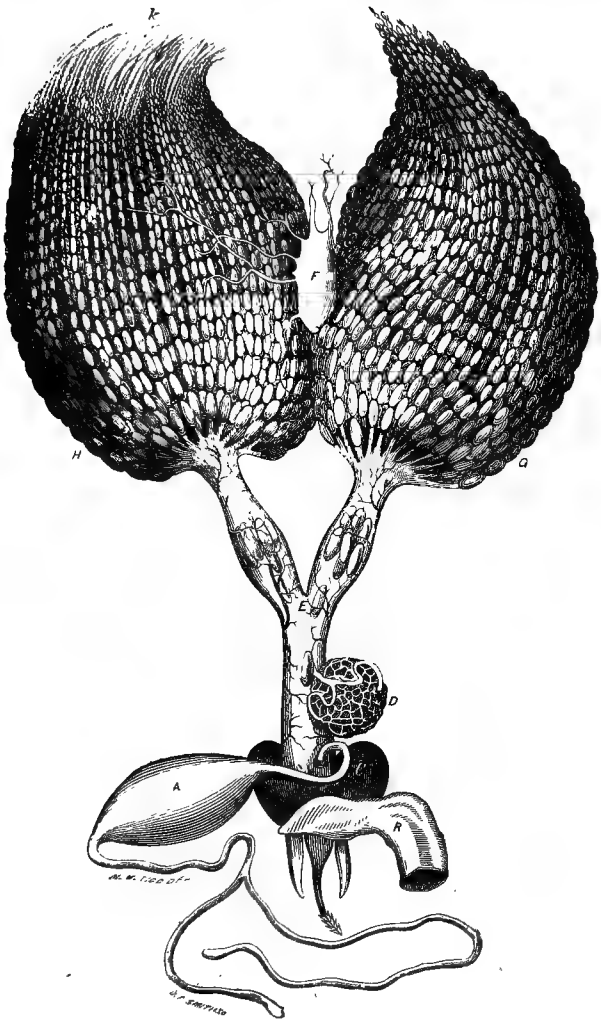

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