D. C. Allen

A

PRACTICAL TREATISE

ON THE

MANAGEMENT OF BEES;

AND THE ESTABLISHMENT OF APIARIES, WITH THE BEST METHOD
OF DESTROYING AND PREVENTING THE DEPREDATIONS OF

THE BEE MOTH.

"While heaven born instinct bounds their measur'd view,
From age to age, from Zembla to Peru,
Their snow white cells the order'd artists frame,
In size, in form, in symmetry, the same."—*Evans.*

BY JAMES THACHER, M. D.

Fellow of the American Academy of Arts and Sciences, &c: &c,

BOSTON:

MARSH & CAPEN, 362 WASHINGTON-STREET.

PRESS OF DOW AND NILES,
1829.

DISTRICT OF MASSACHUSETTS,

to wit:

District Clerk's Office,

BE IT REMEMBERED, that on the Thirtieth day of December A. D. 1828, in the Fifty Third Year of the Independence of the United States of America, Marsh & Capen of the said District, have deposited in this Office the Title of a Book, the Right whereof they claim as Proprietors in the Words following, *to wit* :

“A Practical Treatise on the Management of Bees; and the establishment of Apiaries, with the best method of Destroying or Preventing the Depredations of the Bee Moth.”

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ADVERTISEMENT.

THE primary object of this little compilation, is the dissemination, for the benefit of our agriculturists and husbandmen, of a more systematic method of conduct pertaining to Apiaries, than has heretofore been practised. When our industrious citizens are apprised of the most approved method of cultivating bees, and the rational amusement and actual profit to be derived from well established Apiaries, we may confidently expect, that this branch will no longer loiter in the rear of other improvements in rural economy. Every possible effort has been used, to render this work in all respects, competent to the purpose in view, that of imparting, in the clearest manner, every

point of knowledge requisite for the successful management of an Apiary. The compiler indulges the hope, that his labors will be crowned with the sanction of experienced and respectable authorities, and the approbation of the public.

The destructive ravages of the Bee-moth, have in many places, almost annihilated our bee establishments, and discouraged all attempts to renewed trials. Not less than one hundred hives have, the past season, been entirely destroyed by that enemy, within a few towns in the county of Plymouth, and in places where a single hive has yielded one hundred pounds of honey. From a particular investigation of this subject, the compiler is now able, with much confidence, to announce, that an effectual preventive of such depredations will be found recorded in this production.

Plymouth, November 1828.

INTRODUCTORY.

Apis Mellifica, or Honey Bee.

SOME acquaintance with the natural history and economy of the domestic honey bee, is indispensably necessary to those who are desirous of pursuing a systematic method of treatment of these valuable insects. The study is delightful to the mind that contemplates the mysterious operations of nature, and traces its wonderful phenomena up to nature's God. This subject has, from remote antiquity, arrested the attention of Philosophers, divines, moralists, and the inquisitive mind of all denominations of men. The industrious bee has ever been viewed by intelligent naturalists as an interesting species of insects, and the fruits of its industry as among the choicest productions of nature. There is no branch of husbandry, the cultivation of which furnishes for our table a more innocent and grateful luxury, than that of the bee, nor any part of natural history better calculated to raise our contemplation to that divine wisdom which creates and sustains the infinite variety in the animal world.

In treating of bees, it is proper to describe each species in its individual capacity, and their combination into com-

munities with their form of government and instinctive powers. If we are struck with the wonderful powers of instinct in bees, it may be observed that humble bees, ants, wasps, and all insects which live in congregated society, and some quadrupeds also, are known to display instinctive faculties no less extraordinary. This seems to belong to that order of nature which has been wisely ordained by the great author of all things. The same power who called the human race into being, has with infinite wisdom, endowed the insect tribe with all that sagacity, and with those qualities which are best adapted for their peculiar circumstances in the sphere of existence. The bee is no less admirable in the structure and form of its body, than wonderful in its instinct and sagacity. It is all perfect in proportion and symmetry, all harmony in combination of parts concurring to the design of its creation. This little body could not have existence without the wisdom of Him who created the Leviathan and other animals of superior grade. The bee has a large round eye on each side of its head. It has two strong mandibles, or teeth, which enable it to construct the cells, and to carry from the hive all obnoxious substances. Below the teeth is the proboscis and within the mouth is a very long tongue. It has four wings and six legs; in the third pair of legs are two triangular cavities, to which the small pellets of pollen which they collect from the flowers are fixed when carried to the hive; a part of the second pair is provided with what resembles brushes, for brushing off the pollen to be deposited in the hive. At the extremity of the six feet are fangs, with which the bees attach themselves to the sides of the hive, and to each other. The proboscis is the principal organ employed in collecting the honey; when inac-

tive, it is folded under the head and defended by a scaly sheath, or covering. When employed, it is extended, and the animal apparently sips the honey from the flower into its mouth, which is of considerable size, and whence it is disgorged into the cells. "The stomach consists of two parts, connected by a tube somewhat like the crop of the feathered tribe. In the first apartment, the nectar of flowers is elaborated into honey; in the second, a portion of honey undergoes the action of the digestive powers, and is converted to the use of the laborers." The head of the bee is furnished with two antennæ, by means of which they reciprocally obtain a knowledge of each other, of their young, and their queen, all communicated by the sense of feeling. It is by these simple organs that they are guided in the dark, and enabled to construct their combs and cells, and feed the young brood. When deprived of both their antennæ, bees can no longer recognise objects; their instinctive faculties are lost; and like Sampson, after his locks were shorn, they are feeble, helpless, and soon perish. These facts, and numerous others relative to the history of the bee, to be found in these pages, have been demonstrated by repeated experiments in the hands of that accurate naturalist, Mr. Huber. When we speak of a hive of bees we are to be understood as including the machine which contains the insects, the swarm, or cluster, which leaves the parent hive at a certain season to form a new family, and which is sometimes called a *colony*. Each hive, or colony, or population of a hive, contains three different kinds of bees; females, males, and workers. The females are called *queens*, not more than one of which can ever live in the same hive, and no hive or colony can subsist long without her presence. The *males*, of which there are

hundreds, and sometimes thousands, are called *drones*; and the remainder, being by far the largest number, are denominated *workers*, or *neuters*, from being supposed to belong to neither sex. It is from the eggs of the queen that the whole progeny proceeds and the species is perpetuated. The males perform no functions but that of perpetuating their race; the workers collect the honey, form the wax, build the combs, watch over the growth and supply the necessities of the young brood. The females and workers are furnished with a sting, of which the males are destitute. This is not a simple sharp pointed weapon; it consists of two separate portions, applied longitudinally against each other. The external side of each is provided with several barbs, like those of a dart, which prevent the retraction of the sting from the wound it has inflicted, until the purpose of its penetration, the discharge of the poison, be fulfilled. If the bee is suddenly forced away, the sting is retained in the wound, and the bee dies. A liquid poison is injected into the wound with the sting, and its virulence is such as even to occasion death, if the stings be numerous. Queens are more peaceable and less disposed to sting than the common bee. The three kinds of bees inhabiting a hive are all of different size and appearance, and may easily be recognised. The common bees and males are familiar to every one; the latter being much larger and of duller flight.

CHAPTER I.

Of the Queen Bee.

THE queen resembles neither of the other bees in structure: she is about eight lines and a half in length, while the males are seven, and the workers six. Her abdomen is longer in proportion and increases much when filled with eggs; her wings are so short as scarcely to reach past the third ring, and her color tends to a deeper yellow. The slowness, or even gravity of her march, her stature and above all, the various homage paid her by the bees, characterise her in a distinguishing manner. "We can scarce believe," says a writer, "what our eyes have witnessed on observing the regard and assiduities of the neuters for their beloved queen." She resides in the interior of the hive, and seldom, if ever, departs from her station, unless when she leads out a new swarm. When any alarm is given by knocking on the hive, the queen advances to the entrance, and some persons have a facility of taking her without injury and the whole swarm on missing her will follow wherever she is carried. The government of bees is termed republican, although it resembles more the monarchical, as a single personage, the queen, governs the whole. She is likewise their mother in the strictest sense. Among 20, or 30,000 bees of which a hive fre-

quently consists, the queen is the only one that breeds; and it is to this prerogative that she is indebted for the extreme love and affection which she enjoys from her subjects. Their respect and obedience are truly remarkable. She is almost continually attended by a circle of bees, who devote themselves to her service, some present her with honey, others pass their trunks lightly over her body in order to remove from it any thing that may be offensive. When she walks, those that are in her passage, range themselves in a respectful manner to make way for her. They either know, or appear to know, that this procedure has an important object in view, that of augmenting the number of their citizens. The queen being the parent of the hive, it is from her alone, that a complete swarm composed of queens, drones and workers, can proceed; and without all these different members of the community, it cannot either lay up stores or be preserved in existence. That bees are propagated by means of eggs which are hatched into worms, could not be unknown from times of the most remote antiquity; but no point in the natural history of animals has been more keenly contested than their precise mode of generation. It was concluded, from finding males and females together, in the same hive, that their sexual union gave birth to the young; yet no one had beheld their concourse. Those provided with the means best adapted for observation, could only assert, that something like an indistinct and transient junction had taken place before them. Others, again, with all the assiduity, care and attention they were able to command, could see nothing of the kind; and thence inferred, that the queen was a real hermaphrodite, which in itself possessed the generative powers of both sexes combined.

A third class, where we are surprised the name of Swammerdam should appear, ascribed the impregnation of the queen to a certain *aura* emanating from the bodies of the males, which must necessarily be numerous, in order that it may have sufficient power; and a few observers conceived that external fecundation of the eggs, took place after being deposited in the cells, in the same way as the generation of frogs and fishes is effected. But, on the other hand, young were found in hives provided with queens, though entirely destitute of males. They were seen in spring long before males begin to exist, and in winter, after the whole are destroyed; and an experiment by *Hattorf*, evinced the aversion of queens to drones, rather than an affection for them. He took two virgin queens from their cells, and confined each, along with two drones taken from the same hive, under a glass vessel. One of the drones having approached a queen, was seized by her, and killed on the spot; and the other did exactly the like with one of her companions; the two remaining drones escaped. This experiment on frequent repetition, presented similar results; and the variety of devices to ascertain the fact, were attended with consequences which served still more and more, to perplex the observer. At length, however, the truth seems to be disclosed, as we shall briefly advert to the methods adopted for the purpose of discovering it. Mr. Huber, of Geneva, one of the most intelligent authors who have written on this subject, finding the experiments of all former naturalists unsatisfactory, removed the whole reigning females from a number of hives, and substituted for each, a queen taken at the moment she came to maturity. He then divided the hives into two classes; and having removed all the drones

from those of the first class, he adapted a glass tube to the entrance, so narrow, that no drone could pass, but large enough to admit common bees. The old drones were allowed to remain in the hives of the second, and more were even introduced. A glass tube, also, too small for their exit, though of sufficient capacity for common bees, was likewise adapted to the entrance of the hives. This experiment was carefully made; and, to the author's great surprise, all the queens remained sterile; thus proving, that a female confined to her hive, would continue barren while amidst a saraglio of males. The result of successive experiments, diversified in every possible manner, and made with much skill and indefatigable labor, proved, that the generation of bees is effected by the union of the sexes, as in most other species of insects, and the larger terrestrial animals. But it is never in the interior of the hive that it takes place. The queen, to accomplish it, must issue forth from her dwelling; the only occasion, except one, on which she leaves it, and although her junction with the drone has not yet been witnessed by human eyes, it is supposed to happen high in the air. In illustrating the generation of bees, the author whom we have already cited concluded, that if queens were obliged to go out for impregnation, it would be at the warmest time of the day, as the males then leave the hives. On the 29th of June, a hive containing a virgin queen five days old, was made the subject of observation. The sun had shone from his rising; the air very warm; eleven in the forenoon, the males began to leave the neighboring hives. The entrance of the one containing the queen was then enlarged, and the bees, entering and departing, narrowly observed. The males appeared, and immediately

took flight; and soon afterwards, the young queen came to the entrance. . Before quitting the board, she traversed it, and brushed her belly with her hind legs, during which, she received no attention either from the males or workers. Taking flight, she again approached the hive, as if to examine the place of her departure, that she might recognise it; next, describing circles ten or twelve feet above the surface of the earth, she rapidly rose in the air, and was soon out of sight. The observer and an assistant hastened to contract the entrance of the hive, and in seven minutes the young queen returned. No external marks of fecundation being visible, she was allowed to enter the hive. In a quarter of an hour she came to the entrance, and brushing herself as before, took flight. Returning to examine the hive, she departed, rising so high, that the observers soon lost sight of her. Twenty seven minutes elapsed, before her return from her second excursion; but now she was in a very different condition from that in which she appeared after the first; for she exhibited the most unequivocal evidence of sexual union, even the mutilated parts of the male by which she had been impregnated, and of which she divested herself with her feet. The same experiments were repeated on queens twenty, twenty-five and thirty days old, and all became fertile after a single impregnation. The uniform sterility of queens, when confined in hives with males; the flight of the queens from their hives, in the manner described, and the very conspicuous evidence of impregnation with which they return, afford the clearest demonstration of the facts, which the experiments were intended to prove. But the celebrated Mr. Huish, an English naturalist, considering Huber's theory as visionary, strongly advocates

the doctrine, that the eggs are impregnated by the drones after being deposited in the cells of the queen. In two days, the belly of the queen was swollen, and on investigation, she proved to have laid nearly an hundred eggs in the workers cells. For some reason, which is unknown, the sexual union cannot be accomplished in the hive; and the object of the queen's departure being once fulfilled, she never again leaves it, unless to conduct a swarm. Forty six hours after impregnation, the queen begins laying eggs, which will become workers; and provided impregnation takes place within the first twenty days of her existence, thousands are produced uninterruptedly, during the succeeding eleven months. Then she commences laying eggs, which will be drones. A single copulation is sufficient to impregnate all the eggs which a queen will lay in two years, or, perhaps, the whole that she will lay during her life. The laying of a queen is retarded, or altogether interrupted, by cold; and one impregnated in the end of October, has been known to retain her eggs four months and a half, owing to the intervention of winter. This queen, during March and April, laid about 3000 eggs, producing males only, and so very prolific are these insects, that a single queen may be mother of 12,000 bees, or more, in the space of two months, which is laying at the rate of 200 eggs daily. The queen, before depositing an egg, examines whether the cell is clean and fit to receive it, and also suitable to its future condition; for queens, males and workers, have cells peculiarly adapted to their kind, and the queen by anticipation, seems aware which of these will proceed from the egg she deposits. Those producing workers, are deposited in hexagonal horizontal cells; the cells of the

drones are somewhat irregular in their form, but the cells containing the eggs, intended to produce queens, are large, circular and hang perpendicularly in the hive. When the egg is laid, the bees supply the cell with the pollen of flowers, which serves to feed the young worm coming from it. The eggs of all the three kinds of bees, are hatched in three days; a worker remains five days in the vermicular state, a male six and a half, and a queen five. The worker's worm occupies thirty six hours in spinning its silken envelope, or cocoon; in three days, it changes to a nymph; and only on the twentieth day of its existence, does it become a complete, or perfect winged animal. The drones are still longer in attaining their last metamorphosis, which succeeds in twenty four days after the egg has been laid. But the queen comes to perfection in sixteen days. Food is carried by the bees to the worms as they require it; but when ready to be transformed to a nymph, they are aware that it is no longer necessary; on the contrary, the mouth of the cell is sealed with a covering of wax, formed of concentric circles from the hedge, convex, if including males, and flat, if including workers. The same cell may successively bring different workers to maturity: after one has left it, the bees clean the inside, and the mother again lays there; but the cells containing eggs which become queens, are used no more than once. When the perfect insect escapes, the cell is usually destroyed. Mr. Schirach, an eminent naturalist, discovered, that in certain circumstances, the animal destined to become a worker, could actually be converted into a queen; and that this conversion was in the power of the bees, by means of a particular mode of treatment, bestowed on the worm while in an early stage. He thence concluded, that

every queen is originally, a worker, which, without the particular treatment administered, would have remained a worker, but having undergone this treatment, it is converted to a queen; and that the bees, to attain the conversion, selected the worm when three days old. Nevertheless, it is indubitable, that specific eggs are laid in royal cells, and hatched into queens, which, according to the most credible and satisfactory experiments, never would have produced workers. It is surely to avoid the fatal consequences which attend 20, or 30,000 animals on the loss of a single life, that they have been endowed with such uncommon prerogatives. Immediately on the loss, or removal of a queen, the whole hive is a scene of tumult and disorder: the bees seem to anticipate their own destruction, by the precaution they take to guard against it. Should there be neither eggs nor brood in the combs, they will infallibly perish; their instinctive faculties are lost, they have no object for which their labors are united, they cease to collect honey and prepare wax, and in a short time they disappear and die. But if there be brood in the combs, the industry of the bees continues unabated; for by the proceeding which they follow, they know that their loss will be repaired. Having selected a worm, three days old, or less, they sacrifice three of the contiguous cells, that the cell of the worm, may be formed into one adapted to breed a queen. They next supply it with the necessary food, which is not the common farina, pollen, or bee bread, on which the young workers feed, but a peculiar paste or jelly, of a pungent taste, which is reserved for queens alone. When reached maturity, a queen comes forth, qualified to fulfil every indispensable function on which the preservation of so many thousand lives de-

pend. Working bees have therefore the power of effecting the metamorphosis of one of their own species, to avert the effects of a loss, which would prove the utter ruin of the whole colony. The sole function of the queen bee is, to perpetuate her species; but single, and unassisted by the workers, herself and her offspring would perish. Her fecundity is surprising. Swammerdam affirms, that she contains 50,000 eggs; and some authors advance, that she may be the mother of 100,000 bees in one season. In addition to the peculiarities, exhibited in her propagating young, she is marked by others of the most conspicuous description. She is watched and attended to; and to judge from appearances, sheltered and respected by the workers. Groups of them constantly encircle her; they supply her with honey, brush and lick her limbs; whenever she moves, they recede before her; and, according to the united sentiments of all, who have studied the nature of bees, pay her, what would be called real homage, could we allow them the prerogative of understanding. She is the object of the greatest attachment; her presence inspires them with new instincts, and animates them to labor: the permanent existence of a queen, in short, is the only security of the workers. Some persons have been known to have a complete command or power over bees, and can make a whole swarm follow them from place to place, without injury to themselves or spectators, but the whole secret consists, in having obtained possession of the queen. Those accustomed to handle bees with address, can easily seize the queen, and then, as during swarming, little is to be apprehended from the bees attempting to sting. Though the queen lays several eggs, which will be successively transformed into queens, only

one in its perfect state can exist in a swarm; a plurality seems equally adverse to the intention of nature, as a total defect. Hence it follows, that of two coming at the same time into existence, one must die for the welfare of the community. Nature has therefore inspired queens with the most deadly animosity, and the most insatiable thirst for each others life, which nothing but actual death can appease. Mr. Huber relates the following remarkable combats of queens: In one of his hives fittest for observation, two young queens left their cells almost at the same moment. Whenever they observed each other, they rushed together apparently with great fury, and came into such a position, that the antennæ were mutually seized by their fangs. The head, breast and belly of the one were opposed to the head, breast and belly of the other. The extremity of their bodies had only to be curved, that they might be reciprocally pierced with the stings, and both fall dead together. But nature has not decreed that the two combatants should perish in the duel: when in the condition now described, they separate, and retreat with the utmost precipitation; and when these rivals felt their extremities about to meet, they disengage themselves, and each fled away. A few minutes after separating, however, their mutual terror ceased, and they again began to seek each other. Immediately on coming in sight, they again rushed together, seized one another, and resumed exactly their former position. The result of this encounter was the same. When their bellies approached, they hastily disengaged themselves, and precipitately retreated. During all this time, the workers were in great agitation; and the tumult seemed to increase, when the adversaries separated. Twice they interrupted the flight of the queens,

seized their limbs, and retained them prisoners about a minute. At last, that queen which was either the strongest or the most enraged, darted on her rival at a moment when unperceived, and with her fangs, took hold of the origin of her wing, then rising above her, she curved her own body, and inflicted a mortal wound. She withdrew her sting, and likewise quitted her hold of the wing she had seized: the vanquished queen fell down; dragged herself languidly along; and her strength declining, she soon expired." Another experiment, equally interesting, on the mutual antipathy of queens, elucidates the instinct of the common bees; and seems to prove, that they are aware of the necessity of such combats having a fatal issue. Mr. Huber having painted the thorax of a queen, on purpose that she might be recognised, introduced her into a hive, already provided with a natural queen. A circle of bees quickly formed around the stranger, but not to caress, or receive her with that grateful homage which a queen is wont to experience; on the contrary, they insensibly accumulated to such a degree, and encompassed her so closely, that scarcely a minute elapsed, before she lost her liberty. By a remarkable concurrence, the workers at the same time collected around the reigning queen, and restrained all her motions: she was instantly confined like the stranger. But as if the bees anticipated the combat in which these queens were about to engage, and were impatient to witness its issue, they retained them prisoners, only when preparing to withdraw from each other; and if one less restrained, seemed desirous of approaching her rival, all the bees clustering together gave way, to allow her full liberty for the attack: then, if the queens testified a disposition to fly, the bees returned to

enclose them. That the bees take a decided part in such combats is indubitable. The cluster of bees that here surround the reigning queen, having permitted her some freedom, she appeared to advance towards that part of the comb on which her rival stood. All the bees receded before her: the multitude of workers between the adversaries gradually dispersed, until only two remained; these also removed, and allowed the queens to come in sight. At this moment, the reigning queen rushed on the stranger, and fixing her against the comb, mortally pierced her body with her sting. The antipathy manifested by queens, is not limited to their perfect state, for it extends to nymphs yet in the cells. The future existence of a rival, which may dispute her place in the hive, seems to excite apprehension in a queen, already come to maturity. The oldest queen in the hive, containing five or six royal cells, having undergone her ultimate metamorphosis, hastened, within ten minutes after escaping from her confinement, to visit the cells of the rest still remaining closed. She furiously attacked that nearest to her, and by dint of labor, succeeded in opening the top: then she began tearing the covering, but her efforts being probably inadequate to her purpose, she sought the other end of the cell, where she effected a large aperture. When of sufficient size, she endeavored to introduce her belly; and after many exertions, succeeded in giving her approaching rival a deadly wound. When she left the cell, the bees, which had hitherto been spectators of her labor, began to enlarge the opening and drew forth the body of a queen scarcely come from the nymphine state. The victorious young queen went on to attack other royal cells, allowing none to escape destruction, and the workers followed to extract the

contents of the cell. Nymphs of other hives introduced into one where there is a queen, are equally the objects of animosity. The larvæ* of the whole three species of bees, are endowed with a property widely diffused among insects, that of spinning silk. Each one spins itself a web or cocoon, in which it repõses a certain time inactive, previous to transformation to the perfect state. The larvæ of workers and males, spin complete cocoons close at both ends; the cocoons of queens are imperfect, covering only the head, thorax, and first ring of the abdomen. Nor can the larvæ do otherwise; the particular form and position of the cell, force them to leave the ends of the cocoon open, while in the natural state; but if removed from it, and situated in the same circumstances as the larvæ of males and workers, a complete cocoon is fabricated, in which the animal is fully enveloped. But the purpose of the open cocoon is only now to be discovered; it is, that the enclosed nymph may be exposed, without resistance, to the deadly jealousy of its rivals. Were it close, the sting of the queen, which seems never to be used, excepting to destroy her own species, might be entangled in the silk, by which, she herself might become the sacrifice, and occasion the loss of the whole hive.

It has been warmly contested, whether bees are capable of imparting what we should call thought, in beings higher in the chain of animated existence, and especially, whether there be any thing resembling voice among them? A sound, which we cannot compare to the buzzing of in-

* The larvæ is the worm or caterpillar, which comes from the egg of an insect: it then changes into another state, called the pupa, chrysalis or nymph, and lastly, into the perfect animal. Later naturalists incline to substitute this name in all cases, where the worm is not seen under its final aspect.

sects, by the balances beating on their wings, is heard from the young queens. No researches, however, have yet detected the organ, if it be an external one, from which the sound proceeds. When a queen is hatched, she seeks the cells of those that will become her rival sisters, and uses every possible exertion to destroy them; but the workers, to which other queens, even in their imperfect state, are precious, generally present the most decided opposition, and render her attempts abortive. Yet from the property which the queen possesses, of emitting that certain sound before heard from her cell, their resistance becomes vain; it paralyses all their faculties; and she proceeds to operate destruction. The following are observations of a distinguished naturalist. Huber, on this head, in illustration of the peculiarities among bees, when exposed to danger. "The first of a number of cells containing females, opened on the 9th of June, and a young queen, lively, slender and of a brown color, escaped from it. The new queen occupied all our attention. When she approached the other cells, the bees on guard, pulled, bit her, and chased her away; they seemed to be greatly irritated against her, and she enjoyed tranquility only when at a considerable distance from the cells. This proceeding was frequently repeated through the day. She twice emitted the same distinct sound or clacking, that had been heard in her prison, consisting of several monotonous notes in rapid succession; and in doing so, she stood with her thorax against a comb, and her wings crossed on her back; they were in motion, but without being unfolded or opened. Whatever might be the cause of her assuming this attitude, the bees were effected by it; all hung down their heads, and remained motionless. The

hive presented the same scenes next day. Twenty three royal cells yet remained assiduously guarded by a great many bees. When the queen approached, all the guards became agitated, surrounded her on every side, bit her, and commonly drove her away. Sometimes, when in these circumstances, she emitted the sound, and assumed the posture just described, from that moment, the bees became motionless. Several queens were successively liberated, but eighteen cells still remained to be guarded. The fifth queen left her cell at ten at night, and two queens were now in the hive; they immediately began fighting, but disengaged themselves from each other. However, they again fought several times through the night without any thing decisive. Next day, the 13th of June, we witnessed the death of one, which fell by the wounds of her enemy. The duel was quite similar to what occurs in the combats of queens. The victorious young queen now exhibited a very singular spectacle; she approached the royal cell, and took this moment to utter that sound, and to assume that posture which strikes the bees motionless. For some minutes we conceived, that, taking advantage of the dread shown by the workers on guard, she would open the cell and destroy the young female; and she in fact, prepared to mount the cell; but, in doing so, she ceased to emit the sound, and quitted the attitude which paralyses the workers; the guardians of the cell instantly resumed courage, and by means of tormenting and biting the queen, drove her away."

"With the view of discovering the fundamental law of the government of our republican bees, a hive has been divided into two nearly equal parts; and it has been al-

ways observed, that such bees as had no queen, made no comb.

Should the original queen be accidentally lost or destroyed, the cultivator has still another means of preserving the whole colony, which, destitute of workers brood, would infallibly perish, by substituting a new one in her place. Bees are not immediately sensible of the loss or removal of their queen; their labors are uninterrupted; they watch over the young, and perform their ordinary occupations. But in a few hours agitation arises; all appears a scene of tumult in the hive; a singular humming is heard; the workers desert their young, and rush with delirious impetuosity over the surface of the combs. Then they discover that their queen is no longer among them. There can be no question that this agitation is the consequence of bees having lost their queen; for should she have been intentionally removed, tranquillity returns on restoring her, and what is very singular, she is recognised as their sovereign. If a stranger queen be introduced, after the reigning one is lost or taken away, the agitation continues; the stranger is surrounded, seized, and kept captive by bees, in an impenetrable cluster, where she usually dies, either of hunger or from the privation of air. If eighteen hours elapse, the stranger is at first treated in the same manner, but with less rigor; the bees gradually disperse, and she is at last liberated. But should there be an interval of twenty four hours after the loss of the original queen, before the strange one is substituted, she will be received, and reign from the moment of her introduction into the hive." On this part of our subject, which it is extremely important for the cultivator to be intimately acquainted

with, we are indebted to Huber for some interesting experiments. On the 15th of April, he introduced a fertile queen, eleven months old, into a glass hive, where the bees, having been twenty four hours deprived of their queen, had already begun to construct twelve royal cells. Immediately on placing the stranger female on a comb, the bees in the vicinity, touched her with their antennæ, and passing their trunks over every part of her body, supplied her with honey. These then gave place to others, by which, she was treated exactly in the same manner; all vibrated their wings at once, and ranged themselves in a circle around their sovereign! Hence resulted a kind of agitation, which gradually communicated to the workers, situated on the same side of the comb, and induced them to come and see what was going on. Soon arriving, they broke through the circle formed by the first of their companions, approached the queen, touched her with the antennæ, and gave her honey. After this little ceremony, they retired, and standing behind the others, enlarged the circle. There they vibrated their wings, and buzzed as if experiencing some very agreeable sensation. In a quarter of an hour the queen began to move from her original position, when the bees so far from opposing her, opened the circle at that part towards which she turned, and formed a guard around. While such incidents occurred, on the surface of the comb where the queen stood, all was quiet on the other side. Here the workers, apparently, were ignorant of the queen's arrival in the hive. They labored with great activity at the royal cells, as if still ignorant that they no longer stood in need of them; they watched over the royal larvæ, supplied them with jelly and the like. But the queen, having at length repaired

to this side, she was received with the same respect by the bees, as she had experienced from their companions on the other side of the comb. They encompassed her, gave her honey, and touched her with their antennæ; and what proved better that they treated her as a mother, was their immediately desisting from work at the royal cells; they removed the worms, and devoured the food collected around them. "From that moment the queen was recognized by all her people, and conducted herself in the new habitation as if it had been her native hive."

Thus when bees have had time to forget their own queen, they receive one substituted for her with greater interest, or, perhaps with more conspicuous demonstrations of it. The cultivator must, therefore, carefully practice one of two things when a queen is wanting in any of his hives; he has either to procure a new one by supplying the bees with brood comb, whereby the loss will be repaired in about fourteen or fifteen days, or he must substitute some supernumerary queen, in which case, the impending evils will be completely averted in twenty four hours.

Huber, in speaking of the antennæ of the queen, remarks that according to experiments, "the amputation of one did not affect her instinct; but if both were cut off, near the root, these privileged beings, these mothers, so much the object of consideration, lost all their influence; even the instinct of maternity disappeared: their eggs were not deposited in cells; their mutual animosities also were forgot; they passed close together without recognizing each other, and the workers themselves seemed to participate in their indifference." Such facts evince that the antennæ of both parties, to a recognition, are necessary, and that it is not alone the mutilated one which loses the power of knowing others.

CHAPTER II.

Of the Working Bees or Neuters, and their Instinctive Powers.

The study of the natural history of the bee, furnishes useful instruction to the human mind. The singularity of the means which the Author of nature has chosen for preserving the species of bees, is particularly observable. The mothers, which in almost all other instances, are the watchful and tender nurses of their young, we find in this instance only give them birth. The duty of rearing them is committed to substitutes, the neuters, and they, as nursing mothers, manifest precisely the same affection towards the young of their species, as we observe in the real mothers of other animals. The neuters have been supposed, by some, to belong to neither sex, but Riein discovered that some of that class may lay fertile eggs; and Huber has, by particular experiments, confirmed the fact. They appear capable of a partial fecundation, but they produce male bees only. The working bees are much less in size than the queens or drones; they are armed with a sting, and are easily irritated to make use of it. It is the working bees, that form the great class on which the welfare of a hive principally depends. Without their

incessant aid, the males, females, and even the brood itself, would quickly perish. And while the presence of a queen is essential to their safety, they are no less requisite for her preservation. The working bees collect all the wax and honey, build the combs, guard the hive, &c. and are ever ready to sacrifice their lives for the general good. While some are collecting honey, others are searching the flowers for pollen only; others again never leave the hive, but seem constantly employed in the various works within; and they seem to be endowed with a peculiar instinct, directing each one its different task, and without a sufficient number of this class in each department, no colony will prosper. It is the part of the workers also, to clean and prepare the cells appropriated for the embryos of their own kind, of the queens, and of the males. After the queen has deposited her eggs, the workers supply the food adapted for the worms of each species, and regulate the proportions, sealing every cell with a covering different, according to the particular worm included. Nor are these the limits of their occupations; while some guard the queen, construct the combs, and watch over the necessities of the young, others keep a constant watch day and night, at the entrance of the hive; if a stranger bee, a wasp, or noxious insect appear, it is instantly repelled, or destroyed. Even should a queen, which on usual occasions, is treated with such unequivocal marks of regard, be introduced to the hive of any swarm but her own, the workers immediately seize and restrain her, and without being wounded with their stings, the confinement she suffers is such, that she sometimes dies of absolute suffocation.

It is a part of their economy to procure a resinous substance, called propolis, or bee glue, with which they seal all crevices about the hive, to seclude air, and insects. It is contrary to their nature to suffer any uncleanly substance to remain about the hive; some of them act the part of scavengers by freeing the hive of all nuisances; such carcasses as are too large to be removed they embalm, or cover with a thick layer of wax or propolis, under which they may remain without causing any putrid or offensive effluvia. Although every good swarm is composed of many thousands of bees, yet such is their peculiar instinct that a single bee of any other hive shall not obtrude himself, but he is instantly known and seized on as a robber. Bees have a sort of language, among themselves, whereby they know each others wants; as in building their combs, unloading the laborers, feeding each other, &c. They also foreknow the approach of storm; and will sound an alarm, when any thing injurious disturbs their habitation; and such sounds will be instantly understood and answered by the whole hive.

In the cold regions of Russia and Poland, bees continue in a state of torpor during the winter, but in our climate they are subjected to alternate state of torpor and animation.

The labor of the neuters, is generally in proportion to the number of eggs the queen mother is to lay. They do not engender, but they are taught to know that the queen enjoys that faculty, and they construct their cells according to the number required; so that the greater her fecundity is, the more numerous will be the combs constructed by the workers. It seems to be a law of their nature, and a grand principle of the preservation of the

species, that their attachment to their queen should be so strong that they will absolutely neglect the care of their own lives, when they happen to be separated from her. No sooner are these active insects deprived of their sovereign, than they entirely cease from their labors and suffer themselves to perish, unless their loss can be soon repaired. Nature has entrusted bees as much with regard to the young brood, as she has the mothers of other animals in favor of their offspring, and this affection is extended to all the nymphs without distinction, even if they should be transferred to different hives. The attachment of mothers in general to their young is probably occasioned by the agreeable sensations which they experience from them, and it is highly probable, that the process of nature is similar with respect to the laboring bees, and that she has implanted in the young, towards them a secret cause of agreeable sensations, whereby they are attached to them, and induced to disgorge into their cradles that kind of nutriment which contributes to their growth and support. If bees are not allowed to possess any thing analogous to reason, the regard for their queen, and the watchful care of their young, must result from some pleasurable sensations. It has been ascertained, that after a particular period of the year, when the queen has been impregnated, and the drones are no longer of use, they are cruelly destroyed by those very workers which formerly watched over them so carefully when in their cradles. It is not to be supposed that the neuters know they would perish with hunger were the drones preserved, but there probably is a certain time when the males make such an impression on the senses of the neuters as tends to irritate them, and prompts to their destruction. It is usually in the months of July

and August, that this singular massacre is effected. A curious observer, Huber, desirous of witnessing the scene of carnage, placed six hives on a glass table, and placed himself and an assistant beneath it. . On the 4th of July, the workers actually massacred the males in the whole six hives, at the same hour, and with the same peculiarities. The glass table was covered with bees, full of animation, which flew on the drones, seized them by the antennæ, the wings and limbs, and after having dragged them about, they killed the unfortunate victims, by repeated stings directed between the rings of the belly. The moment that the formidable weapon touched them was the last of their existence; they stretched their wings and expired. It is evident that bees act in concert, that their operations tend to one general object, and that they are aware of its being fulfilled; and this cannot be done without some mode of communication with each other; but as all their performances are in the dark, it is extremely difficult to conceive, how they can know each other's proceedings. Among the strongest traits in the character of bees, is their unrivalled habit of industry. So ardent is their native passion for flowers, and such their pleasure in making honey, that a young bee on the very day of its birth, is seen in the field in pursuit of flowers, and loading its feeble legs with pollen, and its stomach with the nectareous fluid. Whilst the season continues favorable for collecting honey and wax, bees labor from the dawn of day till evening, and they never cease to fill their magazines, is not however, from a fore-knowledge that a season is approaching, when their harvest will be denied them, but they are furnished by nature, with the means of obtaining their food without thinking, or being capable of thinking

of any precautions necessary for that purpose. Their nature requires that they gather honey and wax; they apply themselves to the business during the summer season, and on the return of winter their combs are filled with wax and honey. Reaumur has calculated that within one hour, 3000 bees have returned from their collections to a hive whose population did not exceed 18,000, and Swammerdam found nearly 4000 cells constructed in six days, by a new swarm, consisting of less than 6000 bees. It is not uncommon among us, for a single swarm to collect from 80 to 100 pounds of honey, in a favorable season. Astonishing industry! A single individual of a feeble insect can accomplish but little, but the aggregate of a colony combined, can obtain a wonderful store. Bees collect some part of their honey from what is commonly called honey dew. This is an exudation found on the leaves of trees, in very hot sultry weather. The oak is the principal tree which produces this substance in any quantity; it is often found on the maple, sycamore, hazel and bramble, and also on the leaves of hop plants. Repeated observations prove, that the secretion of honey is powerfully influenced by the electricity of the atmosphere, and bees never labor more actively than during humid, sultry weather, and when a storm is approaching. Sometimes the supply of honey is essentially suspended by the state of the weather, which occasions a total interruption of the labors of the bees, and if this be too long protracted, a populous hive may actually die in the middle of summer. The odour exhaled from the hives, and the size of the bees on their return, are always sure indications whether the flowers contain honey. Although the flowers be destitute of honey, bees still are able to store

up quantities of farina or pollen, necessary for feeding their young. Part of it is immediately given to them, and what is superfluous, is reserved in the cells. Sixty five hives, the whole of which, according to an English writer, exhibited workers in wax, were examined on the 18th of June, when the country was covered with flowers, and while the bees actively pursued their collections. Those returning to old hives, having no cells to construct, deposited their honey in the combs, or gave to their companions; but those of new swarms, converted their honey into wax, and hastened to build combs for the reception of their young. Rainy weather interrupted their labors, and the combs received no addition by the construction of new cells. The weather, however, altered; the chesnut and the elm were in flourish, and on the 1st of July, it being very warm, the bees resumed their labors with the utmost activity, from that day until the sixteenth, both in honey and wax. But thenceforward, no honey being produced, they collected quantities of pollen only; and the odour of the flowers showed there was nothing except an inconsiderable secretion of honey at intervals, barely sufficient for subsisting the bees. It was found, on examining the sixty five hives, in the end of August, that after the middle of July, the bees had ceased to work in wax; that they had stored up a great quantity of pollen; that the honey of the old hives was very much diminished, and in the new ones, scarce any remained; as, what was at first collected, had been consumed in the preparation of wax. The harvest of honey, like that of corn, is early or later, more abundant or scarce, in different years, according to season, and variety of climate and situation. Sometimes, bees will continue in active labor, during Sep.

tember, and they will collect pollen till late in October, if actual frost does not prevent.

The following instances illustrative of the instinctive sagacity of bees, may be interesting to the reader. It is contrary to their nature to endure any filth or corrupted substance to remain in the hive. Obnoxious animals of small size, entering a hive, are immediately stung to death, and then dragged out by the bees to some distance. But should a larger animal, as a snail, or mouse, enter their dwelling, they find means of depriving it of life, but being unable to remove its body from the hive, they carefully cover it over with propolis, by which any putrid effluvia which might disturb their comfort is prevented.

A snail having crept into one of Mr. Reaumur's hives early in the morning, after crawling about for some time, adhered by means of his own slime to one of the glass panes; where, but for the bees, it would probably have remained till either a moist air, or its own spume had loosened the adhesion. The bees, having discovered the snail, immediately surrounded it, and formed a border of propolis or bee glue round the mouth of its shell, which was at last so securely fixed to the glass, as to become unmoveable, either from the moisture of the air without, or by the snail's secretion within. In another instance, a houseless snail, or slug, had entered a hive; the bees, as soon as they discovered it, pursued it with their stings till it expired beneath their repeated strokes; after which, being unable to dislodge it, they covered it all over with propolis. "In these two cases," says an observer, "who can withhold his admiration of the ingenuity and judgment of the bees? In the first case, a troublesome creature gained admission into the hive, which from the impenetra-

bility of its shell they could not destroy. Here, then, their only resource was, to deprive it of locomotion, and obviate putrefaction; both which objects, they accomplished most skilfully and securely, and, as is usual with these sagacious creatures, at the least possible expense of labor and materials. In the latter case, to obviate the evil of putrescence by the total expulsion of the air, they were obliged to be more lavish in the use of their embalming material, and to form with it so complete an incrustation, or case, over 'the slime girt giant,' as to guard them from the consequences which the atmosphere invariably produces upon all animal substances, that are exposed to its action, after life has become extinct. May it not be asked, "what means more effectual, could human wisdom have devised, under similar circumstances?" On taking up a hive in autumn a few years since, the body of a mouse was found entirely encased in the substance of the comb, and so effectually embalmed by their own materials, as to exclude the access of atmospherical air, and to obviate the possibility of annoyance from the process of putrefaction.

"Embalm'd in shroud of glue, the mummy lies,
No worms invade, no foul miasmas rise."—*Evans.*

In the *Edinburgh Encyclopedia* we have the following curious statement: In autumn 1804, the copious collections of honey which had been made during summer, had entirely disappeared, and the moths were uncommonly numerous. The owners of a number of hives, resolving to protect them from farther pillage, closed their entrances with tin gratings, where the apertures were proportioned to the size of the bees, on the 17th of September; but not having enough for the whole, two were left unsecured. It was

seen next morning on examination, that, during the night, the bees had themselves taken the necessary precaution, by contracting the entrances of their hives, so as to make them quite safe against invasion. Each was completely blockaded by a wall, composed of old wax and farine, in which the bees had taken care to leave apertures, corresponding to their own size: two that would prevent above two bees passing at a time, were fashioned like inverted arches; a third was broad enough in front to admit of the passage of several bees at once, but so low, that they were obliged to lean over on one side to get through. All the other hives proved on inspection, to be constructed in the same way, even those provided with the tin gratings. In other instances, the bees had constructed a double wall at the entrance of the hive, with covered galleries so narrow, that no more than a single bee could pass: fifty three swarms began these operations in the course of the same night. Bees when attacked by plunderers of their own species, have been known to adopt singular precautions. On the 9th of July, 1804, an observer having found some of those belonging to a neighboring hive, lying dead on the board of a swarm that had come to pillage, watched the proceedings of the latter. On the 11th of the month, they had built up their entrance, leaving only two apertures at the part highest above the board, which would admit no more than one bee at a time: they were thus proportioned to the size of their enemies, and could be sufficiently guarded by two workers. But on the sequel they were enlarged, and on the 22d they would have allowed two or three bees to pass at once. "Was this," the observer asks, "because they were insensible of having drones among them, for which these openings were too

small?" No farina being in the country at that period, the bees had built their wall of pure wax, taken from the edges of their combs. In a subsequent fortification, erected during September, they used farina along with the wax employed in it. It is proper here to remark, that the *Sphynx Atropos*, the great enemy of bees, is a European insect and is not known in America. It is larger than a bee, of course may be excluded by contracting the entrance into the hive; whereas the American bee moth is smaller than a bee.

A very striking illustration of the reasoning powers of bees, occurred to Mr. Walond: inspecting his bee boxes at the end of October, 1817, he perceived that a certain comb, burthened with honey, had separated from its attachment, and was leaning against another comb, so as to prevent the passage of the bees between them. This accident excited great activity in the colony, but its nature could not be ascertained at the time. At the end of a week, the weather being cold, and the bees clustered together, Mr. Walond observed through the window of the box, that they had constructed two horizontal pillars, betwixt the combs alluded to, and had removed so much of the honey and wax, from the top of each, as to allow the passage of a bee: in about ten days more there was an uninterrupted thoroughfare; the detached comb, at its upper part, had been secured by a strong barrier, and fastened to the window with the spare wax. This being accomplished, the bees removed the horizontal pillars first constructed, as being of no farther use."—[American Quarterly Review, June, 1828.]

An unconquerable attachment to their queen is a remarkable trait in the character of bees. "Dr. Warder, be-

ing desirous of ascertaining the extent of the bees loyalty to their sovereign, ran the hazard of destroying a swarm for that purpose. Having shaken on the grass all the bees from a hive, which they had only tenanted the day before, he searched for the queen, by *stirring* amongst them with a stick. Having found and placed her, with a few attendants, in a box, she was taken into his parlor; where the box being opened, she and her attendants immediately flew to the window, when he clipped off one of her wings, returned her to the box, and confined her there for above an hour. In less than quarter of an hour, the swarm ascertained the loss of their queen, and, instead of clustering together in one solid mass, they diffused themselves over a space of several feet, were much agitated, and uttered a plaintive sound. An hour afterwards they all took flight and settled on the hedge where they had first alighted, after leaving the parent stock; but instead of hanging together like a bunch of grapes, as when a queen is present, they extended themselves along the hedge in small bunches of 40 or 50, or more. The queen was now presented to them, when they all quickly gathered round her, with a joyful hum, and formed one harmonious cluster. At night the Doctor hived them again; and, on the following morning repeated his experiment, to see whether the bees would rise; the queen being in a mutilated state, and unable to accompany them, they surrounded her for several hours, apparently willing to die with her rather than desert her in her distress. The queen was a second time removed, when they spread themselves out again, as though searching for her: her repeated restoration to them at different parts of their circle, produced one uniform result; and these poor, loyal and loving creatures, always marched and counter-

marched every way as the queen was laid. The Doctor persevered in these experiments, till after five days and nights of (voluntary) fasting, *they all died of famine*, except the queen, who lived a few hours longer and then died. The attachment of the queen to the working bees, appeared to be equally as strong as their attachment to her; though offered honey, on several occasions during the periods of her separation from them, she constantly refused it, disdaining life without the company of her subjects."* "Even the dead body of their queen is a subject for the respect and affection of the workers; and they have, according to Huber, preferred the inanimate corpse to any living queen. Dr. Evans relates the following affecting anecdote: A queen in a thinly peopled hive, lay on a comb apparently dying. Six workers surrounded her, seemingly in intent regard, quivering their wings, as if to fan her, and with extended stings, as if to keep off intruders or assailants. On presenting honey, all the bees *except the guards*, partook of it; but they, absorbed in their mournful duty, disregarded the proffered banquet. On the following day, the queen, though lifeless, was yet surrounded by her guard; and of this faithful band of followers, not one deserted his post, until death came kindly to extinguish both his affection and his grief. "Our friend, Professor Thomson, relates that having separated a part of a *sectional* hive with its honey, he covered the hive as usual, and conveyed the separated portion to a dark room in his house. The queen happened to be in the part removed. After several days, he found the bees which it contained at work on the combs, though the box lay in an inverted position, and open at the top. Through a small aperture between the

* American Quarterly Review, for June, 1823.

window shutters, they had gone out and come in, and were content to reside with their queen in a dark chamber, and in a roofless box. The bees left in the *hive*, soon discovered the loss of the queen, and kept lounging and clustering about the box, apparently without spirit and without aim. The restoration of the section with the queen, reanimated them, and the business of the society again proceeded as usual.”* By the persevering researches of the indefatigable Huber, we are favored with the following particulars pertaining to the natural history of bees.

Black Bees.—Huber, in the year 1809, discovered about a hive a considerable number of bees of singular appearance, but differing in color only from common bees, and on account of their color are called *Black Bees*. They were opposed and refused entrance into the hive by the workers, and their daily presence and increasing numbers at the entrance, denoted that the hive was their birth place, and from which they had been expelled. The greatest animosity was observed between these strangers and the common workers, and “once driven from the hive, they never returned, for when the sting spared them, they perished of hunger.” Huber accounts for the production of black bees from a peculiar or vitiated condition of the queen, as they were not found in other hives. By the direction of Huber, these new-comers were made the subjects of dissection by the ingenious Miss Jurine. She found no dissimilarity between them and common bees, in external appearance, except in a smaller quantity of down on the thorax and abdomen, which occasioned their black color. But “by extending her researches farther, she

* American Quarterly Review, for June, 1828.

discovered two distinct ovaries, wherein no eggs were perceptible, indeed, but analogous in form and substance to those of queens, though not so manifest to the observer. A great number of common bees being taken indiscriminately from before the entrance of the hive, ovaries, resembling those of black bees, were found in the body of each, after having been kept two days in brandy to darken the transparent membranes." "The value of this discovery," says Huber, "must be felt by those who have followed the progress and the vicissitudes of the history of bees; and by those who have read the objections against Schirach's theory, which are founded exclusively on the absence of ovaries in workers. Thus the belief of neuters among bees entirely vanishes, at the same time that the most interesting phenomena of their organization are exposed." It has been before stated, that some which have been called neuters, had been found to be susceptible of a partial foundation, but their eggs produced males only. It is decided, however, that there are no such insects as neuters in existence among bees, those which have sustained that character being females, whose organization is not developed. The mode in which they become fecundated is altogether inexplicable. He observes that "all these facts concur in demonstrating that there are no real neuters in this class of insects, which would have interrupted the chain of nature, for I know not that it exists in any other kind; sometimes both sexes are conjoined in one individual, but it seems adverse to nature that there should be neuters."

Of the Workers and Drones.

"A remarkable irregularity subsists in the number of males, compared with the other inhabitants of a hive. Swammerdam found 693 along with 8494 workers. Previous to the swarming of a large hive, Reaumur counted 700 among 26,426 common bees, and one queen. In another, containing only 2900 workers, he found 693 males. He computed 50,000 cells in the former, of which 20,000 were full of brood. About 2520 cells were appropriated for breeding males, and above half of them were occupied by larvæ and nymphs. Thus, including the 700 in the perfect state, he observes, that this hive would be provided with above 2000 males."

An elegant writer and experienced apiarian, in the *North American Review* for October, 1828, reputed to be Mrs. Mary Griffith, of New Brunswick, New Jersey, observes that "the average number of a hive or swarm is from fifteen to twenty thousand bees. Nineteen thousand four hundred and ninety-nine are neuters or working bees, five hundred are drones, and the remaining one is the queen or mother!"

A singular kind of warfare sometimes takes place among bees for the purpose of pillage. A courageous swarm will assault a neighboring colony and subdue it, even at a considerable distance, and in a single day carry the whole stock of honey to their own hive; compelling the subjugated bees to assist in the spoil. And it has sometimes happened that a swarm, when deficient in food, abandons its own hive and takes possession of another to relieve its

necessities or better its circumstances. Weak and feeble hives are constantly liable to such depredations. It is difficult to guard against such warfare, or prevent the robberies of these lawless invaders. Whenever an attack on a hive is discovered, the entrance should be contracted to a small size, and the bottom board should be pushed back flush with the edge of the hive, so as to deprive the assailants of a standing place, and thereby afford to the guard at the mouth a double advantage; and at the same time the hive should be removed to some distance and covered with bushes, which may afford some security. If the robbers are known to belong to a neighboring apiary, let the owner of the hostile hive consider that the receiver is as bad as the thief, and that he ought, in honesty, to use his endeavors to prevent the pillage, either by purchasing or selling, that the two hives may change situations. Both hives had better be sacrificed and the honey secured, than the neighboring hives be involved in the warfare, as sometimes happens: or, the owner of the hive attacked, might remove the bees by the usual method, into another hive and possess himself of the honey.

But there is said to be a species of robbery among bees which is so audacious as scarcely to be credited. It obtains, however, only among a few individuals. They visit a hive as solitary individuals, and being opposed by the sentinels, they continue lurking about the hive till a bee comes home heavily loaded, and alights at some distance from its companions, when the robber seizes, bites, and tears him, till he is obliged to vomit up the honey which he had collected, and the robber immediately licks it up and then makes his escape. This is called sponging, but it is a base kind of robbery.

It seems to be a matter of much doubt and uncertainty, whether bees enjoy the sense of hearing; but their organs of sight appear to be very perfect, especially as respects distant objects. A bee on its departure makes several evolutions, and then rising aloft in the air, flies straight to the flowery field; and having made its collection, it again rises aloft as if to reconnoitre its hive, returns in a perfectly straight line, with great velocity, and recognizes its own hive amidst numerous others resembling it. But sometimes on its return to the hive it appears as though its sight is obscured as to near objects, for it alights on the board and blunders and searches, as if at a loss to find the entrance. When, however, in anger, it darts on an intruder to inflict its sting, it seldom misses its aim, directed to the most exposed parts. The sense of smell enjoyed by bees, is supposed to be such as to answer their purpose in traversing the fields in pursuit of flowers, even to a considerable distance.

CHAPTER III.

Construction of the Combs and Cells.

A view of the internal arrangement of a bee hive is certainly one of the most interesting that can offer itself to the eyes of an observer. There appears, on examination, an astonishing air of grandeur. The curious eye can never be weary of contemplating these workshops, where thousands of laborers are constantly employed in various departments for the common interest. We are struck, in a particular manner, with the regularity and geometrical exactness observable in their works; their magazines replenished with every necessary for the support of the society during the rigorous season of winter; and we behold with wonder and pleasure, the young brood in their cradles, and the tender care of their nursing mothers towards them. The construction of these nests, or cradles, is executed with so much art, and the ground-work and form of them so skilfully contrived, that it must be viewed as an excellent specimen of geometry. The structure of the cells has excited admiration in every contemplative mind, and it is demonstrable, that their figure is the best adapted for containing the greatest possible quantity in the least possible space. By

the hexagonal form of the cells they lose no room, as the circumference of one makes a part of the circumference of another, while, were they contrived in any other shape, there could not be so many cells of equal capaciousness in the same given space. These cells, which are very thin, are strengthened at the entrance by a fillit of wax, and also at the bottom by the angle of one admirably falling in the middle of its opposite. There are in every hive different sorts of combs, adapted to the different species of bees which are to be bred in them. In these combs constructed for breeding the drones, the cells are considerably larger than those which are intended for the working bees; and those which are made for breeding the females or queens are of a very peculiar form, and fashioned with great labor and skill.

The royal cells are of a pyramidal form with a wide base and a long diminished top. They hang perpendicularly in the hive, the point downwards. The cells for drones are in diameter three and one third lines, those of the workers two and three-fifth lines, and these dimensions are invariably observed in all hives.

A number of cells united constitute the comb, formed in parallel sheets, between twelve and thirteen inches square, when the form of their hive will admit of that size. Reaumur calculated that each comb would contain 9000 cells. The primary object of the cells seems to be for propagating the young; after these have gained maturity, they are cleaned out and filled with honey; but there are cells also destined for this purpose from the beginning. The same cells may be employed for several successive broods, and when the whole have come to perfection, they are appropriated for the winter stores; those at the top of a

comb are neatest and best made, as well as of better materials, compared with those at the bottom. In the shape and size of the comb, bees are guided by circumstances, a small cavity is totally fitted with equal combs in parallel sheets, while in one of greater dimensions, there may be some large, and others not one fourth of the size. By a law of nature, from which they seldom deviate, the foundation of the second comb is laid parallel to that of the first, and the successive combs are generally parallel to each other. There is usually an interval of one third of an inch between each comb, and this for substantial reasons. Were they too distant, it is very evident that the bees would be greatly dispersed, and unable to communicate their heat, reciprocally, whence the brood could not receive sufficient warmth. Were the combs too close, on the contrary, the bees could not freely traverse the intervals, and the work of the hive would suffer. Therefore, a certain distance, always uniform, is requisite, and nature, which has taught bees so much, has instructed them in the regular preservation of an equal distance throughout the whole surface of parallel sheets of comb. Should a comb in its construction have taken an oblique direction, it is afterwards brought into a more perpendicular line, by the bees, which diminishes the vacancy intervening. Combs originate in the top, or arch of a hive, and are worked downwards; but should the upper part be removed, it is said the bees will work upwards to fill the cavity. The combs are always found with their edges towards the front of the hive. In order to shorten the courses which they would necessarily have to make round the surface of large combs they open various communications like streets, through

them, and also open passages between their edges, and the sides of the hive.

There are sometimes considerable irregularities in the structure, the workers do not invariably exhibit that perfect hexagonal figure which has been described. The blocks, or sheets of comb, are attached to the top of the hive from which they are suspended, when no cross sticks are used, and so strongly are they made to adhere by the tenacity of propolis, as to support the weight of ten or twelve pounds, when loaded with honey, and in some situations, as in the hollow of trees and open garrets, they extend their combs five or six feet in length.

Combs, when two or three years old, become black, and are worth but little. It may appear singular how bees can fill horizontal cells quite full of honey, and yet prevent it from escaping. Perhaps it is partly retained by its own viscosity, and from adhesion to the sides of a tube of such small diameter. Each cell is sealed with a flat covering most ingeniously devised. A circle is formed round the mouth of the cell which is gradually diminished by other concentric circles, until the aperture remains a point capable of being closed by a single grain of wax. Thus we see the combs and cells constructed with profound skill, seeming to display the work of a geometrician.

It is self evident that here the geometrician is the author of the insect. Whether we consider bees in the light of machines, a sort of clock work, or as having a soul connected with the machine, it is certain that they never improve in instinctive sagacity; all their wonderful works, habits, and economy are precisely the same now, that they were known to be in the infancy of their history. And

so long as our fields and gardens shall afford flowers, so long may we expect to share with the honey-bee in their nectarious fluid.

CHAPTER IV.

Wax, Honey, and Bee Bread.

It is a fact established by satisfactory experiments, that whatever may be its issue from the body of the bee, Wax originates from honey. The fact was narrowly investigated by a naturalist, observing that bees continued carrying quantities of the yellow pellets, or pollen into hives which were quite full of comb, and where there was no room to construct more; and on the other hand that they enlarged the combs of hives containing only a small portion and did so without carrying in the pellets at all. In ascertaining the mode by which wax was produced from honey, Huber confined a swarm of bees in a straw hive to an apartment, along with a quantity of honey and water necessary for their subsistence. The honey was exhausted in five days, and five combs of the finest snow white wax were then found suspended from the arch of the hive. Lest this might have been the produce of the farina carried in by the bees when their confinement commenced, all the combs were removed, and the imprisonment of the bees repeated. But the result was the same, they formed

other five combs of the finest and whitest wax. Mr. Wistar, of Germantown, mentions two facts equally conclusive on this subject.

"I had," says he, "a late swarm last summer, which, in consequence of the drought, filled only one box with honey. As it was late in the season, and the food collected would not enable the bees to subsist through the winter, I shut up the hive, and gave them half a pint of honey every day. They immediately set to work, filled the empty cells, and then constructed new cells enough to fill another box, in which they deposited the remainder of the honey."

A more interesting proof is thus related by the same gentleman. In the summer of 1824, I traced some wild bees which had been feeding on the flowers in my meadow, to their home in the woods, and which I found in the body of an oak tree exactly fifty feet from the ground. Having caused the entrance of the hive to be closed by an expert climber, the limbs were separated in detail, until the trunk alone was left standing. To the upper extremity of this, a tackle-fall was attached, so as to connect it with an adjacent tree, and a saw being applied below the naked trunk, was cut through. When the immense weight was lowered nearly to the earth, the ropes broke, and the mass fell with a violent crash. The part of the tree which contained the hive, separated by the saw, was conveyed to my garden, and placed in a vertical position. On being released, the bees issued out by thousands, and though alarmed, soon became reconciled to the change of situation. By removing a part of the top of the block, the interior of the hive was exposed to view, and the comb itself, nearly six feet in height, was observed to have fallen down two feet below the roof of the cavity.

To repair the damage, was the first object of the laborers ; in doing which, a large part of their store of honey was expended, because it was at too late season to obtain materials from abroad. In the following February these industrious, but unfortunate insects, issuing in a confused manner from the hive, fell dead in thousands, around its entrance, the victims of a poverty created by their efforts to repair the ruins of their habitation.”*

Honey is the richest extracts from the finest flowers. It is a vegetable secretion, which appears at different seasons of the year especially when flowers in general are in bloom. The bees lick it with their long tongue and proboscis, from the flowers ; it is swallowed and on their return to the hive is disgorged, not from the trunk but the mouth, into the cells. The best sort of honey is of a thick consistence, and of a whitish color, inclining to yellow ; possessing an agreeable smell and a pleasant taste. That honey which is made from the flowers of the mignonette is of superior fragrance, and in great abundance ; its flowers continue in bloom all the summer and autumn, affording both honey and farina the whole season. The comb first made by a new swarm, is of the purest and most delicate white, and the honey which it contains, is of the purest kind, light colored, and of delicious flavor, and is called *virgin honey*. Honey is the source of wax, and the food of bees ; its secretion from flowers is effected by adventitious circumstances, and its qualities are different in different countries. Being a vegetable production, the properties of honey depend entirely on the nature of the plants from which it is collected. Bees collect some part

* American Quarterly Review for June 1823.

of their honey from what is commonly called *honey dew*. This is an exudation found on the leaves of trees in very hot sultry weather. While one kind of honey is of the finest flavor, delicious to the taste, pure and transparent; another is of an entirely different consistence, dark, greenish, tenacious, and bitter; and a third kind has been known to produce deleterious effects, which were almost, if not quite, fatal to human life. The late Dr. Barton of Philadelphia, some years ago, published an account of poisonous honey, supposed to be produced by poisonous plants, as *kalmia augustifolia*, or dwarf laurel; *kalmia latifolia*, or great laurel; *kalmia hirsuta*, a pretty little shrub of the Southern States. Other plants, in the opinion of Dr. Barton, produce unwholesome honey, such are Pennsylvania mountain laurel, and the *Datura Stramonium* or Jamestown weed. These plants ought to be extirpated from the vicinity of bee establishments.

Bee Bread. During the summer, and till late in autumn, bees bring home in the hollow of their legs a substance of a yellow, redish or pale color in considerable quantities. This is the farina, or pollen, obtained from various sorts of flowers of plants. This is commonly called *Bee Bread*, and was formerly supposed to be wax. But it is now known that no elementary principles of wax reside in pollen, it is collected solely for the purpose of feeding the young brood, and the perfect bees never live upon it, but the workers take it grain by grain in their teeth, and transmit it to the mouths of the larvæ. The combs are constituted of wax, which owes its origin to honey, or it may be formed from sugar, the saccharine part of which constitutes one principal ingredient in honey. As an article of food honey, when immediately used, is

pernicious to weak stomachs, in which it readily ferments, and occasions flatulency. It possesses, however, salubrious properties; as a medicine, it is a very useful aperient and expectorant, especially when it has been boiled, in which state it may be used with safety and advantage, by asthmatic patients, to promote expectoration of tough phlegm.

Honey comb, wrapped in paper, and kept in a cool place, may be preserved entire during the whole winter, or it may be better preserved in the boxes in which it is made, allowing it to remain exactly as the bees placed it.

To separate the honey, let the comb be cut in small portions and suspended near the fire, or in the sun, in a canvass bag; or let it pass three or four sieves, one always finer than the other, placed over each other. The wax may be purified from the comb, by putting the comb, tied up in a linen or woollen bag, into a vessel of water over the fire; as the heat increases the wax liquefies, and escaping through the interstices of the bag, rises to the surface, and may be skimmed off, while the refuse is retained behind. It may be well to place some weight on the bag, or pebbles within it, to prevent it rising to the surface.

CHAPTER V.

Swarming.

There seems to be no satisfactory cause assigned by authors for the swarming of bees. According to common apprehension, swarming ensues in consequence of a hive being overstocked with numbers, and from a young queen seeking a new dwelling, where she may be placed at the head of a colony.

It is certain, indeed, that when bees are accommodated with apartments sufficiently capacious, they are less frequently disposed to desert the parent hive in quest of another habitation. Still, the want of room cannot, in all instances, be the sole cause, and instead of the young queen, it is always the old one that leads out a swarm, and the same old queen that leads out a swarm this year, will be found at the head of the first which leaves the hive the next year.

An old queen never leaves her hive until she has deposited eggs which will become future queens, nor until her principal laying of eggs producing drones is over. Bees rarely swarm before the month of May, nor after July. The earlier swarms are commonly considered the most

valuable, as they have more time to provide a stock of honey, and they frequently send out new swarms the same season. It is not uncommon for an old hive to send out two or three swarms in one summer.

It is only on a warm and clear sun shine day that swarming takes place, and most frequently between ten and three o'clock. Should the sun be obscured by a cloud, their swarming process is most certainly interrupted, and they await the moment when he shines forth in full lustre.

With regard to the signs of swarming, there is no infallible guide; those precursors on which bee masters are accustomed to place the most reliance, frequently prove fallacious. According to Reaumur, a very accurate naturalist, the signs are first, the appearance of drones, for no swarm will proceed from a hive where there are none; secondly, when the bees are so numerous that part crowd about the outside of the hive, or lodge on the board in clusters of thousands; and thirdly, which is the least equivocal sign of the day of swarming, when fewer bees than usual go abroad for collection, and return without honey or wax.

Most observers also affirm that in the evening before swarming, an uncommon humming or buzzing is heard in the hive, and a distinct sound from the queen, called *tolling*, or *calling*. The bees suddenly appear in great numbers at the mouth of the hive, and rush out in a tumultuous manner, and with a buzzing noise, rise into the air in innumerable multitudes, flying in all directions, and the entrance of the hive appears to be deserted. After wandering about for some minutes, the queen and her suite alight on some neighboring shrub, or branch of a tree, and the whole posse gradually unite round her in a large solid clus-

ter, clinging to each other by their legs. If the swarm rise high in the air, it frequently indicates their inclination to take a long flight, and notwithstanding every effort to retain them, they fly to a great distance, and no trace of them can be discovered.

As they fly in a straight line after they have taken their direction, they may be pursued, but the place of their settling is very uncertain, and they frequently fly to the distance of several miles, and so rapidly, that they are scarcely to be perceived.

It has often been attempted to divert their course by beating on pans, or ringing bells, but these produced no effect in checking their flight; throwing water or sand, and dust among them, may sometimes, by reminding them of rain, induce them to return to the hive. One chief cause or concomitant of swarming, says Huber, apparently consists in the agitation of the queen. She is suddenly affected, hastily traverses the combs, abandoning that slow and steady progression which she ordinarily exhibits; her agitation is communicated to the bees; they crowd to the outlet of the hive, and the queen escaping first, they haste to follow her.

Commonly the whole take but a short flight, and the queen having alighted, the bees cluster around her. This constitutes the new swarm. Huber states that the agitation of the females excites commotion in the workers, which increases their animal heat, and raises the temperature of the hive to such an insupportable degree, that they are compelled to leave it.

In a populous hive, where the thermometer stood from 92 to 97 degrees in a fine summer day, it rose to 104, during the tumult which preceded swarming. The extra-

ordinary instinct and precautions so conspicuous in bees, are apparently affected during the period of swarming. On issuing from the hive, bees appear to have no object in view. After rising in the air it is commonly some tree that arrests their progress, and wherever the queen alights, the bees will cluster around her. But they frequently alight on the grass, although trees may be near; and the present season swarms have twice attached themselves to the upper rail of a post fence. If a hive swarm oftener than once, the new swarms are led out by young queens, as there are usually several in the royal cells in every hive. The young swarm, whether removed from the place where it settles or not, soon begins to work; cells are constructed of wax from the honey the bees have carried along with them; and nature has so arranged it, that the first eggs laid by the queen produce the operative part of the community.

CHAPTER VI.

Hiving Swarms, and transferring Bees from one Hive to another.

In the swarming season, constant attention and watchfulness should be kept over the apiary; if it consist of a considerable number of hives several swarms may be expected every fair day. Empty hives or boxes should be in readiness, and they should be perfectly tight and clean in every part. It is commonly the practice to rub the inside of the hive with aromatic herbs, a solution of salt, or other substance, but the most experienced bee masters deem this altogether unnecessary, as it can be attended with no advantage whatever. The bees are not accustomed to such materials while in the parent hive, and all extraneous matter creates for them unnecessary labor, as they will not suffer the smallest particle to remain in the hive; a sprinkling of milk and molasses may be acceptable to them. All they require, is a clean, dry hive, free from mustiness, and of a proper size. It is convenient to place a table in the shade near the swarm, and when they are quietly settled on a branch of a tree or shrub, one person holds the hive immediately under the swarm, and an as-

sistant gives the branch a sudden shake by which the bees fall into the hive, or if the branch be small it may be carefully sawed off and placed on the table, and the hive instantly set over it, but the hive should be raised a few inches, by sticks placed under it to allow the straggling bees to enter. Should the swarm settle on some inconvenient place, as the eaves of a house, or trunk of a tree, they must by some means be carefully brushed into the hive. Some persons have the address to take the queen from the midst of a swarm and put her into the hive, when the whole swarm will immediately follow. It not unfrequently happens, that from some caprice, or dislike of the hive, the whole swarm will abandon it, and again alight on the branch from which they were taken; in such case they must be reconducted into the hive, even the second or third time if required. Should they return to the parent hive, they will issue from it again in a few days. It sometimes happens that a swarm will settle on a tree in two separate clusters, or a double swarm settle together; this indicates that two queens have left the hive, and that each one is accompanied by her particular adherents. But as no swarm can be too large for one colony, these may all be put into one hive and the queens must decide which shall have the sovereignty. In the evening the new hive containing the swarm should be carefully placed on the stand in the apiary. Although bees are less disposed to sting during their swarming than at any other time, persons hiving them, should always be provided with such dress as will effectually secure them from their stings and particular care should be taken not to injure or irritate them. The most convenient defence will be a covering of millenet or other open stuff, put over a hat, or a wire frame

enclosing the whole head and neck, and a pair of woollen gloves drawn up over the wrist. When approaching bees, the smoke arising from burning leather, is perhaps the most effectual means of quelling their turbulence, and rendering them perfectly mild and harmless. But nothing is more offensive to bees than the human breath, you may blow upon them with bellows, without offence, but breathing on them excites their greatest rage. Should bees on any occasion make an assault on a person, it will avail nothing to oppose or fight them, it is safest to stand in one position or to walk moderately away from them. The following singular incident, is recorded by Thorley. "One of my swarms settled among the close twisted branches of an apple tree, and not to be got into a hive without help, my maid servant, being in the garden, offered her assistance to hold the hive while I dislodged the bees. Having never been acquainted with bees, she put a linen cloth over her head and shoulders, to guard and secure her from their swords. A few of the bees fell into the hive, some upon the ground, but the main body upon the cloth which covered her upper garments. I took the hive out of her hands, when she cried out the bees were got under the covering, and crowding up towards her breast and face, which put her into a trembling posture. When I saw the veil was of no further service; she gave me leave to remove it; this done, a most affecting spectacle presented itself to the view of all the company, filling me with the deepest distress and concern, as I thought myself the unhappy instrument of drawing her into so imminent hazard of her life. Had she enraged them, all resistance would have been vain, and nothing less than her life would have atoned for the offence. I spared not to

use all the arguments I could think of, and using the most affectionate entreaties; begging her with all earnestness in my power to stand her ground, and keep her present posture, in order to which, I gave her encouragement to hope for a full discharge from her disagreeable companions.

I began to search among them for the queen, now got in a great body on her breast, about her neck, and up to her chin. I immediately seized the queen, taking her from among the crowd, with some of the commons along with her, and put them together into the hive. Here I watched her for some time, and as I did not observe that she came out, I conceived an expectation of seeing the whole body quickly abandon their settlement; but instead of that, I soon observed them gathering closer together, without the least signal for departing. Upon this, I immediately reflected, that either there must be another sovereign, or that the same was returned.

I directly commenced a second search, and in a short time, with a most agreeable surprise, found a second, or the same. She strove by entering further into the crowd, to escape me; but I reconducted her, with a great number of the populace, into the hive.

And now the melancholy scene began to change to one infinitely more agreeable and pleasant. The bees missing their queen, began to dislodge and repair to the hive, crowding into it in multitudes, and in the greatest hurry imaginable; and in the space of two or three minutes the maid had not one single bee about her, neither had she so much as one sting, a small number of which would have quickly stopped her breath."

It is agreed by all experienced apiarians that nothing is more important than to have large strong swarms in a hive and when a swarm is too small, two or more should be united. It is recommended by some, that when swarms are united, the supernumerary queens be sought and destroyed; but this is often impracticable, and according to others, it is not absolutely indispensable.

Bromwich, an intelligent writer, states that he had three straw hives of bees standing separately in an enclosed shed. These happened to be blown down by a violent wind in the winter; the weather being very cold, prevented the bees from flying much abroad, but from the position in which they fell, they all accidentally united themselves into one hive, without the loss of a single bee. He immediately raised them on a large flat-topped hive, in order to give them room, which answered the desired purpose beyond expectation; they continued to live in harmony and friendship, and produced the next season more than double the usual profit.

He expresses a belief that all the three queens were reconciled to live in harmony together, and adds, "I have proved it beyond a doubt that more than one queen bee will live in the same colony, or raised boxes, by the many experiments I have made of dividing collateral boxes to increase their numbers."

It is absolutely necessary that the animal heat generated in the hive, should be sufficiently confined, which cannot be the case in a small swarm. The bees, therefore, in each swarm, cannot be too numerous; and it may be confidently affirmed that the cultivator will find much of his success depend on the number of workers contained in a single hive. It appears that bees are discouraged by the

smallness of their numbers ; that when greatly reduced, their instinct is affected, they labor sluggishly, they cease to keep guard at the entrance of their hive, and testify more indifference for their own fate, and that of their young.

It is probable that the advantage lies in a numerous swarm, besides augmenting the temperature of the hive, in having larger classes of workers to perform all the functions required, by which they make greater collections in a shorter time.

The junction of two or more swarms into one, should be performed when the period of collection draws towards a close, and perhaps it may be safest to sacrifice the supernumerary queens when practicable. By this expedient it will be seen that the feeblest swarm will be enabled to subsist through the severest winter, which by itself must have perished ; and if the operation be performed early in the season, their collection of honey will be very abundant.

In every apiary, the empty hives should be weighed and marked, that the quantity of honey within may be, at any time, ascertained.

The practical directions which have been given for the weight of a good swarm, are not, perhaps, perfectly accurate ; writers differ in regard to their estimate of the number of bees required to weigh a pound. A swarm weighing four pounds, is supposed to contain about 20,000 bees, and swarms under four pounds should be rejected as stock hives ; but the best swarms seldom weigh more than six pounds.

According to Reaumur, a very fine swarm which left one of his hives, consisted of 43,000 bees, and weighed

eight pounds. Thus there were, according to him, 5376 in a pound of sixteen ounces.

Bonner, who was famous as a practical operator in uniting swarms, says that his mode may be practised in the middle of the day with little danger, having himself taken off four swarms in one forenoon, without receiving a single sting.

He directs that the mouths of two hives of equal size, the lower one full, and the upper empty, be applied to each other, and a sheet, or large cloth put round them to prevent any bees escaping. The undermost hive must then be rapped with sticks in a manner a drum is beat, rapping chiefly on those sides of the hive to which the edges of the combs are fixed, and avoiding the parts opposite to the sides of the combs, lest they should be loosened, and, by falling together, crush the bees between them. The bees soon run into the new hive, for the noise and concussion, by the rapping, alarm them, and they endeavor to escape to a safer habitation.

When the bees are thus removed into the new hive, it may be placed where the old one stood, which will collect all the bees together, and within ten minutes they will begin working the same as any natural swarm. In the same manner, three swarms may be united.

There is likewise another method, easy and simple, by which swarms may be united, which consists in spreading a cloth at night on the ground near a hive where two new swarms are to be joined; one of them is to be put on a stick laid across the cloth, then give the hive a few smart blows, and the bees will drop in a cluster. The other hive containing bees should now be expeditiously tak-

en from its board and set over the bees, which will speedily ascend into it, and unite with its inhabitants. By the means here described, a swarm may be increased to any desirable extent. And by the same method, bees may be driven from a hive full of honey, for the purpose of obtaining the contents, and a new hive given them as in the case of a new swarm, provided it be done in May or early part of June, allowing them time to collect a sufficient stock of honey for the ensuing winter. Or take a hive of the same size with the one which contains the bees; bore a number of holes on the top and place the full hive upon it. The bees will soon descend into the lower hive and fill it with honey. The entrance of the upper hive should be closed, and that of the other left open. In the autumn drive the bees by means of smoke, or by striking on the outside, into one hive, and remove the other with the honey it contains, instead of suffocating the bees with burning brimstone.

It has on some occasions been found almost impracticable to reconcile two stock hives when united together; but we find in the Quarterly Review for June 1828, an easy method of accomplishing the object, suggested by the Rev. R. Walond. "He procured a plate of tin of the size of a *divider* and thickly perforated with holes, about the size of those in a coarse nutmeg grater.

Having confined in their respective hives or boxes, the two families to be united and placed them over each other, with only a divider between them, he introduced his perforated tin plate, and withdrew the divider. Immediately the bees began to cluster, with hostile intentions; one family clinging to the upper the other to the under side

of the perforated plate, when after remaining in this state for about twenty four hours, the bees, the plate being removed, mingled together as one family, no disturbance being excited, but such as arose from the presence of two queens; the custom being always, in such a case, to dethrone one of them." 'Mr. Walond ascribes the success of this experiment to the production by confinement of a *common* odour, each swarm having, as he supposes, a peculiar smell by which its individuals are known to each other.'

The following article has recently appeared in the newspapers. "The cruel system of smothering bees may now be totally dispensed with, by a plan recently adopted with complete success, it is called "*driving*," and is easily accomplished; thus, at dark, place a metal pot near where the old hive stands, have a new hive prepared with cross sticks, and cream and sugar smeared inside; invert the old hive into the pot, and quickly place the new one over it; tie a cloth round the meeting of both hives, so as to prevent any of the bees escaping; then keep striking the bottom of the metal pot with an iron instrument, and in less than ten minutes all the bees will be driven by the sound from the old to the new hive; then untie the cloth, and lift the new hive to the place where the old one stood, at the same time quickly covering the honey hive with a cloth to prevent any of the bees returning to it. In the morning, lift a corner of the cloth so as to make a small aperture to let out any of the bees that may have been retained."

We are not informed at what season this operation is to be performed, but unless it be done early in the sum-

mer, the bees thus deprived of their honey, must famish during the ensuing winter.

Artificial Swarms.

There are several advantages to be found in forming Artificial Swarms; by this method we avoid the inconveniences which attend the procuring swarms in the common way. Schirach relates that having expelled a queen and a number of her subjects from a hive by smoke, he resolved to attempt to rear a new queen, lest he should lose his hive. For this purpose he introduced a comb consisting of three kinds of brood. The next morning he discovered the absent queen among a cluster of bees, which he returned to the hive, and she was joyfully received. "What was my astonishment" he proceeds "when wishing to introduce her among the combs, I saw that the bees remaining had already planned, and almost finished three royal cells. Having carried away two of the cells, to ascertain whether the bees would continue their operations, I beheld the next morning, with the utmost surprise, that they had removed all the food from around the third worm left behind, on purpose to prevent its conversion to a queen."

A discovery of this kind of transformation soon rendered the art of making Artificial Swarms easier and less expensive. Schirach showed that its success depended solely on having a single royal cell occupied by a worm three days old, instead of providing the bees with large combs

containing the three kinds of brood as before supposed necessary. He proposed several improvements in procuring artificial swarms, but did not claim the invention as his own, as has been asserted.

Two methods are practised for the purpose of obtaining artificial swarms; the one on a large scale, more general and complete, which was unknown to Schirach, who imitates the other. The hives are oblong wooden boxes, both ends of which are moveable. Early in spring the operation is performed. The hive being taken to some distance from the apiary, the farther end is opened, and the bees are driven forward by means of smoke, when some of the combs commonly containing honey, are cut out. Next they are driven back to the farther end, and a certain number of the combs are taken from the anterior part, some empty and some full of brood of all ages. The latter are then put into a new hive and by means of rods, inserted through them from without, they are established in the same order that they held in the old hive. After this is done, the new hive is conveyed to the station which was occupied by the old one, and the latter is removed fifty paces from the apiary. The bees now returning from the field, and finding a hive like that which they had left, lodge themselves there, rear the brood, and prosper.

The success of this operation, amply confirms Schirach's theory.

Another method is to take the hive destined for the purpose, carry it to a dark place, already containing another, in which the new swarm is to be received. Part of the bees, together with their queen, are forced to take refuge in this new lodging, by means of smoke; after which the old hive

is replaced in its former situation, that it may be repeopled by all those returning from the fields; and the new one is established at a suitable distance from it in the apiary. This colony, possessing a queen, can prosper without any foreign aid, and enjoys the advantage of the flourish of the fruit trees, which is sometimes denied to the earliest natural swarms.

This method is practised by M. Lombard whose cylindrical straw hives facilitates the process. This method being founded on the production of a queen in a hive containing only brood, is a farther corroboration of Schirach's doctrine, for its long practice has been always attended with success.

Experiments and theory, therefore, concur in demonstrating that the larva of a bee may become a queen, or a worker, according to circumstances.

Thus we owe one of the most curious discoveries which has embellished Science to the penetration and perseverance of Schirach."—*Huber*.

Artificial swarms may be formed as follows: Take a well stocked hive of four boxes; in some of these, particularly in the two lowermost, if they are well filled, there is certainly a young brood; for in these lower boxes the young bees are accustomed to change from the crystalis, to the perfect state, about the end of April, or beginning of May, if the hive be very full; otherwise, this change does not take place till towards the end of May, or even the middle of June. At that time, a fine serene day, but not excessively hot, must be chosen, and about eight or nine o'clock the hive must be divided into two in the following manner; between the two upper boxes and the two lower ones, force in a slider, so as to separate the box-

es sufficiently for the comb to be cut by drawing through a piece of iron or brass wire. An empty box should be prepared in the place where the hive is to stand; a cover must also be at hand, and as soon as the hive is divided in two parts, the upper boxes must be taken from the lower ones, and the cover must be immediately put upon the latter. The upper boxes are to be placed upon the empty one just mentioned, so that a hive will there be formed of three boxes. The lower boxes on which the cover was put, must be left at rest till evening, at which time a third may be placed under them; and when it appears that a proper quantity of work has been done in the lower box of either hive, a fourth box may be added under the others."

It has been suggested as desirable, that bees might be so managed as to supercede their sending out swarms as usual, that the owners may be spared the trouble of hiving them; but the following facts will illustrate the inutility of thus deviating from nature's course.

In the *New-England Farmer*, vol. 6, p. 290, we have the result of an experiment for that purpose. It is stated that "Mr. E. Williams, of Ashfield, so managed a hive of bees as to prevent their swarming; and having kept them six years, took them up, and after making half a barrel of metheglin, had 293 pounds of strained honey, and 91 do. of excellent honey in the comb, making 384 pounds. He also had 47 pounds of bees wax. Mr. W." says the writer, "sometime since related to me some particulars respecting this extraordinary production. He bought a swarm of bees of middling size, and having no convenient place near his house where he could set them, he built a

shelter several rods distant, so situated that they might swarm and go off without being discovered.

To prevent their swarming, he added other hives to the original one in the following manner: first making a large hive with a hole through the top, three or four inches square, on which he placed his hive of bees, having a hole two inches square to the right and left sides of the new, or lower hives, at the bottom, then made other large hives with holes through two sides, similar to the first, with *cleats* nailed around each of these holes, so as to come in exact contact with each other when placed on the stand, and in this way connected them together, giving the bees a chance to pass and repass through the whole range of hives, having them go in and out at the front of each, as they found most convenient. By this kind of management, his bees spread and increased, and soon became a numerous and powerful community."

The writer of the above relation, speaks of the yield as being an extraordinary and valuable production. He would be astonished were he to make an accurate calculation of the profits which would have been realized had the hive been permitted to pursue the natural course, by sending out swarms. The following computation it must be admitted, is within the bounds of fair probability.

Begin with one swarm, and allow the progressive increase to be one swarm from each of those which have become one year old. At the end of six years you have 63 swarms. From each hive, if of a large size with boxes, might have been taken the moderate quantity of 25 pounds of honey annually. At the close of six years the

aggregate amount would be 1515 pounds of honey; to this add the wax and metheglin. The 63 swarms of bees could not be valued at less than 315 dollars. This great community, this very valuable stock was consigned to suffocation by fire and brimstone, and Mr. W. realized for his six years attention, less than one quarter of the amount of profit which would have accrued from the same stock had they been allowed to follow their natural course.

The above estimate is exclusive of extra swarms, which frequently issue from old hives, and from new swarms of the first year. These items may be set as a counterbalance to all casualties and incidental expenses. It would gratify curiosity could it be ascertained what number of hives the bees of Mr. W. occupied eventually, and whether independent colonies headed by queens were formed; but the probability is that the whole continued united under one sovereign. My own experiment the past summer affords no encouragement to prosecute the scheme of interrupting the natural swarming of bees. Having placed empty hives in contact with those containing bees, with apertures of communication, they occupied the hives as *drawing rooms*, during the summer, and prevented swarms forming; but in autumn they all returned to the parent hives, having made no comb, except a small quantity in one of the hives. The principle is a substantial one, that bees will not prosper unless they are furnished with queens, and I am not endowed with the gracious prerogative of elevating females to thrones.

Notwithstanding my failure in the experiments above mentioned, I should not despair of success in further attempts to propagate bees without their sending out swarms. According to the discoveries of Schirach and Huber, it is

a demonstrated truth that a hive furnished with comb and young brood, will not remain long without a queen. If therefore bees will take possession of an empty hive and pursue their labors in constructing comb, I can see no reason why a queen from the parent hive should not deposit her eggs in the cells and a young brood be generated.

Should such process be ascertained to have taken place, I should have no hesitation in separating this from the parent hive with the expectation that a queen would soon be produced, and an independent family established. If swarms can be multiplied by such process, it would be an acquisition of immense importance, as superceding all the trouble and anxiety which attend the operation of natural swarms, and the loss frequently occasioned by their flight into the woods.

CHAPTER VII.

Situation of an Apiary and Pasturage.

An apiary should be situated in a quiet, sheltered place, where the bees may perform their labors totally undisturbed. It should not be encompassed by high walls, or thickets, which would impede the progress of the bees on their return heavily laden to their hives. The ground in front of the hives should be kept clear of weeds and grass, which afford a harbor for vermin. The apiary should be situated at a convenient distance from the dwelling-house, that it may receive the proper attention. For the facility of swarming and hiving, it is better to have low trees and flowering shrubs, than lofty trees in the vicinity.

It has generally been recommended to give an apiary a southern or southeast aspect, but it is now considered to be of little importance whether any particular direction be selected, as bees will flourish and make their collections whatever may be the position of their dwelling. But it is of the greatest importance that an apiary be so situated, as to afford an extensive range of pasturage, abounding in trees, shrubbery, and flowers. It would be no less absurd

to expect well fattened herds and flocks, fed on a barren soil, than to expect honey and wax from bees limited to districts destitute of melliferous blossoms and flowers. Nor should cultivators suffer their pasturage to be overstocked with numbers of swarms; a small number of well fed hives will prove more productive than thrice the number of weak, meagre, ill provided colonies, if kept in one vicinity. Bees will, it is true, traverse a distance of a few miles in pursuit of flowers, but the shorter the distance they have to traverse, the greater will be the produce of their labors. But another evil attending their flight to distant places, is their exposure to be caught by birds. The blue bird, king bird and martin, keep a vigilant watch for bees on the wing, and swallow them by dozens. In countries where large numbers of hives are kept, it is not uncommon to change the situation of an apiary as the flowers around it decrease. The practice of transporting hives is common in Scotland; persons in the vicinity of Edinburgh, yearly send their whole stock to the Highlands for fresh pasturage. In France hives are transported either by land or water, floating bee hives are very common there; one barge contains from 60 to 100 hives, which are well defended from the inclemency of the weather. Thus the owners float them gently down the stream, while they gather their honey from the flowers along its banks; by land they are transported in spring carts made for the purpose, sometimes halting near fertile fields for the bees to feed. A single bee house yields the proprietor a considerable income. The Egyptians also transport their bees on a large scale on the river Nile.

The hives belonging to different villages are collected, and stowed in boats prepared to receive them. The boats slowly ascend the river, stopping on the way to allow the bees to make their collections on the banks. Three

months are occupied in the voyage and return, when each hive is delivered to its proprietor, whose name has been affixed to it. In one of these bee voyages, a hive being accidentally overturned, the enraged bees so mutinously attacked the seamen that they were glad to leap overboard and swim to the shore, which fortunately was not distant, and the mutineers kept possession of the vessel.

But expensive bee journeys and voyages are altogether unnecessary in our country. Our climate, and our productions, are admirably calculated for the profitable employment of bees. - Every village and every town can support a hundred fold more bees than now have existence among us. The trees which afford honey in greatest abundance, are the different species of willow, maple, chestnut, and the lime or linden tree: but above all, the various kinds of fruit trees when in blossom, especially the white mulberry, peach, apple, palm and cherry. The shrubs and plants are raspberry, strawberry, mignonette, thyme, crocus, white clover, and heath. The blossoms of red clover and the honey suckle, are rich in nectary, but it is placed beyond the reach of the proboscis of bees. Buckwheat is a plant from whose flowers honey may be obtained in great abundance, but it is of an inferior quality, being of a brownish color, and unpleasant flavor, but it comes late in the season, and will answer very well for the winter store of the bees. The wax obtained from it is very excellent.

Waldridge, a German writer, says he saw forty large bee hives filled with honey, to the amount of seventy pounds each, in one fortnight, by their being placed near a large field of buckwheat in flower.

Bonner affirms that he has often seen a hive, by being placed near a range of heath, become ten, or even fifteen pounds heavier in the month of August.

Those who depend on great profits from an extensive bee establishment, should cultivate in their gardens such plants as afford honey in greatest abundance. The first to be mentioned is the mignonette; this affords honey in plenty, and of the finest quality. The bees are very partial to it, and it may, by repeated plantings, be kept in blossom till late in the season which is very advantageous. It is so much a favorite flower among the bees, that they resort to it from a distance; but it ought to be planted near their hives in the garden.

Bromwich, an experienced apiarian, relates that in the year 1779, he planted a great quantity of it in front of two bee hives, at a considerable distance from any other bees. With such abundant supplies as the flowers afforded them, few ever left his garden.

In September he took the honey, and found it exceed, by above a third what he obtained from any other two of his best hives, where the bees were obliged to fly further, and it was equal in fragrance and color, to honey from any country.

Another plant, rich in nectary, is the *Crocus*, in its various species. This is a bulbous rooted plant which ornaments our gardens, and is among our earliest flowers, and multiplies rapidly. An elegant writer in the *North American Review* for October, 1828, extols the *crocus* as producing a handsome flower, and affording a rich feast for bees.

It remains to be observed that water is an essential article among bees; they cannot subsist and nourish the young brood destitute of water. When running brooks are not to be found near an apiary, small shallow rivulets

should be provided for their use, with small stones or sticks for them to stand upon.

Bee hives should be carefully protected from the heat of the sun in summer, as it is frequently so intense as to dissolve the adhesion of the comb, which in its fall crushes the bees, and the hive is ruined.

CHAPTER VIII.

Best constructed Hives and Boxes.

It is a point of no small importance, as regards both profit and convenience, that the apiarian construct hives of the most *improved* construction. A vast variety of hives and boxes, have from time to time been employed, regulating according to the ingenuity or fancy of the inventor. We have been made acquainted, with many instances of bees having voluntarily lodged themselves in garrets, and other apartments, in dwelling houses, in the hollow of trees and cavities of rocks where they have accumulated honey most abundantly.

An instance may be mentioned of a swarm, having, three years ago, entered a garret through the crevice at the eaves of the house, and attached themselves to the chimney at the gable end. They have increased considerably in numbers, and have extended this comb down about five feet, the whole breadth of a large old fashioned chimney, and so completely occupied the space that there appears to be more than enough honey and comb to fill a barrel, besides what has been taken for the use of the family. They have

never swarmed, nor attempted making a new settlement, as they have ample room in the dark garret.

The prosperity of bees in such situation may be explained, perhaps, in part, from the greater heat preserved in an upper apartment during summer, and the warmth from the chimney in winter.

Heat is the great principle which animates insects, and cold is the bane of their existence. Heat has great influence in promoting the hatching of the young brood in the spring, by which the colony is rendered more numerous.

Much has been said of the fittest size and form of a hive and of the materials of which it should consist. Those composed of wood, straw, husks, and osier, have been at various times recommended; but at present, sectional boxes placed in tiers, one above another, or hives provided with boxes on the tops, are generally considered preferable. The chief points to be regarded in the choice, are

1st—It should be of a proper size, proportioned to the swarm, and capable of enlargement or contraction, as occasion may require.

2d—It should be constructed in such manner that the produce may be, at any time, removed, without injuring or disturbing the bees.

3d—It should be made of suitable materials, internally clean and smooth, and free from flaws and cracks.

The old fashioned clumsy hives, so formed that the honey cannot be taken out without destroying the bees, and those also composed of straw, or osier, should be forever discarded, and good deal boards should be the only material employed.

The hive which I have adopted from Dr. T. Willington, of West Cambridge, and which I view as superior to most

others, is $13\frac{1}{2}$ inches square in the clear, and 18 inches high. Two cross bars are placed inside, as usual, but about six or eight inches from the floor to which the bees attach their combs. About ten or eleven inches from the floor, parallel bars or slats, half an inch wide, and half an inch apart, are placed horizontally across the hive, thus making two apartments. Nine boxes, four inches and five eighths of an inch square, open at the bottom only, are set in at the top of the hive and rest on the bars or slats. Or instead of nine, four boxes of such size as to fill exactly the upper apartment may be used. These should be made of boards of about three eighths of an inch in thickness; those of the first size above mentioned will each hold one and an half pounds of comb and honey. Over these boxes should be placed a lid, as a top of the hive, provided with hinges. The bees enter at their door, as is usual in other hives, ascend between the horizontal bars into the several boxes, and fill them first with honey; then the space below the bars, which is always enough to keep them well through the winter. The small boxes may be taken out at any time, when filled with honey, and their places supplied with empty ones. Bees, thus managed, swarm regularly, and increase rapidly. The plan succeeds perfectly well, and affords the owner a handsome share of the finest honey in the comb, free from bee bread or young bees, and of the most delicate whiteness, and delicious flavor. These boxes are usually filled three times in a favorable season, besides the honey in the lower apartment reserved for their winter store. The hive above described may be improved by employing drawers or sliding boxes to be withdrawn at the backside of the hive. Let the partition be made of board instead of bars, having

two apertures about three or four inches long and one wide. Over these place two drawers, side by side, of such size as to occupy the whole of the upper apartment, and having corresponding apertures at the bottom for the ascent of the bees. The cover should be confined by screws that it may be taken off for the purpose of removing its contents. When filled with honey, a thin slider of steel or brass must be introduced beneath to divide the comb and confine the bees while the full drawer is exchanged for an empty one. A glass window in each drawer may be found convenient for the purpose of seeing when it is filled, but it must be blinded on the outside by a slider of wood.

I have this season, 1828, taken out the boxes well filled, about the first week in June, July and August, amounting to about thirty eight pounds, from an old hive; a young swarm cannot afford so much, without stinting them for the winter. On approaching the hives to receive the rent, it is best to close the entrance to prevent the bees rushing out; turning back the lid I pass a common table knife between the boxes to loosen their adhesion, then having an empty box in my left hand, I lift out the full one and quickly supply its place before the bees can rush out through the vacancy.

By this management I seldom receive a sting. There is commonly found ten or a dozen bees in each box with the honey, these may be shaken out, or the boxes may be carried into the house and placed near an open window and they will soon escape. There is one only inconvenience attending the use of these boxes; When lifting them out, the comb is apt to separate higher up than the bottom of the box so that they do not come out quite full. To remedy this evil, I have fixed strips of tin, half an

inch wide, across at the bottom of the boxes from corner to corner, confined at their ends by small screws that they may be removed for the purpose of taking the comb out of the boxes; and this answers perfectly well. From experience, therefore, I am decidedly of opinion that this apparatus is far preferable to any other hive which has fallen under my observation.

It has been said that it is secured by patent, but the patentee is unknown to me. Sectional boxes, of convenient size and form, placed above each other, are well adapted for taking the honey with facility, and the purest honey free from bee bread and the young bees. The boxes are made of well seasoned wood, nine inches long; the same in breadth, and eight inches high; but exactness in dimensions is not important. In the roof there is a communication hole, three inches square, on which is placed another box of the same size; others may be raised above this to an indefinite height; and the bottom of each is provided with an opening like the mouth of a common hive, for the passage of the bees.

When a swarm is lodged in a box, if only two be used, it is immediately to be put over an empty one, as the bees must have more room; and if more than two are used, a new one is successively to be applied below. The bees, beginning from above, will soon fill the upper box with honey; and it is then to be separated from that beneath it, first drawing through a thin long pliable knife to cut the comb. The communication hole of the lower box must then be covered with a board, and the box separated, carried to a distance, where the bees remaining in, it may be dislodged by turning it up, and rapping on its sides with a small stick.

The proper time for this operation, is at sunrise, or in the evening. Collateral boxes have also been proposed, from the belief of their being attended with greater advantages to the bees. The size is nearly the same with that above mentioned. There is a communication hole in the side, and an opening low and wide below, in the sides applied to each other, to allow the bees more ready passage. The following is the method adopted by Rev. Mr Noyes of Needham, Mass.

Take a clean inch board, six inches wide, and saw it into pieces fifteen inches long. Four of these pieces when put together at right angles, will form the four sides of a box, whose dimensions within will be fourteen inches square, and six inches deep. At the centre of the bottom of that side which is designed for the front, make for a door or passage for the bees, an opening one and a half inch long, and one third of an inch deep. Then cover the top and bottom with pieces of board whose thickness does not exceed one sixth, or one eighth of an inch. These covers ought to project in front about one inch, to accommodate the bees with a place or stage, on which they may alight and rest. They serve as partitions between the boxes and the lower cover ought to be confined with small screws, that it may be easily removed, when the honey is to be taken from the box. The door or passage for the bees being already made, a large hole must be opened for the purpose of introducing the bees into the box, and as a communication from one box to another. For this purpose, cut a hole between three and four inches square, through the centre of each of the two covers.

Having all the boxes made in the same form and size, with holes corresponding when placed one above another, it

is immaterial which is used for the top, bottom, or centre one, as in every position there will be a correspondence and uniformity.

The top box is always to be covered with a board, not less in dimensions than the top surface of the hive, with a weight upon it to keep it in its place and prevent its warping. By having these partitions thin, the bees in each box come nearer in contact; and by having the boxes so completely closed, united only by a communication in the centre, they can be separated by a very little breakage of the comb and honey, as all the cells are parallel with the surface of the boxes, and in separating them they are cut horizontally, and not transversely. In hiving a swarm of bees, Mr. Noyes prepares two boxes for their reception; and having cut off the branch to which they are attached and placed it on a table in the shade, he places the two boxes united, with the hole in the lower box, directly over the centre of the bees; they generally indicate by their movements that they know what is designed, and take possession of their new habitation.

If they do not immediately retire to their provided tenement, he gently brushes them into the box, and as they retire into it he gradually lowers the box and leaves them no passage out but the door at the bottom.

If the bees settle upon a high branch, he suspends a table between two ladders, on which he places the two boxes, the lower one a little raised from the table, so as to give them a passage, and then with a wing brushes them on to the table when they will not fail to enter the tenement provided for their reception.

The process of diminishing or increasing the number of boxes is both simple, easy and safe. In collecting their

tribute, if it be in the morning before they have gone abroad, he closes the door upon them ; if in the middle of the day, when they are active, he approaches them with the smoke that arises from burning leather ; this will make them retreat into their hive, or leave the branch of a tree, when hiving them. It will also disarm them of all resentment, and render them harmless.

Supposing the hive to consist of three boxes, and you wish to avail yourself of the honey in the middle box, it will be necessary to be provided with four sheets of tin, or sliders made of board, one eighth of an inch thick, and twelve inches wide, and eighteen inches long, made sharp at one end, and the other secured by a narrow piece of board to prevent its warping, and as a handle to the slider. The upper box must be raised in front a little, and one of the sliders, being inserted and pushed forward, cuts off all communication between the two upper boxes ; then insert another slider directly under the first. This being done, take the top box off, and the other slider remaining on the top of the second, will confine them in the other boxes ; next insert two more sliders between the two remaining boxes, in the same manner, and the hive is prepared to be separated into three parts. Then raise the middle box by lifting it by the slider immediately under it, carrying it a little distance from the others ; then put the two remaining boxes together, insert an empty one in the middle, or on the tops, remove the sliders, let the boxes come in contact, open the doors, and give the bees their liberty.

The box containing the honey to be taken is now to be carried, while the sliders confine the bees, into a chamber,

made entirely dark, except a small opening in a window. The bees, as Mr. Noyes has discovered, are soon attracted by this small outlet through which they gladly pass, and rejoin their companions in the hive.

The process of removing the top or bottom box requires but two sliders, and is much more simple and does not render it necessary to cut off the communication between the two remaining boxes. In putting in the sliders, the boxes must not be raised so high as to permit the bees to escape.

Should it be discovered that the queen bee is in the box taken away, she ought to be taken carefully out and put into the hive.

The reader may imagine that the employment of boxes as described above is complex and tedious; but the Rev. Mr. Noyes from twenty years experience holds it in preference to any other.

Another method:

Take a box ten inches in height, twelve inches square in the clear, of good deal boards, at least one inch thick. On the top part six bars one fourth inch thick, four of them one and a half inch board, the other two, that is, the two next to the sides of the box, one inch each, so that when all placed in grooves made in the back and front parts of the box, they will be on a level with the top of the box, leaving seven interstices of half an inch space. On the top a cover is to be screwed on. A door of ingress or egress for the bees must be made at the lower part, as in common hives.

Into this box the swarm must be introduced, and when they have filled the box about two thirds full of comb, which a strong swarm will do in ten or fifteen days, then

close the entrance so that no bees can escape, unscrew the cover, have in readiness a thin slider of steel or brass, one sixteenth of an inch thick, as large as the cover which slides in between the cover and the top of the hive, which will prevent the bees escaping at the interstices until you have placed another box of the same dimensions over the one containing the bees. Then draw out your slider, and the bees will go up through the interstices into the upper box, and after having filled the lower one, and sometimes before, they will fill the new box.

When the bees have filled one or more of the upper boxes, you may take one away, closing the entrance, and introducing the slider between the lower box and the one you intend to remove. Take the box off and put an empty one in its place. The bees will leave the box of honey if carried to some distance, and striking on it repeatedly with a stick.

The lower box, well filled, will be sufficient to support an ordinary stock during the winter. Those whose curiosity leads them to view the various and progressive operations of bees, may gratify themselves by putting squares of glass into the sides of the hives, but they must be closed by sliding shutters on the outside, as light is injurious to bees in their hive. If a glass vessel of suitable size be placed on the top of the box or hive, they will soon fill it with pure comb and honey, but this ought to be enclosed from the light.

The following observations were published by George Morgan Esq. formerly of Princeton, New Jersey. (Dom. Encyclo.) "Several writers on the management of bees have given very ingenious directions for taking their new

made honey, without destroying those useful creatures. My humanity, hurt at the idea of setting fire to the fatal match, induced me to imitate their methods; particularly those of Mr. Wildman and the Rev. Mr. White, whose directions I observed very attentively, with some success; but my expectations were not gratified, as I found young broods in every hive I took, and consequently the honey obtained was impure. However, after a variety of experiments, I discovered an agreeable, safe, and easy way to take the honey without the least injury or disturbance of the bees.

My boxes are made after the manner of Mr. White's, of any well seasoned wood, ten inches in the clear; in pairs with communications at the sides, for the bees to pass freely from one box to another: a pane of glass 7 by 9, with a sliding shutter, may be put into the back part of each box, through which you may see the bees at work. Any person who can handle a saw and hammer, may make the boxes at a small expense. The communication between the boxes are at top and bottom; those at top should be three inches long and half an inch wide, to serve as streets or alleys betwixt the hives. The communications at bottom should be five or six inches long and three fourths of an inch deep, so as to afford a free passage from one hive to another. The mouth of the hive may be from three to ten inches long and half an inch deep. In the busy season, this wide entrance facilitates the bees going out and coming in, and may be contracted at pleasure in autumn.

Early the next morning after having a swarm of bees in one of those boxes, I add another to it, the door of which I close until the bees begin to work in it; when I open it to facilitate their industry.

Each box, of the above mentioned dimensions, will contain thirty pounds of honey. An early swarm in a favorable situation and season, will fill two boxes, and cast out several swarms; each of which will fill two boxes with honey. As winter approaches, all the bees collect themselves into one box and will leave the other, with its contents to the use of the owner, whose profit in good seasons, will be sixty pounds of honey, and several additional swarms, for every stock kept over the preceding winter. Fifteen or twenty pounds of honey are sufficient to keep a stock over our longest winters, but I leave them thirty pounds. Thus I obtain the purest honey, without the use of the match, or any trouble in dividing or disturbing the bees; for on turning up the hives which have no glasses, I discover, immediately, that in which the bees are collected, and I carry off the other, without a single bee in it. The losses and disappointments I have met with in a great variety of experiments, induce me to recommend this management to every lover of bees, as I have found it easy, pleasant and profitable."

Unaccustomed to sectional boxes, I cannot but indulge a partiality in favor of the hive before described. It possesses all the facilities of sectional boxes, is more simple in its management, and admits the honey to be taken at pleasure in small or larger quantities as may be desired, and with little exposure to the stings of the bees; and moreover, it affords a convenient mode of feeding a feeble swarm when required.

For the purpose of facilitating a knowledge of the economy of bees, the celebrated Huber invented a hive, ingenious in its construction and admirably adapted to the pur-

pose in view. It is called *Book* or *Leaf* *hive*, and consists of twelve vertical frames, applied parallel to each other, and connected together. The sides are twelve inches long: the cross spars nine or ten; the thickness of both the sides and the spars an inch and a quarter, which last dimensions, should be exactly observed.

A piece of comb, is introduced to guide the bees in their work, supported on a moveable slider, which may be elevated or depressed by pegs.

The comb is secured by the pegs, and the position of those corresponding on the opposite sides, as well as the whole apparatus, is illustrated by a plate in Huber's work. The twelve frames are covered by two shutters at the ends, and two frames each with a shutter, are inserted to separate the bees in forming an artificial swarm. The entrance at the bottom of each frame may be opened at pleasure; but the whole, except the first and last, should be kept close. The component frames are connected by means of hinges, and may be opened like the leaves of a book. The inventor of this hive, found it of the greatest utility in prosecuting his interesting experiments; the bees filled the hive with comb, each single block in a separate apartment, and on opening the leaves the bees were unusually tame and peaceable, admitting of the most critical inspection into the minutiae of their economy. Another important advantage attending this invention, is the great facility it affords for the formation of artificial swarms; for this purpose H. considers it incomparably the most useful and convenient of any other yet invented. But the reader, who may be desirous of further particulars on this subject, is referred to H's very learned and interesting work on the natural history of bees, third edition (Edinburgh.)

There is an improvement in bee boxes, and it may be applied to hives, suggested by Bevan. "Instead of cutting a hole in the lower edge of the box, as usual for the bees to enter, he makes a groove in the board on which the hive stands, and thus enables the apiarian to place his boxes upon his stands, in *any direction*, and renders sliding shutters unnecessary appendages of the sections."

This plan may serve as some security against the night moth, but it does not admit of such free ventilation as the old method.

It is with the greatest satisfaction that I now have an opportunity of introducing the following account from the North American Review for June 1828. "The excellent hive, invented and successfully employed for a number of years, by Mrs. Mary Griffith of New Brunswick, N. J., is likely soon to supersede every other now in use. One gentleman in this neighborhood has combined the sectional hive of *Christ* with that invented by Mrs. Griffith, and promises himself advantageous results. The description of her hive, is from the pen of the inventress."

"The Charlieshope hive, is thirteen inches square at the top; *but as the sides decrease in width to the bottom*, the base is narrower, being only seven inches on the flanks, and thirteen inches in front, and at the back. The hive is in height about twenty six inches in front, and twenty behind. Of course, the floor is an inclined plane. It is fastened behind with hinges, and at the sides with hooks and staples. The roof or cover is, like the rest of the hive, made of common inch board, with cleats screwed on the top, to prevent it from warping; the top is screwed to

the hive in two places ; three holes are bored in this cover of one inch diameter, and about a quarter of an inch apart, on a line with each other, and parallel with the front of the hive ; three holes are found to be necessary, as the bees would otherwise build in such manner as to close them and prevent their ascent to the upper box, when that becomes necessary.

The under part of the top or cover is *rough*, as the *propolis* or bee glue does not, at all times, adhere sufficiently well to a smooth surface.

Every other part of the hive is as smooth as possible, and the whole hive, box and all, is well made and joined. The upper box is thirteen inches square, and the width of a board deep, from eight to ten inches. This box is likewise smoothly planed, excepting the inside of the top board, which is rough.

The box sits snugly on the top of the hive ; the cleats are placed in such a manner on the upper surface of the cover, as to fix the box firmly.

When it is ascertained that the hive is full of honey, the plugs in the three holes are taken out. The bees may then ascend, and if the season be favorable, they will fill the box with comb and honey.

About three or four inches from the top of the front and back of the hive, are two cleats, which serve to sustain the hive in a moveable frame, made of narrow slats of wood, which enables any one to carry the hive from place to place, as the hiving and other operations make it necessary. The hives are likewise suspended by small cleats on permanent joists or scantlings of the apiary. Hives thus suspended, are out of the reach of mice, and they are too bet-

ter, on a variety of accounts. The opening and shutting of the floor allows of daily inspection. The floor can be cleaned often. The inclination of the sides and bottom allows the perspiration of the bees to flow off rapidly.

This is a great point gained, as dysenteries are induced by the absorption of such acrid matter. The slope in the floor enables the bees to remove all extraneous matter, and to defend themselves from robbers and intruders. The entrance to the hive is about three inches wide, and half an inch high. A door of wire, the meshes of which are small enough to prevent the entrance of the miller, rests behind two door posts made of needles; these needles are driven into the floor close to the entrance. The little doors are always put behind the needles as soon as the bees are in for the night, and they are removed at day light. About the middle of April, the doors are first used and they are discontinued in two months.

After the middle of June, the floors are let down, and are suffered to hang until day light, when they are *gently* raised up and hooked. The floor of the hive projects in front about three inches. Thus forming an apron or platform on which the bees alight before they enter in at the little door."

Some further particulars relative to the Charlieshope hive is extracted from the *American Quarterly Review* for Oct. 1828, reputed to be also from the pen of the ingenious inventress, as follows :

"Two rows of scantlings or joists four inches square, and running the whole length of the apiary, receive the hives between them, which are thus suspended at a distance of about three feet from the ground. By the slope

of the hive at the sides, the combs wedge themselves as they are made, and there is no use for the ill contrived crossed sticks, that are generally thrust in the old hives, to keep the combs from falling down by their own weight. The floor is, as we observed; fastened by hinges and hooks.

It is likewise an inclined plane, having a slope of at least four inches. The advantages of this inclination will be instantly seen. The perspiration of the bees, which is copious, is by the inclination of the sides and floor, conveyed off at once, without being absorbed by the boards. All extraneous matter can be carried away by the bees with very little trouble, and they can defend themselves from robbers or corsair bees with much greater ease than if the floor were flat. As the floor opens and shuts, the observer can inspect the interior of the hive at pleasure, not with the hope of getting at the minutæ of the bees' policy, but to see the forwardness of the combs, the number of the bees, and the general appearance, which a practised eye can soon understand. When the floor of the hive is left down all night, and the bees hang very low from the combs in the morning, they will soon remove themselves up again, if the floor is raised very gently and slowly, and fastened as usual. It is ascertained satisfactorily, that the young brood and the bee bread or pollen, are deposited in the hive where the swarm is first put. The holes in the cover are therefore kept shut by plugs until the hive be filled. The holes are then opened, the bees immediately pass up, and if the season be propitious, they fill the upper box with comb and honey, which, as there is neither brood nor bee bread, is of

the finest and purest kind. We have often seen forty and sixty pounds obtained by this simple proceeding ; and the box is also used to feed a famished hive in the spring. A single comb left in one of these boxes will sustain a swarm, that has eaten up all its honey, until vegetation commences.

As boxes and hives are of equal size, any one box will fit a hive.

When the combs in the hive are three years old, two of them can be taken out every winter, provided there remain honey enough in the rest for the use of the bees. Thirty weight of honey is the average quantity that suffices for a swarm of large size.

The hives in question weigh empty, about twelve pounds a swarm of bees four pounds, the wax two pounds. The whole therefore ought to weigh about fifty pounds in November.

All over this quantity can be taken out to advantage, as the wax becomes very dark after two or three years ; the whole of the combs can be thus renewed in the course of four years, as the bees replace them early in the spring.

When a swarm is to be hived, the hive is put in a moveable frame, which is easily carried to the tree where the swarm hangs, and this is proved to be the easiest method of hiving swarms ; as the screws are taken out of the cover, and the hive lifted up to the swarm into which they are shaken ; the frame and hive are then placed on the ground, and the cover is gently laid and screwed fast to the hive.

Little sticks are put against the apron and rest on the ground, serving for ladders for those bees that fell to the ground, when the main body was shaken into the hive. Bees, from the moment of their leaving the hive when swarming, until they are fairly settled, and at work in a new habitation, seem stupid and confused.

This arises, however, from the precarious situation of their queen.

If she fall into the hive when the swarm is shaken in, all the remaining bees will soon find their way to the entrance; for a peculiar sound is emitted by these insects when their queen is present.

If, however, she remain on the limb, it will be necessary to shake it again over the hive, as the bees will leave it to fly up to the place where the queen is.

When the bees are quiet in the hive, (which is ascertained by the number that are seen hovering in the front of the entrance on the wing, and by others ventilating the hive with their wings,) the top can be covered with a sheet doubled several times, to keep off the heat of the sun.

The hive must remain in the same spot until eight or nine in the evening, when two persons can quietly and gently convey it, frame and all, to the apiary, and place the hive, with great care, between the joists where it is permanently to remain.

Hives should be made and painted a year before they are used, as the smell of paint is disagreeable to the bees.

The smoother the boxes and hives are, inside and outside, the better both for the health of the bees, and for

preventing the deposit of the egg, of the miller. We must except the *roofs* of the hive, and of the box, as they should be rough; for we have ascertained that the propolis or bee glue, does not adhere so closely to a smooth surface at all times."

CHAPTER IX.

Best method of destroying or preventing the depredations of the Bee Moth.

Notwithstanding the instinctive powers and peculiar faculties of these singular insects, their capability of self preservation and defence, they have to contend with a foe of inferior grade, the *bee moth*, to whose insidious assaults they are compelled to yield all the wealth and power of their well established republics.

According to a skilful Entomologist, T. W. Harris, M. D. of Milton, the true bee moth, the "*PHALÆNA (Tinea) CEREANEA* of Linnæus," is a native of Europe, but has been introduced and naturalized in our country. Our knowledge of the history and habits of this insect is very imperfect, but from particular attention and observation, the two last seasons, I have acquired some information that may probably be improved to practical advantage and utility.

The bee moth makes its appearance in the form of a small miller, or nocturnal butterfly, about the middle, or last of April, according to the warmth of the season, and con-

tinues its depredations till September. These insects discover a peculiar disposition to molest bees, and propagate their species in or near bee hives. They are more prevalent in some situations than in others.

In some districts the stock of bees is entirely annihilated, and all attempts to cultivate them are abandoned. This pernicious insect is smaller than a bee; hence it is difficult to guard against its entrance into the hive. It is of a greyish color, paler towards the head, glossy brown or purplish near the outer margin of the wings. They have four wings, but fly but little; are frequently observed attached to some substance, appearing as if motionless, but on the approach of danger, they instantaneously leap off with great rapidity.

They effect their mischievous purpose in the night, when by the aid of a light, they may be seen in great numbers, hovering about bee hives. They deposit their eggs either within the hive, or about the edges and crevices around it. Within a few weeks, (probably three or four,) the eggs are hatched, and produce diminutive worms, or grubs, having sixteen feet, and a reddish head. Those which are not within the hive, grope their way, and enter into it through any crack they can find, and generally prefer the top of the hive; not unfrequently, with the strong jaws with which they are furnished, they cut a channel of their own size through the substance of the board into the hive.

These worms soon spin a thin web, not unlike a caterpillar, in which they envelope themselves, and cover the outside of the case with wax and their own excrements, and continue to enlarge and extend their covering, forming a

sort of long gallery, leaving an opening for the head, and while in their armour they are perfectly secure from the annoyance of the bees.

They feed on the wax and comb, devouring in their march the cells which contain the eggs and the young brood of bees, until they are wholly destroyed. Having, at length, attained their full size and maturity, the worms are changed into a chrysalis state, their bodies are contracted within their cocoon, they cease to feed, and in due time are transformed into a winged insect, the true bee moth. In this new condition, they are equally unassailable by the bees, and continue their ravages in the hive till the whole order and economy of the colony being interrupted, the bees die, or in despair abandon their hive to the victors, the first or second year of their attack.

About the middle of May 1828, I observed the bees dragging from out of the hive some of these worms, in their naked state, and on raising the hive, I perceived on the floor board a mass of matter, which I supposed was the excrements of the bees, but on inspection I discovered a web intermixed, and numerous grubs from the size of a needle's point to that of half an inch in length. These must have proceeded from eggs laid in April. I enclosed several of these grubs in a small box for experiment. They immediately spun their web tissue, in which they covered themselves, and, not long after, their bodies were contracted to a very small size without any appearance of head or legs, and showing no signs of life. On the 24th of June, one of these creatures was transformed into the genuine bee-moth, leaving its external covering; and several other transformations ensued in the box during the

months of July and August. Thus, the disgusting caterpillar, which not long ago crept on sixteen legs, and then, in its pupa state, lay torpid and quiescent in its cocoon, now flies freely through the air in elegance of form, and beauty of color. They soon pursue the same train of actions to provide for a new progeny, which had been pursued by the parent insect of the preceding year; and it is probable that two or more generations are produced the same season. Dr. Harris observes, "When these worms have attained their full size, they construct an oblong oval pod or cocoon, in which they change to the pupa. Reaumur found cocoons as early as April. I have seen them in July and August, in great numbers, clustered together in the hive. The moths, disclosed from these cocoons, seek an exit from the hive, couple, and perish after the females have deposited their eggs in a suitable nidus. They are remarkably fertile, a single female laying 400 or 500 eggs."

Methods by which the Bee Moth may be destroyed.

It is utterly impossible by any means that can be devised, to exterminate this destructive species of insect, unless the whole community will combine for the purpose, but their numbers may be considerably diminished, and their depredations in a great measure prevented. Their numbers may be diminished by placing near the hives at night open shallow vessels, containing a mixture of sweetened

water, to a pint of which add about a gill of vinegar. By sipping this liquor, they become intoxicated, and are drowned by hundreds, where they are numerous, and they should be burnt the next morning, lest, by the heat of the sun and air, they become resuscitated.

A gentleman informs me, that he has for weeks in succession taken such numbers in this way and given them to his fowls, that they were in the habit of flocking about him every morning to receive their boon. When they are collected about the hives in the evening, great numbers may be killed by beating with a broom.

When these insects are accumulated among the comb in the hive, the only remedy consists in removing the bees into another hive. If this be done in May or June, they will have time to provide a stock of honey, sufficient for their support during the ensuing winter. Otherwise, they may be put into a hive with another swarm that is rather feeble.

Methods of preventing the depredations of the bee moth.

The fact I have not seen noticed, but believe it may be affirmed, that moths of every species instinctively avoid the earth as a nidus for their eggs, as uncongenial to their nature.* The moth of the silk worm selects a dry solid

* The insect which deposits its eggs at the root of the peach tree, and is probably the parent of the apple tree borer, called *Ægeria Persica*, by the late Professor Barton, and by Dr. Harris, is excepted in the above remark, as being supposed of a different species of insects.

substance, for the purpose of depositing her eggs. The moth of the canker worm, which resides in the earth, and that of the caterpillar, invariably ascends the trees to deposit its eggs on the branches, and a smaller species, by curling the leaves, convert them into nests for their progeny. I have seen the moth which frequents our windows in the evening, in the act of laying her eggs on the window sash. It is common to see the bee moth gliding along with its curved tail on the surface of a board in the act of laying its eggs; but on the earth this process would be impeded, and the eggs, if dropped there, would be lost, and the production of grubs thereby frustrated. These insects, therefore, like all other moths, avoid the earth as a nidus for their progeny.

These circumstances considered may aid in the choice of a secure situation for bee hives. The moths generally deposit their eggs around the inner edges of the hive, and in crevices between the hive and floor board; and there is much reason to believe, that a portion of these eggs are taken up by the legs of the bees and carried into the hive, where they are hatched. If, therefore, the hives are placed on the naked ground, no such convenient place can be found, and their object would be defeated. In confirmation of this position, we have the experiments of Mr. David Chandler, (*New-England Farmer* vol. 6) whose assertions, being supported by several years experience, are undoubtedly deserving of particular consideration. The plan of Mr. Chandler is, to place the hives on the naked ground at some distance from the bee house, which he says he has practised for several years with success.

But his plan is liable to the inconvenience of shifting the hives from the stand, and when placed on the ground they are exposed to dirt and various reptiles and insects, especially toads which are great enemies to bees; and the damp exhalations from the earth would prove injurious to them. Besides, in hot weather bees require a space of board to hang upon in clusters, in order to cool and refresh themselves.

Instead, therefore of removing the hives from their stands, I should prefer the following method. In the month of April, before the moths make their appearance, let the floor board of each hive be removed and the floor of the bee house or stand be covered with earth about two inches in depth, which should be pressed down to a solid smooth surface.* Upon this, let the hive be placed during the moth season, and in autumn the floor board may be placed under the hive, upon the earth, and it may be again removed the next season.

This plan would appear to afford a complete remedy against the depredations of the bee moths. They would not it is presumed, pass over the floor of earth to deposit their eggs within the hive, and no suitable place could be found on the out side. A margin of about two inches of the floor in front might be left uncovered with earth for the bees to rest or hang upon, but this, and every other part of the hive to which the moths can have access, should be scrubbed with a stiff brush every morning, in order to remove any eggs which may have been laid the preceding night. A floor of earth would also afford the

* Or the floor board itself may be covered with earth.

advantage of absorbing any filth from the bees, and thereby conduce to their health and comfort, and moreover, obviate that peculiar odour by which the moth is allured to the hives. The utility and efficiency of this method, however, remain to be decided by further trials and observation, though I should repose more confidence in it than in any other method that has been proposed, and shall adopt it with all my hives the next season. The late Dr. Low, of Albany, recommended the expedient of suspending the hives a few inches above the floor board by means of cords, and to have the floor board moveable up and down according to the weather, for the purpose of rendering the bees comfortable. The advantages calculated upon by this plan, are depriving the bee moths and grubs of a place of concealment, and, when exposed to open view, the bee will, as supposed, destroy or remove them from the board, and at the same time a free circulation of air would be afforded within the hive.

However feasible this method may appear, its entire efficiency may be doubted, as the moths may, by the aid of their wings, ascend into the hive although suspended, and deposit their eggs in the upper part. As a substitute for cords, raising the hives by blocks of wood at their corners has been put in practice, but the blocks themselves form crevices for the lodgment of eggs, and moreover may serve as a convenient medium for the ascent of both moths and grubs. We have some reports, nevertheless, in favor of the utility of this method, but in many instances, within the scope of my inquiries, it has disappointed expectation, and some complain that the bees are much disturbed in their labors by the wind and dirt,

thus admitted. But there are other objections of no small importance. When the hives are raised the bees extend their comb downwards so low, that the hive cannot be let down to the floor without materially injuring the comb. Besides the exposure of the contents of the hive, offers a constant temptation to robbers from other hives, and the open space serves as a sort of *rail-way* to facilitate their depredations.

The following plan for an *Improved Bee House*, unquestionably affords the greatest utility, and combines all the requisite advantages.

Let a fabric be constructed of a length proportioned to the number of hives which it is to contain. The width, about sixteen or eighteen inches, and the height about three feet, with a roof sloping in front. The front part, instead of being opened, should be entirely closed, having apertures and proper distances at the bottom, to correspond exactly with the mouths of the several hives, to be placed within; at the entrance of each, a strip of board about two and a half inches wide should be fixed to serve as a platform for the bees to alight upon before they enter. The floor should be double, the upper board being planed smooth, upon which the hives are to be placed with their mouths brought in contact with the apertures in the front of the house. The whole wall on the back part should consist of doors furnished with hinges, and hooks and staples. This fabric is to be placed on posts about two and a half feet high, set into the ground to prevent it being turned over by the wind. The advantages of this structure are obvious:

1st—It forms a complete security against the ravages of the night moths, as they are deprived of all access to the

hive, and of any resting place except the little platform at the entrance, and even this may be covered with a layer of earth if deemed necessary.

2d—The hives are shielded from the intense heat of the sun in summer, which is injurious to bees, and by which the combs are frequently melted, and fall to the bottom.

3d—The hives being secured from the weather are less liable to decay, and the bees are comfortably accommodated during winter, without being excited by the warmth of the sun, to leave the hive. The doors may be shut or left open, as circumstances may require, both winter and summer.

I have now a bee house of the above description, which meets my most sanguine expectations. It is a few inches wider than my hives, and rises above them, so as to afford every convenience for placing boxes on the top, and for taking out the boxes containing honey, with little or no exposure to the stings of the bees.

Another plan for an apiary may be suggested for consideration. The hives may be placed entirely under cover, as in the chamber of a chaise house, or other outbuilding, or a house formed of cheap materials, may be erected for the purpose.

It is possible that the bees when about to send out swarms, finding themselves in a capacious room, may be induced to attach themselves to some parts within the walls and form independent colonies, as they have been known to do in garrets and other places in dwelling houses.

The hives being thus enclosed either in a chamber, or in an appropriate building, small windows with sliders, may be made for the passage of the bees, and these may be closed

at night, during the season of the moth's visitation. If left open, however, very few moths would find their way to the hives, as there would be no mellifluous odour to allure them.

The celebrated Bonner, who devoted his life to the cultivation of bees, kept his apiary in a garret in the city of Edinburgh. He prosecuted the employment of an apiarian with great success and profit, supplying gentlemen's rural seats with stock hives, and the city with honey. He made some valuable improvements in this branch of rural economy, and published a useful book on the subject.

In all situations of bees, both in winter and summer, a free circulation of air is of indispensable necessity; and they should not be confined, for any length of time without affording them the freest ventilation; for which purpose it might be proper to have small apertures in each hive directly opposite to its mouth to be covered with a plate of tin perforated with holes, too small for bees to escape or insects to enter, or the back part of the hive may be a little raised, by introducing a thin wedge under its edge, taking care to clear the passage when obstructed by the bees.

From the foregoing observations and details, may be found a more complete remedy against the ravages of the formidable enemy of bees than has heretofore been suggested, and it remains with the cultivator to select that mode which best accords with his own views.

CHAPTER X.

Directions for purchasing Stock Hives.

A superstitious notion has long prevailed, that fate has decreed that a traffic in bees shall never prosper. Either the seller or purchaser, or both, will inevitably suffer the evil consequences of such practice.

A tincture of the same superstition, even in our enlightened times, may be traced among a certain class of people, and from whom a hive of bees cannot be purchased at any price. Inquiring of a poor man if he would sell me a hive of bees, he replied with some surprise—"what, sell bees? no, not for five hundred dollars."

"Why, what is your objection?"

"Any man who sells bees, will certainly be poor all his life time."

This man was not worth fifty dollars, and he was fearful that poverty would always be his lot, if he should sell bees. But the reader may be assured that he may traffic in bees with the same impunity as in merino sheep; fate will no sooner interfere in one instance, than in the other;

and with proper attention he may calculate to realize much greater profit from the former than the latter animals.

The proper season for purchasing stock hives, is in autumn, or winter ; and great care must be observed in transporting them. If the distance be short, the hive must be enclosed in a cloth, and suspended on a pole borne on men's shoulders. But they may be conveniently transported in a sleigh, or spring carriage, which admit of easy motion, avoiding sudden jars, which would be in danger of separating the combs from the upper part of the hive, and in its fall might crush the bees, and thereby ruin the whole hive.

It is difficult to prescribe rules to be observed in the choice of stock hives, very much must depend on the honour and fairness of the vender. The hive should be well made, and free from cracks and decay. The bees that show themselves, should be lively and active ; the greater the number, the more valuable ; and they should not be more than 2 or 3 years old, but a young swarm should be preferred, provided it contain a sufficient quantity of honey. The purchaser should attend to the weight, and reject such as do not in November weigh twenty five or thirty pounds, exclusive of the hive. But the greatest risk consists in the hive being infested with bee moths and worms, as a very small number of the insects entirely destroy the value of the hive. The hive should be raised from the board, and the interior inspected with care so far as practicable, and if any webs, worms, or moths can be discovered the hive should be rejected. If some of the contiguous hives are known to be infested, and if the bees

at the entrance be few in number, and they appear to be inactive, there is much reason to suspect that moths are ravaging within. The possessor of the hive, however, by his particular observation the preceding season, may be able to know the condition of the hive in that respect.

With regard to the real value of a stock hive, it may be fair to estimate according to the quantity of honey; if it contain forty pounds, six or seven dollars may be considered a fair price; but very good hives sometimes command eight or ten dollars. A writer in the Long Island Journal says: "Two years ago I bought a swarm on the limb of a tree for three dollars and twenty five cents. From this one hive I now have five others, which, independently of the honey they have produced, I value at twenty eight dollars, and should the three following seasons prove favorable I shall from this one hive have bees enough to support my family. From one hive I can generally get two others every year. At a moderate calculation, I shall have in three years, sixty hives; and should the season be favorable, I shall have one hundred. Each one will every season produce honey to the amount of seven dollars and fifty cents." It may perhaps be observed that this writer is too sanguine in his calculations; and considering casualties, it can scarcely be supposed that he will actually realize such enormous profits. See an estimate on pretty correct principles in page 72 of this volume.

CHAPTER XL

Management of Stock Hives during winter.

In every apiary certain hives are selected for winter stock, but the cruel practice of destroying the residue by suffocation in autumn, to obtain their store of honey, is yet too generally put in execution, if not throughout New England, certainly within the sphere of our inquiries. Bees are cultivated for the purpose of deriving profit from their labors, and it is for our interest to multiply them as much as the nature of the country admits; it would be no less absurd, therefore, to skin a favorite horse for the sake of his hide, than to suffocate whole colonies of these industrious insects to possess ourselves of their spoil. The loss is often irreparable, and it is time that this strange attachment to prejudices and old customs should be abandoned, as being a tax on the profits of the proprietor. In the foregoing pages, ample means are detailed by which the cultivator may avail himself of a large share of their productions, while their useful lives are spared. A good swarm, in a favorable season, will collect from fifty to one

hundred pounds of honey, and the extent of their expenditure is from twenty five to thirty pounds during the winter. The superfluous quantity may be taken from the hive with perfect safety. Much speculation has subsisted of late relative to the most eligible situation for hives during the winter. While some are advocates for a warm, sheltered situation, others prefer an exposure to all the vicissitudes of the weather, and in both these conditions mortality has in many instances overtaken them. A writer with the signature *Veritas*, in the *New-England Farmer* vol. 4, asserts that "scores of swarms have been lost from their being casually buried by a driving snow storm; the bees were stifled."

If this be a correct statement, the owners were inexcusably culpable for their negligence. But it is more reasonable to ascribe the disasters to starvation. *Veritas* adds, "I have witnessed many experiments for the preservation of bees through the winter, such as placing them in cellars, barns &c. but the result proved to my satisfaction, that all interference, however humane, is attended with consequences fatal to them." But it is difficult to reconcile discrepancies. Dr. James Howison of Scotland says, "from my own observation, the hives which are best covered during winter, always prosper most the following summer." An English writer relates, that of two hives of equal weight, the one placed in a green-house subject to a moderate temperature, the other was left exposed to all the vicissitudes of the weather; the former I enveloped in blankets, the latter was without covering. I weighed these two hives regularly every month, and in the month of February I found that the hive which had been

kept warm had consumed eight pounds of food more than the other. It must, however, be allowed, that the hive which had been so kindly nursed, swarmed ten days sooner than that which had been exposed."

The warmer hives are kept in March and April the better, as it accelerates the hatching of the eggs, and promotes the prolific nature of the queen.

It is well known that bees are capable of sustaining the most intense degree of cold, even in the rigid regions of Russia and Poland, in which countries they are said to rest in a state of torpidity during winter.

In our climate hornets, wasps and humble bees, as well as flies and butterflies, remain torpid and motionless during the whole of this season ; and a small number of bees separate from the hive, may be rendered torpid at the freezing point, or even at 45 degrees, though they soon die, unless resuscitated by the application of warmth. But the main body, clustered within a populous hive, do not become torpid at the greatest degree of cold in our winters ; for while the thermometer is several degrees below the freezing point in the open air, it stands at 86. or 88 degrees within the hive, where the bees preserve their heat by clustering together and by motion. According to Swammerdam the heat of a hive is such, even in the middle of winter ; that the honey never crystalizes, or assumes a granulated consistence, unless the number of the bees be too much reduced.

In our variable winters, at every return of genial warmth, the bees become animated and immediately expose themselves to the influence of the sun. In these circumstances, great numbers are lost ; becoming chilled and their

wings rendered useless, they are unable, if at some distance from the hive, to return to it.

The last winter being remarkably mild, more bees than common were lost in this way, and the hives were considerably diminished in value. When the earth is covered with snow, some straw should be spread over it, to prevent the bees, from plunging into it, whence they could not escape.

As the bees can find no employment during winter, it may be proper to confine them within their hives by a tin grating, to prevent them from flying abroad. It may be observed as an axiom, that in both animal and vegetable life, from the highest to the lowest grade, we gain nothing by withholding a due portion of nutriment, and it may, perhaps, be affirmed, as a demonstrated truth, that bees which have been amply sustained during winter and spring are earlier in hatching their young brood, and more industrious in providing a store of honey, than those which have been stinted.

According to my judgment, the principal requisite for the preservation of bees in winter, are, that the hive contain a sufficient number of bees to maintain a certain degree of warmth, that they have a plentiful store of honey, and that they be secluded from the inclemency of snow

NOTE. Huber asserts that the usual "temperature of hives in summer is 95 or 97 degrees. In August, 1791, when the thermometer in the open air stood at 94 degrees, it did not rise above 99 in the most populous hives."

"When the thermometer in a hive rises to 104 degrees, the heat is so much greater than the hatching of the eggs require, that it is intolerable to the bees."

and rain. It would seem advisable, that the hives be protected by means of straw put around them. It is a philosophical truth, that the vital principle is cherished and promoted by heat, and that all animals and insects flourish and prosper most when under its influence ; analogy, therefore, would seem to dictate, that bees be kept moderately, and as far as possible, uniformly warm.

The indefatigable Huber, in his researches into the natural history of bees, made these insects the subjects of various experiments, to ascertain the degree of cold requisite to render them torpid.

Having surrounded a receiver containing them, with pounded ice, the thermometer fell from 65 degrees, the temperature of the atmosphere, to 45, when their torpidity commenced.

He subjected them to experiments, also, to ascertain the circumstances relative to their respiration. Having by the air pump deprived bees of air, in a quarter of an hour they began to manifest signs of uneasiness. In another quarter the bees fell to the bottom of the vessel, incapable of rising. All became suffocated in three quarters of an hour after the commencement of the operation ; nevertheless, when removed, and exposed to the air, they recovered.

The preservation and circulation of air in the interior of the hive is effected by the bees vibrating their wings. During warm weather, a certain number of bees always appear before the entrance of the hive occupied in ventilating, and about twenty are seen in the same employment at the bottom of the hive. By striking the air with their wings, bees fan themselves for coolness, and the ventila-

etion, or the buzzing which denotes it, seemed to H. to be more active in winter than at any other time. These concise remarks are connected with what follows. We have lately been made acquainted with the singular expedient of burying hives of bees in the earth, for their preservation during winter. It would appear a priori, a visionary scheme, altogether inconsistent with the principles of nature, that animals or insects, whose residence is on the earth, could exist, when deprived of air and light beneath its surface.

But authenticated facts must not be resisted, although they set at defiance our reasoning powers. Numerous facts in natural history occur which demonstrate that little confidence should be reposed in hypothetical disquisitions or uncertain contingencies.

That hives of bees have been preserved through the winter, when deposited three or four feet below the surface of the earth, is unquestionably true. It has been practised in New Hampshire for several years, and it is seldom that a swarm perishes in that situation. [New England Farmer, vol. 4 and 5.]

A similar experiment has been tried with success by a clergyman, who buried his bees in a peat stack. The degree of cold 4 feet below the surface of the earth, in our climate, is supposed to be about 50 degrees, and bees become torpid at 45.

It is evident, therefore, that they are not in a torpid state when immured in November. To my view, however, it appears an unnatural process thus to subject insects to a sudden transition from atmospherical air, and light, to a state of utter darkness. The avowed object in burying bees in the earth is, that they may pass the winter with

little or no food, and it is stated that very small feeble swarms thus treated, or when confined in dark cellars, are preserved, when in any other situation they must have perished of hunger.

The method practised in burying bees is to choose a spot of dry ground, where there is no probability of water reaching the hive. Dig the hole considerably larger than the hive, and about eighteen inches deeper than the height of it. Put a board under the bottom, caulk all the holes up tight, fill the vacancy round the hive with straw, cover it over so deep that no frost can reach it."

They are immured in November and liberated in April, when, if they appear destitute of honey, it will be necessary to feed them. That bees should survive under such circumstances, seems to be among the inscrutable phenomena in natural history.

Though I do not hesitate to advance the opinion, that their preservation is to be ascribed more to a uniform degree of warmth, than to any other cause. But with respect to air for the purpose of respiration during their seclusion in the earth, will the quantity of air enclosed with the hive, together with the aid of their own ventilating powers, subserve the purpose of respiration? We know but little respecting the efficacy of their ventilating process, but we know that bees have in numerous instances sustained such privations during five months with perfect impunity.

We are not without the most satisfactory evidence, that small famished hives almost destitute of honey, have been preserved through the winter by being deposited in dark cellars, and such situation is strongly recommended by respectable authority.

Feeding of Bees.

When a proper quantity of honey is allotted to bees in autumn, they require no further supply until the opening of the flowers in May. But it sometimes occurs that hives are found in a famishing condition, in winter or spring, and a supply of food becomes indispensable. The most proper kind, is pure, not candied, honey, the nutriment which nature has designed for them, and it would be well to reserve some boxes of it in the comb for this purpose. A pretty thick syrup of sugar is a very good substitute, but dry sugar is improper, as the bees are unable to break the grains fine enough to swallow. When bees require feeding, a box containing honey in the comb may be given them; but when other is used, it may be best to dilute it with warm water, and whether this, or syrup be given, care should be taken not to feed profusely at a time. About two pounds per month is supposed to be equal to the wants of any one hive.

Bees may be conveniently fed by introducing little troughs filled with honey under the hive, or a plate of honey may be placed under the hive, and straws laid across the plate, covered with paper, perforated with small holes, through which the bees suck the honey without difficulty.

CHAPTER XII.

Remedy for Stings of Bees.

The stings of bees are not often attended with serious consequences, though when numerous, they are not altogether without danger.

A few solitary instances have been reported in which a single sting has proved mortal, but this must be ascribed to some peculiarities in the constitution of the victims. When the sting is left in the flesh, the pain and swelling are severe, and the first point to be attended to is to extract the sting. The poison ejected into the wound inflicted, is in its nature an acid, and is neutralized by alkalies.

One of the most efficacious applications is the volatile spirit of armonia; this, if applied immediately, relieves the pain almost instantaneously, and in case the stings are numerous and severe, it should be taken internally, in doses of twenty or thirty drops every few hours.

Another remedy, no less effectual, is the common table salt (muriate of soda.) This article in fine powder, a little moistened, should be applied to the part after the sting

is extracted, and it affords immediate relief, and soon abates the swelling.

Should a sting be received within the mouth or throat, salt should be applied to the part. Olive oil has been recommended as useful, but the remedies above mentioned are known to be so effectual when properly employed, that no other need be recommended.

Diseases of Bees.

The disease most common and fatal to our favorite insects, is dysentery. A late writer in the North American Review asserts that they are also effected with dyspepsia; but from their correct and sober habits, we presume they are exempt from gout and rheumatism.

They are known to be affected with dysentery by their inactive and feeble appearance in the spring, and by numerous dark colored spots on the board, resembling linseed, and emitting a very offensive smell.

This disease is probably contagious among bees, and the sick hives should be immediately removed from the apiary, and so far as practicable, the dead and the sick should be separated from the well.

A very free ventilation should be given them, and the board, and inside of the hive, so far as can be reached, should be washed with lime water, or weak lie. A little fine salt laid on the board, may have a tendency, with the other means mentioned, to check the disease.

Mead, and medicated wine, have been recommended as remedies, but it is little better than quackery ; the disease in its nature is incurable, and no medical skill can avail them.

With respect to dyspepsia, the symptoms designating that disease in *bees*, is beyond my skill, and if they cannot find a remedy in their own instinct, the unhappy sufferers must be resigned to their fate, for their case is altogether hopeless.

CONCLUSION.

It cannot be too strongly recommended to all agriculturalists and husbandmen, to avail themselves of the great profit and luxury to be derived from the culture of the *honey bee*. Few persons have a just conception of the immense amount expended in some countries, and even in our own, for the production of this little insect; and still more would be consumed, could it be procured.

It has been stated that England pays annually to the north of Germany, forty or fifty thousand pounds sterling for the produce of the bee. Even in America, honey and wax are imported to a very considerable amount, although no country possesses greater advantages for the culture of the bee, and by proper attention to the subject, the necessity for importation might be entirely superseded.

That the reader may be better apprised of the importance of the subject under consideration, I make the following extract from the *Farmer's Manual*, by F. Butler.

“ The profit which is obtained from the bee, stands in no proportion to the little trouble and time required in their culture, and this is sufficient to induce those who estimate things properly, to give a preference to the culture of the bee above all other agricultural pursuits, especially as no sacrifice of time or property are required, and no extensive

capital necessary. As a proof of the importance attached to the culture of the bee, Wildman quotes a modern author, who affirms that when the Romans took possession of the Island of Corsica, they imposed a tribute of wax on the inhabitants, to the amount of 200,000 pounds annually; supposing the island retained the same quantity, that would give 400,000 pounds per annum made in one island by this wonderful insect. The known proportion of wax to honey in a hive, is, as 1 to 15 or 20; then multiply 400,000 pounds by 15 or 20, we have six or eight millions of pounds of honey, independent of the wax as above; what a source of wealth for Corsica, and all countries which will profit by the improvement.

I have before me a French newspaper of the 20th of September, 1787, which states, under an article dated Hanover, August 30th: "The culture of the bee is a particular object with the Hanoverians; the produce of wax this year, is estimated at 300,000 pounds; this multiplied by 15, gives 4,500,000 pounds of honey; a most incredible quantity to be collected in globules by a particular species of insect."

APPENDIX.

Whilst concluding this little volume, I was favored with a polite communication from that experienced apiarian, and horticulturist Mrs. Mary Griffith, of New-Brunswick, New-Jersey. This lady has devoted many years to the amusement and advantages of an apiary, in which she has done much credit to herself and conferred numerous benefits on the public. She is probably the first, if not the only one, in the United States, who has established an apiary upon just and methodical principles. She has invented an ingeniously constructed hive, which promises to supersede most others that have been in use. In the *North American Review* for October 1828, will be found a production from her elegant pen, on the subject of bees from which by her permission I make the following extracts.

“We have, for seven years, had a little colony under our immediate inspection, and we began our personal observation with the knowledge of all that ancient and modern theorists have advanced, in relation to the habits, customs, and manners, of this wonderful insect. We

came to their superintendence with a mind tinctured with all that was marvellous and fanciful, and with an ardor that seven years have not subdued; although theory after theory has now been melted away, and most of the wonders and enigmas have been solved, and reduced to the clearest and most simple particulars, our wonder and admiration, although deprived of the charms of the fanciful legends in which the history of bees was embodied, are still undiminished, nay, increased; for an elevation of thought and feeling has been produced by the study.

Notwithstanding the astonishing sagacity to be traced in the economy of bees, and the diversity of habits which might be expected, nature in reality is less variable in this instance than in most others; for although climate and a contracted habitation may reduce their size, and scantiness of food reduce their number, yet as long as there are flowers, the bee will abstract the honey and as long as there are forests, the bee will construct a cell. With other insects and animals, and even with man himself, the case is different. Insects will imbibe nourishment from the exudations of both animal and vegetable substances. Man can accommodate himself to every variety of diet, and thrive on all. The bee alone never changes its food. The sweet sap that exudes from vegetable pores, and which is accumulated in the nectary of flowers, serves alike to sustain the bee, and to render the seeds of plants fit for germination.

The working bees have the instinctive faculties of building different shaped cells; of choosing and preparing the food, both for the larvæ and for themselves; of taking care of the young brood; of carrying off noxious and extraneous

matter; of defending themselves from enemies of *their own species*; and of expelling the drones when they are no longer of use in the hive. They have the instinctive knowledge that they cannot, as other insects do, exist individually; they are constructed, therefore, in so admirable a manner as to make every thing subservient to the safety and comfort of the mother of the brood. She is, in their estimation, as much a part of themselves, as an eye or a limb. Their care of her is a kind of self preservation, a law implanted in every living thing.

After rejecting all the fanciful and marvellous speculations of the theorists, there are still several material points unsettled, on three of which, we propose to make a few remarks at the present time.

1st. The most modern and most rational theorists differ in their opinions respecting the accuracy of the facts, that are stated in relation to the queen bee's leaving the hive at any other time than when she goes forth with a new swarm.

2d. They dispute likewise on the possibility of the bees making a queen bee, from a neuter, when circumstances require it.

3d. They are still ignorant whether the drones perform the office of nurse to the larvæ when deposited in the different cells.

On the first point we venture to state unhesitatingly, that *the queen bee never leaves the hive, but when she accompanies a swarm*. For ten weeks we fixed our attention on the entrance of two hives that stood close to each other on a bench. One watch, either in person, or entrusted to another as interested and vigilant as ourselves, commenced

at grey dawn, and continued till sunset ; and never within that period did the queen bee of either hive leave them, but at the time of swarming, which occurred once in each hive during one inspection.

With an eye to this single circumstance, we have, for six successive years subsequent to the careful observation just stated, been in the constant habit of noting every peculiar movement at the entrance of hives, but we never saw the queen. Independently of the reliances that can be placed on observations of this kind, we have confirmation derived from strong probabilities.

The average number of a hive or swarm is from fifteen to twenty thousand bees. Nineteen thousand four hundred and ninety nine are neuters or working bees, five hundred are drones, and the remaining *one* is the queen or mother ! Every living thing, from man down to an ephemeral insect, pursues the bee to its destination for the sake of the honey that is deposited in its cell, or secreted in its honey bag. To obtain that which the bee is carrying to its hive, numerous birds and insects are on the watch, and an incredible number of bees fall victims, in consequence, to their enemies. Independently of this, there are the changes in the weather, such as high winds, sudden showers, hot sunshine, and then there is the liability to fall into rivers, besides a hundred other dangers to which bees are exposed.

Can any one, who considers all these casualties, suppose that the instinct in bees is so defective, as to allow so important a member of the community, and the only one of the kind too, to leave the hive and run the immense risk that would attend an excursion in the air. It is a well

established fact, that one queen lays all the eggs of the hive; that part of the daily duties of the working bees is to nourish the young brood, which if there were no queen, they could not do, as there would be no eggs. If the bees are disturbed in their regular routine of business, they become uneasy and incapable of proceeding. When they return from the nectary of flowers, with the usual quantity of sweet fluid, they hasten to bestow the first or uppermost part of honey on the larvæ and young bees, and when this simple undigested liquid is disposed of, they deposit that which has gone through a certain chymical process in the cells.

If, therefore, on entering the hive, they find no queen, they run about anxious and distressed, drop the little pellets of pollen that are attached to their legs, strike their antennæ against one another, and are in great agitation during the day. Sometimes two days are passed in this restless state, before they make an effort to repair their loss.

If the queen bee were to leave the hive, as Huber and others fancy, she would run great risk of never being able to return to it. Even around the apiary, before she had made the usual evolutions in the air, common to all bees on leaving the hive, she might become the prey of one of the many birds, that are hovering over head, or on the watch. The blue bird, the king bird, and the cat bird, swallow bees by dozens while on the wing; and the queen bee would have less chance of escape as she is larger, and therefore more conspicuous, and is besides very slow and heavy in her motions, her wings being smaller in proportion to her body than those of the working bee and the drone.

From our own observations, therefore, as well as from the above inferences, we must believe that the queen bee never leaves the hive, but for the establishment of a new colony.

The next material point of dispute is, whether it be in the power of the working bees to convert the larvæ of a working bee into that of a queen, when by accident the hive is deprived of one.

According to the most accurate naturalists, the organization of the queen, or mother bee, is different from that of either the drone or the neuters. It appears to us quite as rational and philosophical, to suppose that a queen bee could be converted into a neuter, and therefore, that all bees at first were of the shape and organic structure of the queen, as to suppose that a neuter or working bee could have new organs added, and new curves given to its limbs, and new instincts to its nature.

If we could see the interior of a hive whenever it suited our convenience, we should not be so lost in conjecture; but the irritability of those little insects, prevents a constant and minute internal inspection. It is a part of their instinct to know that *light, heat, cold and moisture*, in an undue and unaccustomed degree, are prejudicial to the formation of wax, to the consistence of the honey, and to the health of the brood. They therefore use all the little arts and advantages they possess, to prevent any one from exposing them to the injurious influence of those active powers.

When a queen bee ceases to animate the hive, the bees are conscious of her loss; after searching for her through the hive for a day or more, they examine the royal cells,

which are of a peculiar construction and reversed in position, hanging vertically, with the mouth underneath. If no eggs or larvæ are to be found in these cells, they then *enlarge* several of those cells which are appropriated to the eggs of neuters, and in which *queen eggs have been deposited*. They soon attach a royal cell to the enlarged surface, and the queen bee, enabled now to grow, protrudes itself by degrees into the royal cell, and comes out perfectly formed to the great pleasure of the bees.

Now this in itself is curious and wonderful. There is no need of adding superhuman powers to an insect, when the simple facts show such singular sagacity. The truth is, that the queen or mother bee lays the neuter eggs in certain cells of a particular construction; in fact the eggs are laid, at least many of them, as soon as the foundations are begun, before the cells are built.

The bees know from the peculiar shape of the egg that it is to have a cell of certain dimensions. When the neuter and drone eggs are deposited, the royal cells are then filled, for abundant observations prove that the queen eggs are laid last.

If the royal cells are not sufficient to hold all the queen eggs, they are laid in the *common cells*, and in the course of the regular business of the hive, these cells are attended to with the rest.

When the larvæ is of a size to fill the cell, a covering of wax is put on, and here ends the life, or rather the embryo of the queen; for no longer having room to expand, it perishes, and is dragged out in the nymph form, as soon as the bees discover that animation is extinct.

If, during the progress of the egg from the larva to the nymph state, the mother queen dies, and there are no eggs

in the royal cells, then the bees have recourse to the queen eggs that are laid in the common cells. By enlarging the entrance, and by attaching to it a cell which hangs *vertically*, they continue the life of the larva, and a queen bee is formed.

Here is no work of transformation. The insect is already formed, and nothing remains to be done but the mere mechanical operation of building a habitation which shall be adequate to its wants.

The peculiar organic construction of the queen bee perhaps requires a difference of food, as we perceive it does of dwelling.

No doubt it is necessary to supply it more abundantly, and with greater care. The very position it is compelled to take, shows that it requires a different kind of nurture, from either the common bee or the drone. It is wonderful that instinct is so competent to direct these changes; but it would be more wonderful if, in addition to this instinct, the bee had the power to *construct new organs*, as it does different cells, and thus to endow the insect with a different nature.

The third point unsettled, and which is likely to remain forever a secret, is, whether the eggs of the queen are hatched after the manner of the eggs of fish, whether they simply are animated by incubation, or by the care and nourishment bestowed upon them by the working or neuter bees.

On this point, experiment has proved nothing. The greatest diversity of opinion exists. There are upwards of a thousand writers on the history and policy of the bee, yet no two have either observed or reasoned alike.

Even the two distinguished naturalists, who have passed the best portion of their lives in studying bees, with equal zeal, and with equal opportunity, have come to very different conclusions.

Huber is by far the most circumstantial experimentalist who has turned his attention to this subject. But his truly philosophical mind has been rendered comparatively useless, nay, worse than useless, by the ignorance, or wilful misrepresentations of his assistant, Francis Burnens. Huber could but philosophise on facts as they daily were represented to him, his solutions of things *unreal*, and having no truth in nature, are most ingenious and rational. Had his physical sight been as perfect as his mental vision, his work would doubtless have been all that could be effected by the industry and talent of man.

The naturalists of Europe, misled by his extraordinary talent, adopted Huber's notions with respect to bees, and his opinions were considered as conclusive. The public opinion became imbued with the spirit of his doctrines, and we find the greatest and acutest reasoners discussing in perfect security the nature of an insect, that could at one moment organize animal life, and impart to it new instincts, and in the next construct bulwarks, and other modes of defence, to protect himself from an enemy, that until the last century never molested him.

The real fondness that was inspired for the study of the bee by the interesting works of Huber, engaged many in the pursuit; and the very mistakes that he has made, have led to something nearer the truth.

Owing to the general improvement in education, the taste for the marvellous is fast disappearing; and there are

now many who set themselves down to the study, with their reason unbiassed, and their judgment free to decide according to the evidence of facts.

The little work, the title of which we have prefixed to this article, called the "Farmer's Manual," contains in a small compass, as much of the minutiae of the *management* of bees, as is necessary to the common cultivator. Mr. Butler is a sensible practical writer, as well on other branches of rural economy, as on bees, and we would recommend his book to all who are engaged in those pursuits; for, with some slight deviations from his rules, such as a different climate would indicate, his experience may be beneficial to all.

We esteem it a very desirable object to make the care of the bee more common than it has hitherto been in this part of the country.

With the exception of a small one under the superintendence of the society of the shakers, established at New Lebanon, we neither saw, nor could we hear of a single apiary, on a journey last summer to Lebanon Springs, although we made many inquiries. Never was there a country more suited to the cultivation of bees. Even in August there is an abundance of white clover, and small springs, and shallow rivulets appear at every turn.

There is no doubt that bees were formerly more frequently kept in America, than at present. In many places in New Jersey, where there is now scarcely a bee to be seen, there once existed millions of these insects, to the great profit of their owners.

It was common for one dealer in a country town to sell fifteen or twenty barrels of strained honey alone, to say

nothing of wax and comb honey, as well as a kind of wine, made of the washings of combs, called *metheglin*. These articles of commerce have almost disappeared, and we find that it is mainly attributable to the ravages of the miller, or night moths, which have of late years spread destruction through the hives.

The attention of naturalists has been directed to the history of this fatal enemy of the bee, and many attempts have been made to construct hives that would prevent the miller from depositing its eggs in them; but the plans were defective, because there was no contrivance for inspecting the hives. Before we close this article, we will endeavor to give a description of a hive, that is so constructed as to enable any one to see the interior and to free it from all extraneous matter, as well as to protect it from the inroads of the night miller.

On the general subject of the care of bees, the following remarks, the result of personal experience, may be acceptable to the reader.

The situation of an apiary is of little importance. We have seen bees thrive as well with an eastern as with a northern aspect. If the entrance of the hive face the north, the bees may possibly be detained within, a minute or two later in the summer; but this is more than counterbalanced by the same cause operating in winter, when it is desirable that the bees should remain in the hive.

But for ourselves, we have seen no difference in the time of quitting the cells, between those that faced the north, and those that had a southern exposure. Nor have we observed that there is any difference in the welfare of

hives as placed in valleys or elevated on hills, meaning of course, hills of thirty or forty feet in height.

We have seen hives prosper, adjoining a stercorary, and often times near a piggery. We have known colonies of bees to exist for a term of twenty years, with no other protection from the heat and cold, than the top of the hives. They have multiplied equally well under an open shed; but as a free circulation of air is necessary for their health and comfort, we have never known them to thrive when quite enclosed. A house, therefore, strictly so called, which is shut on all sides, may serve to amuse the observer for a year or two, but there must be an extraordinary combination of fortunate circumstances if the bees increase, while confined in it.

It is better to begin with a single hive, and so attain a knowledge of the habits and instincts of the bees by degrees. We have known several persons, who have purchased a number of hives at once, and relinquished the pursuit from the perplexity that ensued when the swarming season commenced.

But there is no similar occupation, so easily followed, and none that requires so little capital, as that of keeping bees. The profit is enormous. If a person well trained to the employment, should follow the plan adopted in some parts of Europe, by removing the bees from place to place, in a kind of ark on a river of some length, thus providing a plentiful supply of food, he might increase his stock to any extent.

An apiary of twenty hives could maintain itself in an area of a mile, where there is plenty of blossoms. Every farmer should however provide pasture for his bees, as

well as for his cows; and therefore when the spring and summer flowers are gone he should have a field of buckwheat ready, which although not so palatable as other flowers, will serve the bees for winter food.

An apiary or bee shed should be, at the eves, about four feet from the ground, with a roof sloping both ways, and with any aspect the owner chooses. It should be ten feet wide, and the length of it should be increased as the hives multiply. It is however difficult to describe one accurately.

The most convenient one that we have seen is on a farm near New Brunswick in New Jersey. It is fifty feet long, and contains sixteen hives on each side. The swarms which are successively cast off, are placed under the same shed in the winter, and an equal number of the old hives are sold to make room for them. This apiary might be enlarged to any extent, were there pasture enough for the bees, but the area of the bees' flight, as there are now many cultivators of bees in this district does not furnish food enough for a great number.

In this apiary the miller or night moth is successfully guarded against. A small wire door, made to slide behind two door posts, formed of needles, is closed over the entrance of the hive; as soon as the bees have retired for the night. This is done during the months of April, May, and June, after that, if the weather sets in warm, and the bees are oppressed by heat, the floor of the hive is let down, which, as it is fastened to the hive behind with hinges, and on the sides with hooks and staples, can easily be accomplished. Two rows of scantlings or joists, four inches square, and running the whole length of the apiary, re-

ceive the hives between them, which are thus suspended at a distance of about three feet from the ground.

The hive invented by Mrs. Griffith has been particularly described in page 94 of this volume. "Models of the hive have been sent to several of the horticultural societies of Europe, and they are getting into use in this country.

* * * * *

And here we would remark, that it has been the custom, from the earliest ages, to rub the inside of the hive with a handful of salt and clover, or some other grass or sweet scented herb previously to the swarm's being put in the hive. We have seen no advantage in this; on the contrary it gives a great deal of unnecessary labor to the bees, as they will be compelled to remove every particle of foreign matter from the hive before they begin to work.

A clean, cool hive, free from any peculiar smell or mustiness will be acceptable to the bees; and the more closely the hive is joined together, the less labor will the insects have, whose first care it is to stop up every crevice, that light and air may be excluded.

We must not omit to reprehend, as utterly useless, the vile practice of making an astounding noise, with tin pans and kettles, when the bees are swarming. It may have originated in some ancient superstition, or it may have been the signal to call aid from the fields, to assist in the hiving. If harmless, it is unnecessary, and every thing that tends to incumber the management of bees should be avoided.

Straw hives are unsuitable to our climate, and afford a harbor for all kinds of insects. It is folly to talk of their

cheapness. If a man intends to keep bees, he must in the first place, make the hives in the very best manner; by this we mean, of good materials, and of good workmanship. A hive badly joined by an awkward carpenter is worse than a hollow tree. One half of the labors of the bee is directed to the repairs of their dwelling.*

It is not asserted, that the bees will, of themselves, fall into these hives, or that no trouble or expense is necessary in the management of an apiary. We know that both care and expense are required; but the latter, after the first disbursement, is very trifling. Vigilance and neatness are forever in requisition, and the care of bees, like all other profitable business, cannot be pursued to any advantage, unless it receive daily and minute attention. But have we not accomplished a great deal when we have reduced the thing to this certainty?

But although as we have before observed, nothing is more simple in theory and practice, than the history and care of bees, yet it requires a constant and unremitting attention, if we aim either at instruction or profit. Can any thing be well done and to advantage without these? Varro in his treatise *de Re Rustica* is the first who has spoken of *hives*. He wrote upwards of 1870 years ago, and how many different sorts of hives have been constructed since his time, to say nothing of the different theories? We wish to see bees in every garden throughout America, but we have no desire to see the subject encumbered

* A model of the hive which we consider of the best construction, may be seen at the village of the Lebanon Shakers, in the hands of Daniel Hawkins; or at the seat of Theodore Sedgwick, Esq. in Stockbridge. The inventor of this hive has had an opportunity of judging of its merits by experience. For a description of this hive see page 94 of this volume.

with more than is necessary to advance the pleasure and profit of the pursuit.

To the naturalist we will leave discoveries of organization and propagation they are foreign to our purpose, as they only serve to perplex and deter us from the main points. But it is proper to know the most simple mode of managing a hive, and this includes the pasture or food that is necessary for its sustenance. Hunger destroys as many bees as the miller. We ought to cultivate such shrubs and plants as the bees like; without this they will starve.

The American black willow and the red maple are the first trees that are visited by the bees. They are fond of the crocus, which is the earliest of our bulbous roots; and these we can have in abundance, as they multiply quickly and occupy little space. They are beautiful in themselves, affording a rich treat to the eye; and they flower so early, and are of such bright and vivid colors, that we take as much pleasure in them as the bees do.

The stercoreary and piggery are next resorted to by these insects. These we presume are their medicine shops, and the extract absorbed from them must be used as a tonic. Blossoms of all kinds, excepting those of the red clover and the honey suckle, are excellent food; and the bees especially profit by the increased attention bestowed at present on the cultivation of the peach tree in some parts of this country. They not only drink the nectar and abstract the pollen of the flower, but they appropriate the peach itself. We have seen twenty or thirty bees devour a peach in half an hour, that is, they carried the juices of it to their cells. The humming bird

alone, can reach the bottom of the nectary of the honey suckle, but even here the instinct of the bee is seen. The small birds, such as the wren, make an incision on the outside, near the bottom of the flower, and extract a part of its juices. The bee takes advantage of this opening, and avails itself of what is left.

The scent of the bees is so acute, that every flower which has a powerful odour can be discovered by them at a great distance. Strawberry blossoms, mignonette, wild and garden thyme, herbs of all kinds, apple, plum, cherry, and above all, raspberry blossoms, and white clover are delicious food for them, and a thriving orchard, garden, and apiary, fitly go together.

* * * * *

In the hive of a new swarm, during the months of July and August, there are fewer small bees, than in one that has been tenanted for 4 or 5 years. The bee like other insects, spins itself a covering, before it becomes a fly. When it emerges with wings, from its cell, several older bees approach it, feed it with the contents of their stomachs, and then clear out the cell and deposit in it fresh honey.

This is their constant practice; and the bee that is just born, as soon as it has been fed, and has stretched its wings, flies off to a flower, and commences its labors. But although the bees clean out the cell the moment a young bee is born, yet they either find no inconvenience from that part of the film, which the young bee leaves at the bottom of the cell, and which is of a silky nature, or they are unable to detach it.

In consequence of this, the cell is not so deep, and

as the same circumstances occur perpetually, brood alternately with honey, the cells become every year visibly smaller, and consequently those bees that are bred in these small cells, of which there are a great number, are never of the full size of those that have had more room.

Even the queen eggs, which *we* say are often deposited in the cells of neuters, and have afterwards larger cells attached to the first, never produce so large a queen bee as if the cell had been of proper dimensions at first.

Thus we see that the construction of the cell may diminish the size of a bee, even to the extinction of life, just as the contraction of a Chinese shoe, reduces the foot, even to uselessness; but in neither case will a single new organ be taken from, or added to the foot, whether the cell or shoe be larger or smaller.

A young bee will readily be distinguished from an old one, by the greyish colored down that covers it, and which it loses by the wear and tear of hard labor; and if the bee be not destroyed before the season is over, this down entirely disappears, and the ground work of the insect is seen, white or black.

On a close examination, very few of these black, or aged bees will be seen at the opening of the spring, as not having the stamina of those that are younger, they perish from inability to encounter the vicissitudes of winter.

Our seasons are very variable. The scorching droughts summers deny to plants their accustomed moisture; no honey can therefore be made at such times, and they are compelled to eat of their winter food. They cluster about

the hive, or deprived of their accustomed labor, they are very restless, and often intrude into a neighboring hive, apparently for the want of employment.

In the summer of 1825, during the latter part of July the heat was so distressing to the bees, the thermometer standing at 92 degrees in the shade, that they seemed to have lost their usual instinct. A number of hives of the old fashioned patterns, that stood on a bench, were well filled with bees. At two o'clock, for three days in succession, the whole swarm of each hive rushed out, and ran into the adjoining hive, where they remained for a few seconds, without apparent offence to the invaded bees, who in their turn flew madly out, and paid the same unceremonious visit to their neighbors. No quarrel ensued, not a bee was killed by these eruptive movements. They seemed maddened by the heat, and yet the queen was left in the hive, for with all our attention to the sallying parties, we did not see a single queen among them.

The same phrenzy did not occur in those hives that were suspended upon joists; thus proving that the bees did not suffer so much from heat in those suspended hives, as they did in the flat bottomed ones, that rested on a bench.

Our winters are equally disastrous to the poor bees. Of late years there have been so many mild days during the cold season, that a great deal of honey has been consumed. These alternations of torpor and animation, cause greater exhaustion, and loss of physical powers, than would be occasioned by a continuance of uniform torpor. This we infer from the fact, that in Russia, where the winters are uniformly cold, bees do not perish, and in the West Indies, where there is perpetual verdure, they are never exhausted.

But although a bee may remain torpid, to a certain extent, for six months in the year without injury in those climates to which the insect has long been accustomed; yet it could not exist for the same space of time in lower latitudes, where such a period of continued cold rarely occurs.

Nature has not constructed them for every emergency. She has done no more for them in this particular, than she has for man; they are compelled to get accustomed to change of climate by degrees; not by an alteration of the structure of their organs, for that can never occur under any circumstances, but by some change that takes place in the circulation of the fluids of the body, by which the system is accommodated to a higher or lower temperature. But we leave this part of the question to the naturalists learned in the science.

We know of but two diseases to which the bees are subject in this county, and they have to our knowledge never occurred at any other season than the early part of the spring,—dysentery and dyspepsia. The latter arises from the indolent, inactive life that they are compelled to lead in our variable winters. The rule holds good with the most diminutive, as well as the greatest in animal life, that if we eat, and wish to preserve health, we must work.

During the winter of 1828, the bees suffered more, and lost more of their numbers than has often been known before. There scarcely was a day that they did not sally out to search for employment and food; but not being properly stimulated, they seldom returned to the hive. We frequently saw them crawling on the ground, weak and spiritless; and those that did return, soon perished. On ex-

aming the hives, we observed that nearly all the honey was consumed; and many of the brood that in ordinary seasons, are not hatched until the first part of April, assumed the fly form at an earlier period, and died.

The cure for this disorder, the bees take into their own hands. As soon as the flowers appear, they go to *work*; and then it is that they resort to aperients and tonics, which they extract from the floors of the piggeries.

The other disease proceeds from long confinement in bad air, and from unwholesome food, and is invariably fatal; nor can the bees avert it by any instinct of their own. We know of no cure for the dysentery when the bee is seized with it. Those that have it badly must die. We can restore those that are least affected, by frequently washing the hives, as far as we can reach, with weak lie, and by ventilating them, and removing the dead bees.

In every point of view, therefore, it appears that bees should be cultivated. The wax that is consumed in this country, in various ways, is enormous, and most of it is imported.

If we may credit Huish, Great Britain imports from Germany and Italy upwards of eighty thousand pounds sterling worth of wax annually. We are unable to say, with any precision to what amount it is imported by us; but judging from the quantity that each family uses in a year, and the amount employed in various arts, it must be worthy of notice.

It is really disgraceful to such a country as ours to import wax or honey. We ought every year to export tons of it ourselves; and we trust that in the course of a few years, this improvement will take place.

Massachusetts and Connecticut are well situated, and abundantly supplied with proper food for bees; and their climate being less variable, is better adapted to their nature.

We spoke of hills of twenty or thirty feet in height; this only applies to the site of an apiary near a dwelling; the dwelling itself may be on a hill. We have heard of convents situated on mountains, that have been well stocked with hives.

In short, nothing is wanting but good pasture, good hives, cleanliness and attention to insure a rich reward to those who engage in the pursuit.

Children are naturally very fond of watching the proceedings of bees, and they would soon learn to take care of them, if they were not learnt to fear them. All danger can be guarded against by making them wear woollen gloves that are long enough to draw over their sleeves at the wrist, and a wire cap to cover their head. They could thus be trained to manage bees; and training is quite as necessary to the full comprehension of the occupation, as it is in the trade of a carpenter, or shoemaker.

A good old French bishop, in paying his annual visit to his clergy, was very much afflicted by the representations they made of their extreme poverty, and which the appearance of their houses and families corroborated. Whilst he was deploring the state of things which had reduced them to this sad condition, he arrived at the house of a curate, who, living amongst a poorer set of parishoners than any he had yet visited, would he feared, be in a still more woful plight than the others. Contrary, however, to his expectations, he found appearances very much

improved. Every thing about the house wore the aspect of comfort and plenty. The good bishop was amazed. 'How is this my friend,' said he, 'you are the first man that I have met, with a cheerful face and a plentiful board. Have you any income independent of your cure?' 'Yes sir,' said the clergyman, 'I have; my family would starve on the pittance I receive from the poor people I instruct. Come with me into the garden, and I will show you the *stock* that yields me an excellent interest.' On going to the garden, he showed the bishop a range of bee hives. There is the bank from which I draw an annual dividend. It never stops payment.' Ever after that memorable visit, when any of his clergy complained to the bishop of poverty, he would say to them, 'keep bees, keep bees;' and we shall bid our readers adieu with the same advice.

POSTSCRIPT.

*Extracts of Letters from Mrs. Mary Griffith,
November 1828.*

“ This summer three swarms settled on the same limb. No hive that I had, was large enough to hold them, so I put them in a flour barrel, running sticks through it to keep the combs from falling. These bees filled the barrel with fine honey. I was obliged to smother the bees as I could not keep them in that form. I was very sorry to do it.

I am not troubled by the bee moth. I have for several years shut the little wire doors at night (see page 95) although in so doing, I often shut out a large cluster of bees that lay around the entrance. Although this effectually prevented the entrance of the bee moth, yet it always excited commotion in the hive, and the bees never could get accustomed to the restraint.

In April I opened the floors of six hives, and left them hanging down all summer. To my great pleasure I saw that these hives were not in the least injured by the miller

or bee moth. I have several times turned them over to examine them, and am now satisfied, that the hives need never be closed at the bottom.

This improvement saves a great deal of personal attention, as a deputy cannot always be depended upon. I have no doubt of the fact that the moth gets in the open hive but there seems to be a *necessity* that the insect should have a *horizontal* board or platform for the deposition of its eggs, this it cannot have if the floor be open, and in consequence it has to go elsewhere to lay the eggs. The bee moth can work its way in a very narrow crevice and great care should be taken to have every part of the hive made very tight and exact, even the upper box must close exactly on the top of the hive. Around several of mine that did not lie closely, I put a cement of wax and flour, pressed in the crevices while soft, and in these the miller could not get; but in one that I overlooked, the worms had made great ravages before I detected them. Thus you see that very great care and vigilance are necessary even with my hive. It has been the practice for many years to raise the old fashioned hive from the stand and rest it on clam shells or little blocks of wood. This in *many* cases prevented the mischief, but it was in many cases too defective, as the eggs were found on the top of the angle of the blocks or clam shells. It however, gave me the first thought of elevating my hives.

I am of opinion that bees will live through the winter, quite as well with the bottom open as shut; you can make the experiment. In two of the hives that I left open this summer, the bees made the combs descend below the hive. During the cold weather in the early part of this

month, I cut them off a little above the edge of the hive and closed the door again. Every farmer *now* is cultivating bees in my neighborhood, of course I am prevented from keeping as many hives as at first. My apiary is constructed for thirty two, to which number I mean to confine myself. I have sold a great many hives of bees this fall."

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ERRATA. Page 7, for *Sampson* read *Samson*—page 13, 2d line from top, for *Bfore* read *Before*—same page near the bottom for *mutulated* read *mutilated*—page 15 for *Judge* read *edge*—page 36 14th line from bottom, for *singular* read *similar*—last line but one for *insensible* read *sensible*—page 41 11th line from the bottom for *foundation* read *fecundation*—page 47 4th line from top for *fitted* read *filled*—page 53 for *angustifolia* read *angustifolia*—last line for *immediately* read *immoderately*—page 57 12th line from the top for *produced* read *produce*—page 80 5th line from top for *regulating* read *regulated*—page 108 5th line from bottom for *this comb* read *their comb*—page 108 middle for *and proper distances* read *at proper distances*—page 129 last line but one for *one watch* read *our watch*—page 130 4th line from top for *one inspection* read *our inspection*—line 9th for *reliances* read *reliance*—page 159 11th line from the bottom for *proved* read *provided*.

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