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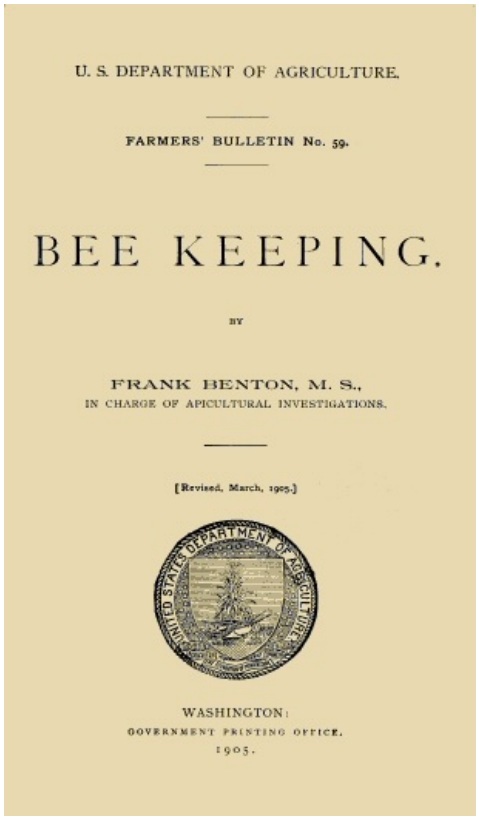
U. S. DEPARTMENT OF AGRICULTURE.

FARMERS' BULLETIN No. 59.

BEE KEEPING.

BY

FRANK BENTON, M. S.,
IN CHARGE OF APICULTURAL INVESTIGATIONS.

[Revised, March, 1905.]

WASHINGTON:
GOVERNMENT PRINTING OFFICE.
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LETTER OF TRANSMITTAL.

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U. S. Department of Agriculture,

Bureau of Entomology,
Washington, D. O., March 1905.

Sir: Frequent inquiries from correspondents of the Department of Agriculture for information on matters pertaining to the culture of bees, and particularly as to the conditions under which one may reasonably expect to meet with success in this pursuit, led to the preparation of this bulletin in July, 1897. Though designed by the author primarily to answer a few of the specific questions which are most likely to present themselves to the mind of the inquirer wholly unfamiliar with the subject, the aim has been also to introduce in the treatment of the various topics information which it is hoped will lead many of longer experience into more successful methods than they have yet practiced. The stereotype plates of the earlier editions having become much worn, necessitating the resetting of the type of the entire bulletin, the opportunity has been afforded of inserting several new paragraphs and making a few slight changes in the text as heretofore published.

Respectfully,

L. O. Howard,
Entomologist,

Hon. James Wilson,
Secretary of Agriculture,

« 4 »
« 5 »

CONTENTS.

« 6 »
« 7 »

ILLUSTRATIONS.

« 8 »
« 9 »

BEE KEEPING.

LOCATIONS SUITED TO THE KEEPING OF BEES.

It may be safely said that any place where farming, gardening, or fruit raising can be successfully followed is adapted to the profitable keeping of bees—in a limited way at least, if not extensively. Many of these localities will support extensive apiaries. In addition to this there are, within the borders of the United States, thousands of good locations for the apiarist—forest, prairie, swamp, and mountain regions—where agriculture has as yet not gained a foothold, either because of remoteness from markets or the uninviting character of soil or climate. This pursuit

may also be followed in or near towns and, to a limited extent, in large cities. It even happens in some instances that bees in cities or towns find more abundant pasturage than in country locations which are considered fair.

The city of Washington is an example of this, bees located here doing better during the spring and summer months than those in the surrounding country, owing to the bee pasturage found in the numerous gardens and parks and the nectar-yielding shade trees along the streets. This is due mainly to the fact that the linden, or basswood, which is rarely seen in the country about Washington, has been planted extensively in the parks and for miles on both sides of many of the streets and avenues of the city.[A] Another source in the city not found extensively in the country adjacent is melilot, Bokhara or sweet clover (*Melilotus alba*), which has crept into vacant lots and neglected corners, and diffuses its agreeable perfume to the delight of all city dwellers, whether human or insect. The writer has practiced with profit the transportation of nearly a hundred colonies from a country apiary 10 miles distant to Washington for the linden and sweet clover yield. He has also seen a prosperous apiary kept on the roof of a business house in the heart of New York City, and on several occasions has visited another apiary of 30 to 40 colonies, which a skillful apiarist had located on the roof of his store in the business portion of Cincinnati, Ohio, and from which 30 to 40 pounds of honey per colony were usually obtained each year.

[A] Several species of lindens are included in these plantings, but none yields more than our common American linden, or basswood (*Tilia americana*).

« 10 »

Another apiary personally inspected was located directly on the sand banks forming the eastern shore of Lake Michigan. These bees were, of course, unable to forage westward from the apiary, hence had but half "a field." The soil of the area over which the bees ranged was a light sand, unproductive for most crops, and the region was little developed agriculturally, most of the honey coming from forest trees and from shrubs and wild plants growing in old burnings and windfalls, yet 25 to 30 pounds of excellent honey per colony was the usual surplus obtained. At one time the writer had an apiary in the city of Detroit, Mich., where the wide river on one side cut off nearly half of the pasturage, yet the bees did will. And again for several years he had an apiary containing from 100 to 200 colonies of bees on a very sterile coast of the Island of Cyprus, and another nearly as large located but a few rods from the seashore on a rocky point of Syria. Both of these apiaries were devoted in the main to queen rearing, yet the yield of honey was not an unimportant item, especially in the Syrian apiary, while in the Cyprus apiary some honey was frequently taken, and it was rarely necessary to feed the bees for stores. In the latter case about one-fourth of the range was out off by the sea, the bees being located at the head of an open bay and a short distance from the shore, while the location of the Syrian apiary prevented the bees from securing half of the usual range, hence their greater prosperity was due to the nature and quantity of the pasturage of their limited range.

It is evident, therefore, that no one similarly located need be deterred from keeping bees, provided the nectar-yielding trees and plants of the half range are of the right sort and abundant. Moreover, regions so rough and sterile or so swampy as to give no encouragement to the agriculturist, or even to the stock raiser, will often yield a good income to the bee keeper, insignificant and apparently worthless herbs and shrubs furnishing forage for the bees. The ability of the bees to range over areas inaccessible to other farm stock and to draw their sustenance from dense forests when the timber is of the right kind, and the freedom which, because of their nature, must be accorded them to pasture on whatever natural sources are within their range of 3 or 4 miles, must be taken into account in estimating the possibilities of a locality. It will be found that very few localities exist in our country where at least a few colonies of bees may not be kept. Whether a large number might be profitably kept in a given locality can be decided only by a careful examination as to the honey-producing flora within range of the apiary (see pp. 12 and 26-29).

The danger of overstocking a given locality is very frequently exaggerated. Each range, it is self-evident, has a limit. The writer is, however, fully convinced, after long experience in numerous localities and under the most varied circumstances, that three or four times as many colonies as are commonly considered sufficient to stock a given range may usually be kept with a « 11 »
relative degree of profit. But to secure such results sufficient care and close observation have too frequently not been given in the selection of bees adapted to the locality and conditions. A more frequent failure has been lack of proper attention to the individual colonies, particularly as to the age and character of the queens in each. The space given for brood rearing is often too small, and frequently no care is given to secure the proper amount of brood in time to insure a population ready for each harvest. Attention to these points would enable great numbers of bee keepers who now regard 50 to 100 colonies as fully stocking their range to reach several hundreds in a single apiary, with slight or no diminution in the average yield per colony.

THE RETURNS TO BE EXPECTED FROM AN APIARY.

Although apiculture is extremely fascinating to most people who have a taste for the study of nature, requiring, as it does, out-of-door life, with enough exercise to be of benefit to one whose

main occupation is sedentary, the income to be derived from it when rightly followed is a consideration which generally has some weight and is often the chief factor in leading one to undertake the care of bees. Certainly, where large apiaries are planned, the prime object is the material profit, for they require much hard labor and great watchfulness, and the performance of the work at stated times is imperative, so that in this case there is less opportunity than where but a few colonies are kept to make a leisurely study of the natural history and habits of these interesting insects, because—unless the keeper is willing to forego a considerable portion of his profits—his time must necessarily be almost wholly taken up in attending to the most apparent wants of his charges.

One very naturally supposes that the return from a single hive, or several of them, in a given locality, may be taken as a fair index of what may be expected each season. Such return, if considered average, may serve as a basis on which to reckon, but as so many conditions influence it, great differences in actual results-will be found to occur in successive seasons. Apiculture, like all other branches of agriculture, depends largely upon the natural resources of the location, and the favorableness or unfavorableness of any particular season, no matter how skillful the management, may make great differences in the year's return. The knowledge, skill, industry, and promptness of the one who undertakes the care of the apiary have likewise much to do with the return. Furthermore, profits are of course largely affected by the nature and proximity of the markets.

A moderate estimate for a fairly good locality would be 35 to 40 pounds of extracted honey or 25 pounds of comb honey per colony. This presupposes good wintering and an average season. « 12 » When two or more of the important honey-yielding plants are present in abundance and are fairly supplemented by minor miscellaneous honey plants the locality may be considered excellent, and an expectation of realizing more than the yield mentioned above may be entertained. With extracted honey of good quality at its present wholesale price of 6 to 8 cents per pound and comb honey at 12 to 14 cents, each hive should under favorable circumstances give a gross annual return of $2.50 to $3. From this about one-third is to be deducted to cover expenses other than the item of labor. These will include the purchase of comb foundation and sections, repairs, eventual replacing of hives and implements, and the interest on the capital invested. By locating in some section particularly favorable to apiculture—that is, near large linden forests, with clover fields within range, supplemented by buckwheat; or in a section where alfalfa is raised for seed; where mesquite, California sages, and wild buckwheat abound; where mangrove, palmettos, and titi, or where sourwood, tulip tree, and asters are plentiful—the net profits here indicated may frequently be doubled or trebled.

But these favored locations, like all others, are also subject to reverses—the result of droughts, great wet, freezes which kill back the bee pasturage, etc., and though some years the profits are so much larger than those named above as to lend a very roseate hue to the outlook for the accumulation of wealth on the part of anyone who can possess himself of a hundred or two colonies of bees, the beginner will do well to proceed cautiously, bearing in mind that much experience is necessary to enable him to turn to the best account seasons below the average, while during poor seasons it will take considerable under standing of the subject, energetic action, and some sacrifice to tide over, without disaster, or at least without such great discouragement as to cause neglect and loss of faith in the business. On the whole, there should be expected from the raising of bees for any purpose whatever only fair pay for one's time, good interest on the money invested, and a sufficient margin to cover contingencies. With no greater expectations from it than this, and where intelligence directs the work, apiculture will be found, in the long run, to rank among the best and safest of rural industries.

The value of bees in the pollination of various fruit and seed crops is often sufficient reason to warrant the keeping of a small apiary, even if circumstances do not favor its management in such a manner as to secure the largest possible crops of honey or to insure the saving of all swarms. The quality and quantity of many varieties of apples, pears, plums, and small fruits depend absolutely upon complete cross-pollination. The most active agents in this work are honey bees.

« 13 »

ANYONE WHO DESIRES TO DO SO CAN LEARN TO MANIPULATE BEES.

Any person with fairly steady nerves and some patience and courage can easily learn to control and manipulate bees. There are, it is true, a few exceptional individuals whose systems are particularly susceptible to the poison injected by the bee, so much so that serious effects follow a single sting. Such cases are, however, very rare. In most instances where care is not taken to avoid all stings the system eventually becomes accustomed to the poison, so that beyond momentary pain a sting causes no inconvenience.

To a certain extent the belief exists that bees have, without apparent cause, a violent dislike for some people, while others, without any effort, are received into their favor. The latter part of this proposition has a better foundation than the first part, for it is the actions, rather than any peculiarity of the individual himself, that anger the bees.

Bees prefer, of course, not to be disturbed; hence they usually keep guards on the lookout for

intruders. When visitors approach the hives these guards are very apt to fly toward them as if to inquire whether harm is intended or not, and should the visitor not inspire them with fear by using smoke or some similar means, but should himself show fear and nervousness, he will be very likely to arouse their suspicions still further, or even to anger them should he strike at them or endeavor to dodge their approach. Indeed, one not accustomed to the notes of bees is very likely, unconsciously, to dodge his head about when a worker buzzes uncomfortably close to his face. It may be a movement of but an inch or two, but perhaps a quick jerk, and being noticed by the suspicious guard is resented; a sting follows, and yet the recipient declares that he did nothing to cause the attack, but that bees merely hate him and always sting him when he approaches them. On the other hand, an equally unprotected person who moves about with deliberation may generally, under the same circumstances, be let off without receiving a sting. It is in this case not so much what he does as what he does not do.

It is not to be understood that bees will always refrain from stinging if one remains somewhat passive in the vicinity of their hives, for the fact is that at some seasons common black bees and crosses having blood of this race fly some distance to attack passers-by, or even, without just provocation and with but slight warning, to plant a sting in the face of one who is standing near the apiary. But as the avoidance of such unpleasant occurrences depends largely upon the kind of bees kept, and, to a certain extent, upon an acquaintance with a few facts with which anyone of intelligence may easily familiarize himself, and the observance of certain precautions which are quite simple and after a little practice will become easy, and as the opening and manipulation of « 14 » hives in securing honey, etc., is equally simple and attended with no greater risks, it is safe to say that almost anyone can, with perseverance and the exercise of due caution, learn to manipulate bees with perfect freedom and without serious risk of being stung.

HOW TO AVOID STINGS.

Stings can be avoided, first, by having gentle bees. If no other point of superiority over the common brown or black bee than that of gentleness could be fairly claimed for some of the races introduced and some of the strains developed in recent years, it would still be worth while to get them on this account alone. When the fact of superiority in several other important points is considered also, there should be no further question as to the advisability of procuring them in preference to the common variety. The beginner is advised never to think of doing otherwise. No one likes stings, and even the veteran who affects insensibility to the wrath of his charges will find his interest and pleasure in them much increased by replacing blacks and their crosses with better varieties. Nor is this merely to gratify a fancy or for convenience alone. If, by reason of the stinging qualities of the bees kept, an examination for the purpose of ascertaining the condition of a colony of bees becomes a disagreeable task to the one who cares for the apiary, little things necessary to the welfare of the colonies will be postponed or omitted altogether and the apiary will soon present a neglected appearance, and the actual profits will be affected.

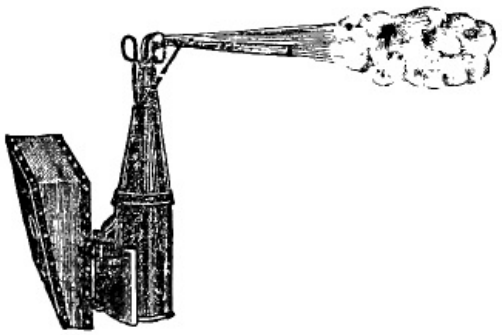

Fig. 1.—The Bingham bee smoker.

Of the races already in general cultivation, Carniolans are the gentlest, although Caucasians, more recently introduced from south-eastern Russia and only now being put on sale, are by far the least inclined to sting of any bees, and may be handled at all times without resorting to the protection of a bee veil, and generally without smoke, or at most a very slight application of smoke. Some strains of Italians equal in gentleness average Carniolans, but in general the race native to Italy is by no means as gentle as that found in Carniola, Austria, and the Caucasians are much to be preferred for the beginner. In case these gentler races are not easily procurable he need not hesitate, however, to undertake, after adopting due precautions, the manipulation of pure Italians.

In crossing well-established breeds the males of a gentle race should be used, otherwise the workers of the cross may vary greatly in temper, especially in the first few generations. Only careful selection continued for some time will so fix the desirable traits as to result in their « 15 » reproduction with a fair degree of certainty in the offspring. Bees having the blood of blacks and Italians are nearly always quite vicious in the case of the first cross, and are even harder to subdue with smoke than are pure blacks. Other races need not be considered here, as they are adapted to special purposes; and the skill of the bee-master, the conditions of climate, flora, etc.,

and the particular line of production to be followed, should decide whether their introduction is advisable or not.[B]

[B] For a fuller discussion of this subject, see "The Honey Bee: A Manual of Instruction in Apiculture," by Frank Benton, M. S., Bulletin No. 1, new series, Bureau of Entomology, U. S. Dept. of Agriculture, third edition, 1899, Chap. I, pp. 11-18.

The second essential to enable one to avoid stings is to have a good smoker at hand whenever the bees are to be handled. Any way of getting smoke of any kind into the hive and about it may answer the purpose, but for ease and effectiveness in keeping bees under control nothing will take the place of the modern bellows smoker (fig. 1). A good one lasts years, and its cost is so slight ($1 to $1.25 for the medium sizes) that the expenditure may be considered one of the wisest that can be made in fitting up an apiary.

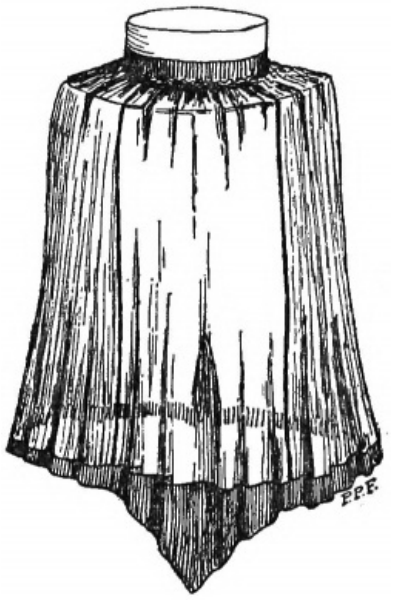

FIG. 2.—Bee veil.

A veil (fig. 2), made of black bobinet or Brussels net, to draw over the hat, and a pair of gloves, preferably of rubber, may be used at first. But whoever has fairly peaceable bees and learns even a little about their ways will soon discard the gloves, unless, indeed, he be exceedingly timid, or one of those to whom a bee sting would be a dreadful affliction. The veil can be safely dispensed with if the gentlest bees are kept.

Simple and convenient hives, employing the Langstroth principle, and with stories and frames interchangeable and so constructed as to reduce propolization to a minimum and to insure straight combs, will much facilitate the avoidance of stings.

The use of the bee escape (fig. 3) in removing surplus honey greatly reduces the risk of being stung during this operation, for it saves much manipulation of combs and shaking and brushing of bees. This useful device is fitted into a slot made in a board the same size as the top of the hive, and the whole, when slipped in between the brood apartment and an upper story or super, will permit all of the workers above to go down into the lower story but not to return to the top « 16 »
above to go down into the lower story, but not to return to the top one, so that in one night it is possible to free entirely a set of combs from bees without any manipulation of the combs, and without smoking, shaking, or brushing the bees.

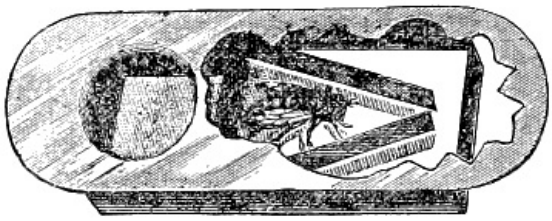

FIG. 3.—The Porter spring bee escape.

Lastly, reasonable care in manipulation and a suitable system of management, which, of course, implies the doing of work in proper season, will, with the observance of the foregoing points, make the risk of stings exceedingly slight. Indeed, intelligent attention to the most important of the points mentioned above, with extra gentleness and moderation in manipulation, will enable anyone who so desires to avoid all stings.

WHAT RACE OF BEES TO CHOOSE.

Reference has already been made to the relative gentleness of the various races, and since the gentler types are themselves excellent honey gatherers, and the particular advantages to be derived from some of the more energetic races which do not happen to be so mild in temperament are not likely to be secured by the beginner who is unfamiliar with the most approved methods of manipulation of such bees, it is strongly recommended that only the gentle ones be at first adopted—either Caucasians, Carniolans, or Italians. Should full colonies of these not be obtainable near home, colonies of ordinary bees may be changed by replacing their queens with queens of the desired race, the latter having been procured in small boxes by mail. If possible the introduction had better be made by an expert, although in general, by following the instructions which accompany the new queen, success will also be attained by the beginner.

A brief summary of the leading traits of the various races now in this country will be of use in guiding the purchaser, as well as instructive to him for reference.

Caucasians are natives of that portion of Russia lying between the Black and Caspian seas, are exceedingly gentle, good workers, good defenders of their hives, prolific, build many queen cells, and swarm often if confined to small hives. The workers are dark leaden gray in their general color, and present quite a ringed appearance because of the alternation of this dark color with the lighter fuzz which edges the segments of the abdomen. They also show frequently one to two yellow or leather-colored bands, are somewhat smaller bodied than Italians or Carniolans, have good wing-expanse, and hence are nimble flyers. The drones are rather small and quite dark in color; queens not large, and vary in color from a coppery-yellow to a dark bronze.

Carniolans are much larger bodied and somewhat lighter gray in color than the Caucasians, « 17 »
but show likewise in many instances one or two rusty or dark-red bands. Their great hardiness and excellent wing-power enable them to fly freely in much cooler weather than some other races stand, and to regain their hive entrances under adverse conditions. They are prolific, active, and good honey gatherers, producing combs of snowy whiteness. As in the case of the Caucasians, their prolificness causes them to fill small hives to overflowing with bees, and this naturally results in numerous swarms. It is therefore advisable to use hives containing ten to twelve frames in the brood chamber. The nature of the Carniolans is essentially a quiet one, so that upon the approach of cold weather they settle down in a very compact and extremely quiet cluster, a condition which contributes in no small degree to their excellent wintering qualities. The drones are the largest of all drones of this species, and are covered with a thick coat of gray fuzz. The queens vary from a light color to a very dark leather color, the typical queen being, however, dark bronze, large, well rounded, strong, and active.

Italians, the first of the foreign races to be introduced into this country, are much more widely known, and have with reason found great favor, since they are industrious, good defenders of their hives, and excellent honey gatherers, as well as handsome in appearance, being usually evenly marked with three yellow bands across the anterior portion of the abdomen. The blood has become so disseminated through the apiaries of the country that many hybrid bees having but one to two yellow bands are counted as Italians, and their cross disposition, derived through the males of the common race, is charged to the Italians. Strains of Italians pure in blood have been bred by selection in this country until the three yellow bands have become so wide as to be nearly or quite joined, and in some instances nearly the whole abdomen is yellow. In general, however, as regards gathering powers it does not seem that any improvement has been made by this selection, the dark or leather-colored Italians proving, all in all, more vigorous, gentle, and better honey gatherers, while as regards wintering they are also superior. It must be acknowledged, however, that the Italian race is slightly inferior in wintering qualities to all of the others which have been generally introduced into America.

Cyprians, from the island of Cyprus, may be taken as a general type with which to compare other eastern races. They are small bodied, more slender, in fact, than any of the European races of bees. The abdomen is more pointed and shows, when the bees are purely bred, three light-colored bands on the upper surface, and considerable yellow on the under side. Between the wing attachments on the thorax is a little prominence, shaped like a half moon, which is usually « 18 »
quite plainly yellow in color. The queens are small bodied, yellow in color, with more or less black at the tip of the abdomen. The drones have a heavy coat of fuzz on the thorax, and the abdomen presents a mottled yellow appearance, being often highly yellow. Cyprians possess longer tongues and greater wing-power than other races. This, combined with great prolificness and most remarkable activity, renders them the best of honey gatherers. In temper, however, they may be regarded as rather aggressive, rendering their management by any who are not experts extremely difficult. This feature may, however, be largely overcome by crossing the queens of this race with the drones of very gentle types. In this manner bees are produced that are readily amenable to smoke and ordinary methods in manipulation, combined with the excellent honey-gathering powers and prolificness of the eastern races.

Cyprio-Carniolans and Cyprio-Caucasians.—The author conceived the idea in the early eighties that by crossing the Cyprian and Carniolan races a type might be developed which would combine the excellent traits of both of these. The first matings of Cyprians and Carniolans were made by him in 1883 in Carniola itself, thus insuring positively the fecundation of the Cyprian queens by Carniolan drones. Bees combining the blood of the two races in various proportions have since been tested for years in comparison with all other known races, with the result that the cross mentioned above has been found to exceed all of the pure races in honey-gathering powers, owing undoubtedly to the combination of great energy, hardiness, prolificness, and wing-power, as well as greater length of tongue—a fact established by actual measurements. Similar

results, with even greater gentleness, may be expected from the cross obtained between Cyprian queens and Caucasian drones.

Syrian and Palestine or "Holy-Land" bees.—What has been said of Cyprians may be taken to apply in a general sense to Syrian and Palestine bees, except that in these the good qualities are slightly less prominent, while some of the bad ones of the Cyprians are accentuated. No separate description of these is, therefore, particularly necessary in this place.

German, Common Black, or Brown bees.—The bees commonly found wild, and cultivated to a greater or less extent, in this country, and known under the above name, are probably derived from early introductions from the Old World. In comparison with the races above enumerated, they may be said to be inferior, since they possess the least energy in honey collecting, are less prolific, and not as good defenders of their hives. Under favorable conditions, however, as regards pasturage they may be relied upon for excellent results. They are, however, spiteful under manipulation, and have the disagreeable habit of running from the combs and dropping in bunches on the ground, likewise of flying from the hive entrance and attacking passers-by. They are more easily discouraged than other bees during slack times as regards honey production, and this is doubtless the main reason for their generally inferior economic value.

WHAT HIVE TO ADOPT.

The suspended Langstroth frame is used more than any other frame among English-speaking bee keepers. It is safe to say that in the United States 500 hives are made and used which are essentially Langstroth in principle to one frame hive of any other kind whatever. In the British Islands, Australia, and New Zealand the proportion of frames on the Langstroth principle in use is probably even greater, scarcely any other frame hives being employed.

The success of American bee culture in the last twenty years was first attributed by European bee keepers to the honey-producing power of the country; but the most intelligent apiarists who have tried the American methods with the Langstroth hive now recognize that success is principally due to the manipulations that it permits. ("The Hive and Honey Bee," revised, 1888, page 145.)

We can predict, and without any fear of mistake, that the principles on which the Langstroth hive is based will be admitted sooner or later by the most progressive bee keepers of the world. ("Revue Internationale d' Apiculture" (Switzerland), September, 1885, edited by Edouard Bertrand.)

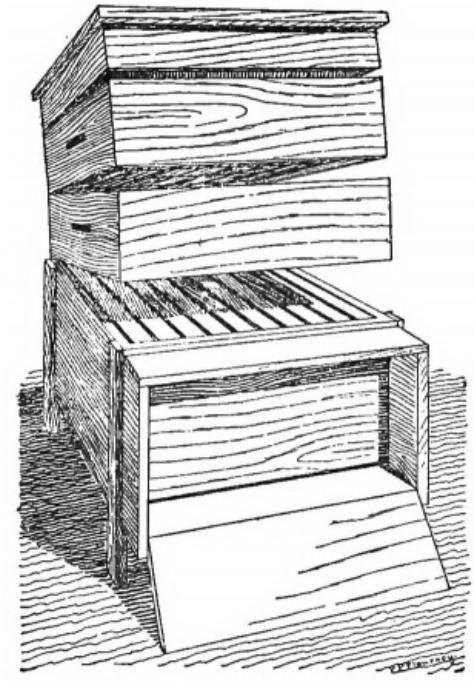

FIG. 4.—Langstroth hive with two half-depth supers for surplus honey.

There being no patent on the Langstroth hive, and accurately made hives being obtainable at moderate prices from hive factories in various parts of the country, it is taken for granted that the enterprising beginner will adopt a simple form embodying this principle—the loose-fitting, suspended comb frame—as its main feature. The hive should not only be substantially built, but should have accurate bee-spaces and a close-fitting, rain-proof cover or roof. Factory-made hives, as a rule, best meet these requirements, as both lock joints and halved corners can only be made to advantage by machinery, and the expert hive builder understands, of course, the absolute necessity of great accuracy in bee-spaces, as well as the great desirability of good material and

workmanship (figs. 4, 5, and 11). Provision should also be made for winter protection. (See pages 39-41.)

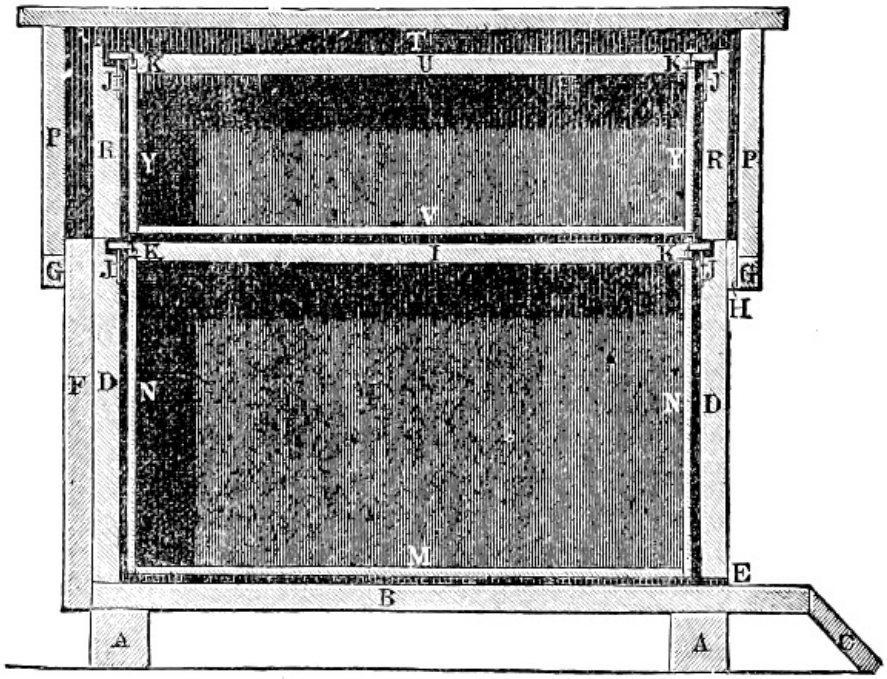

FIG. 5.—The Langstroth hive—Dadant-Quinby form—cross section showing construction.

For comb honey, hives permitting the insertion in the brood apartment of any number of frames up to eight, or frequently up to ten, are most in use. In securing extracted honey, those with ten to twelve frames in each story are preferable, and as many stories, one above the other, are employed as the strength of the colony and a given harvest may require. A construction, therefore, which readily admits of expansion and of contraction, as occasion demands, is desirable.

Mention should be made of a hive of quite different construction, a prominent feature of which is this ease of contraction and expansion. It is the last hive which the late M. Quinby gave to the public—the Quinby closed-end frame hive (fig. 6). This hive is used with great success by certain American bee keepers of long experience and whose apiaries are among the largest in the world.

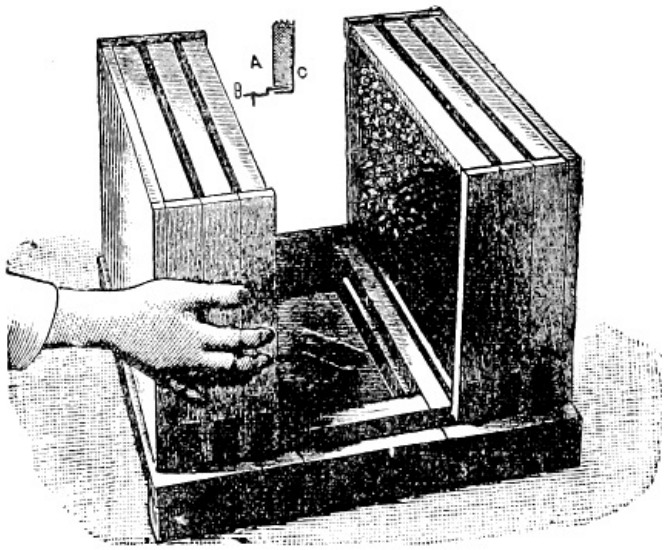

FIG. 6.—Quinby closed-end frames.

MANAGEMENT IN SWARMING.

NATURAL SWARMING.

When a swarm is seen issuing or in the air, the best thing to do is, in general, simply to wait a bit. The weather is usually rather warm then, and rushing about to get tin pans, dinner gongs, spraying outfits, etc., aside from its disagreeableness, may get one so excited and into such a perspiration as to unfit him to do with the bees that which is likely to be necessary a few minutes later. The bees will probably gather in a clump on a tree or bush near the apiary, and however

formidable getting them into the hive may at first seem, nothing will be simpler than shaking them into their new hive, or into a basket or box, from which they may be poured in front of the hive, just as one would pour out a measure of wheat or beans. If any stick to the basket or box, invert it and give a sharp thump with one edge against the ground. If the hive has been standing in the shade so that the boards composing it are not heated, and if it be now well shaded and plenty of ventilation be given above and below, the bees are almost certain to take possession at once and begin work actively.

The securing of swarms can be made, however, even simpler than this by having the colonies placed several feet apart on a smooth lawn or dooryard and clipping one wing of each laying queen so as to prevent her flying. The prime or first swarm from each hive is accompanied by the old queen, and if she be clipped she will of course fall from the alighting board to the ground and may be secured in a cage. The bees will circle about a few times and return. Meanwhile the only thing for the attendant to do is to replace the parent colony by an empty hive. The returning bees will enter the latter and the queen may be allowed to go in with them, the cage being placed with its open end directly against the entrance to insure this. The swarm is thus made to hive itself.

The parent colony removed to a new stand a rod or more away will rarely give a second swarm. But to make certain all queen cells except one may be cut out four or five days after the issuance of the first swarm. At the same time one-third to one-half of the remaining bee's of the removed colony may be shaken at the entrance of the hive containing the swarm. This reduces the population of the parent colony greatly, but the loss is soon made good by the young workers emerging daily, and the new queen which will issue from the single queen cell, spared when cutting out cells, will soon restock the hive with brood. The shaking out of additional bees, coupled with the removal of all queen cells but one, will prevent for the time all further swarming from the given hive, and in most instances end it for the season. The bees thus added to the newly hived swarm, even though too young to enter the field at once as honey gatherers, will nevertheless release from inside work an equal number of older bees, enabling the latter to go out as field bees.

« 22 »

Each after-swarm (second, third, etc.), it should be borne in mind, is accompanied by one or more unimpregnated queens, and these must not be clipped until they have flown out and mated. The regular deposition of eggs in worker cells may nearly always be regarded as a safe sign that mating has taken place. Eggs will usually be found in such cells within the first ten days of the queen's life. After-swarms may remain in the air, circling about for some time, and they frequently cluster high—a good reason, in addition to the more important fact that their issuance is not consistent with the production of the most surplus honey, for the prevention of all after-swarming.

ARTIFICIAL SWARMING.

Where an increase of colonies is desired, and in case no one can be near the apiary to care for natural swarms with clipped queens, some one of the artificial methods of forming new colonies may be advantageously employed. Natural swarming is, however, to be preferred to a poor system of artificial increase. And no matter which of the artificial methods be adopted, it should be cautiously followed, lest, should unfavorable weather appear suddenly, considerable labor and expense be incurred to prevent disastrous results. It is also of prime importance not to weaken materially the gathering powers of strong colonies just at the opening of the harvest or during its progress; hence, whatever division takes place then must leave the field force—the gatherers—in one mass and in normal condition for work, that is, not discouraged by being queenless, and not overburdened by having brood without a sufficient number of nurse bees to care for it.

Dividing.—A plan which fulfills these conditions is the following: From a populous colony a comb or two with adhering bees and the queen may be taken and placed in a new hive, which, when other frames with starters have been added, is then to be put on the stand of the populous colony from which the combs were taken. The removed colony is to be taken a rod or more from its old stand, so that the flight bees returning from the field will enter the newly established colony. The old colony may be given a laying queen or a mature queen cell a day or two later This finishes the work in a short time.

Nucleus system.—A better plan, though not so quickly completed, is to take from the populous colony only enough bees and combs to make a fair nucleus on a new stand. A queen is easily and safely introduced into this nucleus, or a queen cell is readily accepted a day or two later. As soon as the young queen has begun egg laying, combs of emerging brood may be added from time to time. These may be obtained from any populous colonies whose tendency to swarm it is desirable to check, the bees adhering to them when they are removed being in all instances brushed back into their own hive. With fair pasturage the nucleus will soon be able to build combs and may be given frames of comb foundation, or, if the queen be of the current year's raising, frames with narrow strips of foundation as guides may be inserted, since all combs constructed by the nucleus will be composed of worker cells.

« 23 »

Shaken or brushed swarms.—The practice of shaking or brushing bees from the combs of populous colonies into new hives to form artificial or forced swarms has been practiced for many years, to a limited extent in this country and more largely abroad. As early, at least, as 1872 the late C. J. H. Gravenhorst, the editor of Die Illustrierte Bienenzeitung, author of Der Praktische Imker, and inventor of the Bogenstuelper hive, made artificial swarms in this manner. His articles

led the author to experiment in this line and finally to settle upon the plan of placing colonies designed for honey production in pairs in the apiary and, after having brought them up to a suitable strength, shaking or brushing most of the bees of the two into a third hive at the approach of the main honey flow, one queen being allowed to enter the new hive with the shaken swarm. The latter is to be placed on the old stand midway in position between the spots previously occupied by the parent colonies, these having been removed some distance, to be managed thereafter as colonies that have swarmed. The newly shaken swarm is to receive comb foundation starters in the frames and within a day or two surplus receptacles for honey. In case, however, drawn combs be used in the super, there had better be one or two frames in the brood apartment partly filled with completed comb to hold the first pollen collected. The shaking or brushing should be done toward the latter part of the day and during a time when new honey is coming in, or in the absence of the latter liberal feeding should precede the shaking and be kept up until the start of the honey flow. The shaken swarm is thus brought into quite the same condition as usually obtains in the case of a natural swarm. It is able to send out a strong gathering force at once and will store honey rapidly. The increase of 50 per cent is as large as is consistent with the securing of the best honey yield.

PREVENTION OF SWARMING.

Under the conditions most frequently occurring, however—that is, where it is not practicable to be present at all times during the swarming season, or where the desired number of colonies has been attained—a system of management is advisable which in general contemplates the prevention, in so far as possible, of the issuance of swarms without at the same time interfering with honey storing. The paragraphs following on this subject are taken from the Department publication "The Honey Bee," cited on page 15, footnote:

The most commonly practiced and easily applied preventive measure is that of giving abundant room for storage of honey. This to be effective should be given early in the season, before the bees get fairly into the swarming notion, and the honey should be removed frequently, unless additional empty combs can be given in the case of colonies managed for extracted honey, while those storing in sections should be given additional supers before those already on are completed. With colonies run for comb honey it is not so easy to keep down swarming as in those run for extracted honey and kept supplied with empty comb. Free ventilation and shading of the hives as soon as warm days come will also tend toward prevention. Opening the hives once or twice weekly and destroying all queen cells that have been commenced will check swarming for a time in many instances, and is a plan which seems very thorough and the most plausible of any to beginners. But sometimes swarms issue without waiting to form cells; it is also very difficult to find all cells without shaking the bees from each comb in succession, an operation which, besides consuming much time, is very laborious when supers have to be removed, and greatly disturbs the labors of the bees. If but one cell is overlooked the colony will still swarm. The plan therefore leaves at best much to be desired, and is in general not worth the effort it costs and can not be depended on.

« 24 »

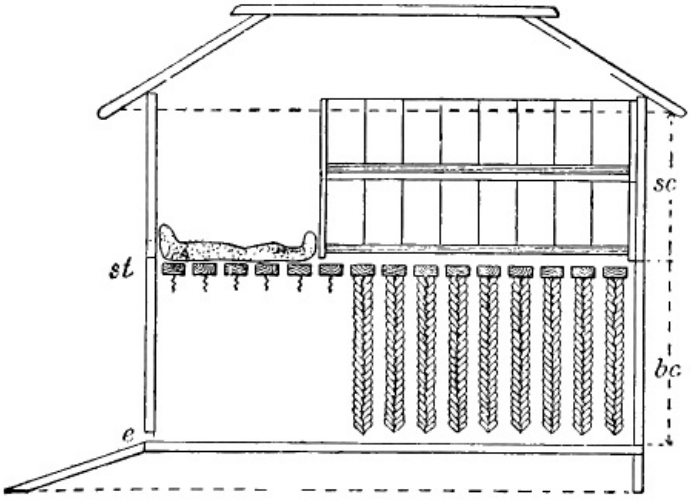

FIG. 7.—The Simmins nonswarming system—single-story hive with supers: *bc*, brood chamber; *sc*, supers; *st*, starters of foundation; *e*, entrance.

Dequeening.—The removal of a queen at the opening of a swarming season interferes, of course, with the plans of the bees, and they will then delay swarming until they get a young queen. Then, if the bee keeper destroys all queen cells before the tenth day, swarming will again be checked. But to prevent swarming by keeping colonies queenless longer than a few days at most is to attain a certain desired result at a disproportionate cost, for the bees will not store diligently when first made queenless, and the whole yield of honey, especially if the flow is extended over some time, or other yields come later in the season, is likely or even nearly sure to be less from such colonies, while the interruption to brood roaring may decimate the colony and prove very disastrous to it. The plan is therefore not to be commended.

Requeening.—Quite the opposite of this, and more efficacious in the prevention of swarming, is the practice of replacing the old queen early in the season with a young one of the same season's raising, produced, perhaps, in the South before it is possible to rear queens in the North. Such queens are not likely to swarm during the first season, and, as they are vigorous layers, the hive will be well populated at all times and thus ready for any harvest. This is important, inasmuch as a flow of honey may come unexpectedly from some plant ordinarily not counted upon; and also, since the conditions essential to the development of the various honey-yielding plants differ greatly, their time and succession of honey yield will also differ with the season the same as the quantity may vary. Young queens are also safest to head the colonies for the winter. The plan is conducive to the highest prosperity of the colonies, and is consistent with the securing of the largest average yield of honey, since, besides giving them vigorous layers, it generally keeps the population together in powerful colonies. It is therefore to be commended on all accounts as being in line with the most progressive management, without at the same time interfering with the application of other preventive measures.

« 25 »

Space near entrances.—Arranging frames with starters, or combs merely begun, between the brood nest and the flight hole of the hive, while the bees are given storing space above or back of the brood nest (figs. 7 and 8), is a plan

strongly recommended by Mr. Samuel Simmins, of England, and which has come to be known as "the Simmins nonswarming method," some features of it and the combination into a well-defined method having been original with him. It is an excellent preventive measure, though not invariably successful, even when the distinctive features brought forward prominently by Mr. Simmins—empty space between the brood combs and entrance, together with the employment of drawn combs in the supers—are supplemented by other measures already mentioned; but when, in addition to the space between the brood and the flight hole, the precaution be taken to get supers on in time, to ventilate the hive well, and to keep queens not over two years old, swarming will be very limited. If to these precautions be added that of substituting for the old queens young ones of the current season's raising, before swarming has begun, practical immunity from swarming is generally insured.

Selection in breeding.—Some races of bees show greater inclination than others toward swarming, and the same difference can be noted between individual colonies of a given race; therefore, whatever methods be adopted to prevent or limit increase, no doubt the constant selection of those queens to breed from whose workers show the least tendency toward swarming would in time greatly reduce this disposition. Indeed, it is perfectly consistent to believe that persistent effort, coupled with rigid and intelligent selection, will eventually result in a strain of bees quite as much entitled to be termed nonswarming as certain breeds of fowls which have been produced by artificial selection are to be called nonsitters. These terms are of course only relative, being merely indicative of the possession of a certain disposition in a less degree than that shown by others of the same species. It might never be possible to change the nature of our honeybees so completely that they would never swarm under any circumstances, and even if possible it would take a long period, so strongly implanted seems this instinct. But to modify it is within the reach of any intelligent breeder who will persistently make the effort. Such work should be undertaken in experimental apiaries where its continuance when a single point has been gained will not be affected by the changes of individual fortunes.

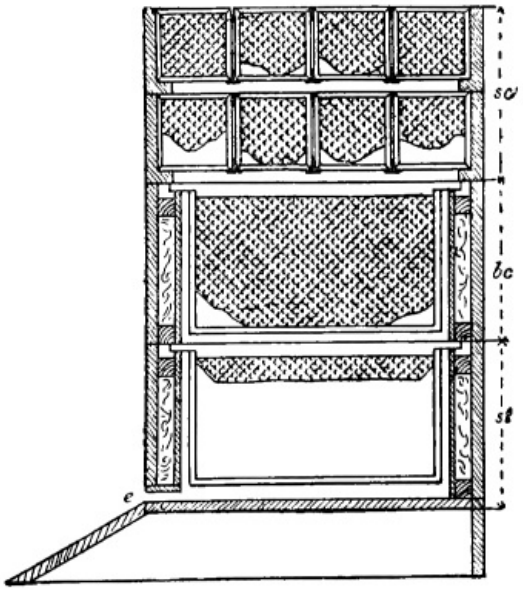

FIG. 8.—The Simmins nonswarming system—double-story hive with supers: *bc*, brood chamber; *sc*, supers; *st*, chamber with starters of comb foundation; *e*, entrance.

SPECIAL CROPS FOR HONEY ALONE NOT PROFITABLE.

With a small apiary, planting for honey alone certainly can not be made profitable. Small plats of honey-producing plants are valuable mainly because they afford an opportunity of observing when and under what circumstances the bees work on certain blossoms, and for the purpose of determining what might be depended upon to fill a gap in the honey resources of a given locality whenever the size of the apiary might make this a consideration of some importance. Even with a large apiary probably no case exists in which, in the present condition of the subject, planting for honey alone would prove profitable. But when selecting crops for cultivation for other purposes, or shrubs and trees for planting, the bee keeper should of course choose such as will also furnish honey at a time when pasturage for his bees would otherwise be wanting.

As complete a list as possible should be made of the plants and trees visited by honeybees, and notes should be added as to period of blossoming, importance of yield, whether honey or pollen or both of these are collected, quality of the product, etc. If gaps occur during which no natural forage abounds for the bees, some crop can usually be selected which will fill the interval, and, while supplying a continuous succession of honey-yielding blossoms for the bees, will give in addition a yield of fruit, grain, or forage from the same land. The novice is warned, however, not to expect too much from a small area. He must remember that as the bees commonly go 2½ to 3 miles in all directions from the apiary, they thus range over an area of 12,000 to 18,000 acres, and if but 1 square foot in 100 produces a honey-yielding plant they still have 120 to 180 acres of pasturage, and quite likely the equivalent of 30 to 40 acres may be in bloom at one time within range of the bees. A few acres more or less at such a time will therefore not make a great deal of difference.

But if coming between the principal crops—especially if the bees, as is often the case, would otherwise have no pasturage at all—the area provided for them may be of greater relative

importance than the larger area of natural pasturage; for it frequently occurs that the smaller part only of the honey produced by the field over which the bees of an apiary range can be collected by them before it is washed out by rains, or the liquid portion is evaporated and the blossoms withered, while a smaller area may be more assiduously visited, and, the nectar being gathered as fast as secreted, a greater yield per acre may result.

It is further of some importance to fill in such a gap with something to keep the bees busy, instead of letting them spend their time trying to rob one another; and, what is probably even more important, the pasturage thus furnished will keep up brood rearing and comb building and assist materially in preparing the colonies for the succeeding honey flow.

« 27 »

There are many plants and trees of economic value, in addition to their production of honey, which may be utilized in one portion or another of the United States in the manner indicated. Adaptability to climate and soil, the periods of honey dearth to be filled in, markets for the crop produced, etc., must all come in to influence the choice. The following list includes the more important plants of economic value in this country which are good honey and pollen yielders. Most of those named are adapted to a considerable portion of the Union. Except in the case of plants restricted to the South, the dates given are applicable, in the main, to middle latitudes.

ECONOMIC PLANTS AND TREES FOR CULTIVATION FOR HONEY AND POLLEN.

Filbert bushes, useful for wind-breaks and for their nuts, yield pollen in February and March.

Rape can be grown successfully in the North for pasturage, for green manuring, or for seed, and when permitted to blossom yields considerable pollen and honey. Winter varieties are sown late in the summer or early in the autumn, and blossom in April or May following. This early yield forms an excellent stimulus to brood rearing. Summer or bird rape, grown chiefly for its seed, blossoms about a month after sowing. It does best during the cooler months of the growing season.

Russian or hairy vetch is a hardy leguminous plant of great value for forage and use in green manuring. The blossoms appear early in the season, and, where there is any lack in early pollen, especially in northern and cool regions, this vetch will be found of great value to the bees.

Fruit blossoms—apricot, peach, pear, plum, cherry, apple, currant, and gooseberry—yield pollen and honey in abundance during April or May; strawberry and blackberry are sometimes visited freely by bees, but are generally far less important than the others mentioned. Colonies that have wintered well often gather during apple bloom 12 to 15 pounds of surplus honey of fine quality. The raspberry secretes a large amount of nectar of superb quality, and coming in May or June, thus later than the other fruit blossoms and when the colonies are stronger and the weather is more settled, full advantage can nearly always be taken of this yield. Grape and persimmon blossom also in June; the latter is an excellent source. In subtropical portions of the country orange and lemon trees yield fine honey in March and April, and the cultivation of the banana has added a profuse honey yielder which puts forth successive blossoms all through the summer months.

Locust, **tulip tree** ("poplar," or whitewood), and **horse-chestnut**, useful for shade, ornament, and timber, are all fine honey producers in May. The locust yields light-colored, clear honey of fine quality, the others amber-colored honey of good body and fair flavor.

« 28 »

Clovers.—Crimson, blossoming in April or May, yields fine, light-colored honey; white, alsike, and mammoth or medium, blossoming in May, June, and July, give honey of excellent quality and rich yellow color.

Mustard grown for seed flowers from June to August. The honey is somewhat acrid and crystallizes soon, yet the plant, where abundant, is of much importance to the bees and the bee keeper in case other forage is scant at the time.

Asparagus blossoms are much visited by bees in June and July.

Esparcet, or **sainfoin**, yields in May and June fine honey, almost as clear as spring water. It is a perennial leguminous plant, rather hardy, an excellent forage crop, and particularly valuable for milch cows. It succeeds best on a limestone soil or when lime is used as a fertilizer, and is itself an excellent green manure for soils deficient in nitrogen and phosphoric acid.

Sulla, or sulla clover, a perennial plant, closely related to esparcet or sainfoin, succeeds, like the latter, best upon limestone soil or when fertilized with lime. It yields a splendid quality of honey from beautiful pink blossoms, which continue during May and June. The plant is an excellent soil fertilizer and of great value in connection with the feeding of stock, particularly dairy animals. It is, however, much less hardy than esparcet, and success with it can therefore hardly be looked for above the latitude of North Carolina and Arkansas. When the qualities and requirements of this plant were brought by the writer to the notice of a prominent scientific agriculturist of the South, this gentleman suggested as very probable that the black belt of Alabama, Mississippi, Louisiana, and Texas would be well adapted to it, the lands of this region being exceedingly strong in lime. In portions of southern Europe sulla clover is a most important forage crop for farm stock as well as for honey bees.

Serradella is an annual leguminous plant which will grow on sandy land, and which yields, besides good forage, clear honey of good quality in June and July.

Chestnut, valuable for timber, ornament, shade, and nuts, yields honey and pollen in June or July.

Linden, **sourwood**, and **catalpa**, fine shade, ornamental, and timber trees, yield great quantities of first quality honey in June and July.

Cotton.—In the South cotton blossoms, appearing as they do in succession during the whole summer, often yield considerable honey. It would appear, however, that when the plants are very rank in growth the blossoms—being correspondingly large—are too deep for the bees to reach the nectar.

Chicory, raised for salad and for its roots, is, whenever permitted to blossom, eagerly visited for honey in July and August.

Sweet, medicinal, and pot herbs, such as marjoram, savory, lavender, catnip, balm, sage, thyme, etc., when allowed to blossom, nearly all yield honey in June, July, or August. Where fields of them are grown for the seed the honey yield may be considerable from this source. « 29 »

Alfalfa furnishes in the West a large amount of very fine honey during June and July. Its importance there as a forage crop is well known, but how far eastward its cultivation may be profitably extended is still a question, and even should it prove of value in the East as a forage plant, its honey-producing qualities there would be still uncertain.

Parsnips, when left for seed, blossom freely from June to August, inclusive, and are much frequented by honey bees.

Peppermint, raised for its foliage, from which oil is distilled, is most frequently cut before the bees derive much benefit from it, but whenever allowed to blossom it is eagerly sought after by them, and yields honey freely during July and August.

Bokhara, or **sweet clover**, is in some sections of the country considered a valuable forage crop. Animals can be taught to like it, and it is very valuable as a restorer of exhausted lime soils, while in regions lacking in bee pasturage during the summer months it is a very important addition. It withstands drought remarkably well and yields a large quantity of fine honey.

Cucumber, **squash**, **pumpkin**, and **melon** blossoms furnish honey and some pollen to the bees in July and August.

Eucalypti, valuable for their timber and as ornaments to lawn and roadside, are quick-growing trees adapted to the southern portions of the United States. They yield much honey between July and October.

The **carob tree**, whose cultivation has been commenced in the Southwest, is an excellent honey yielder in late summer. It is an ornamental tree and gives, in addition to honey, another valuable product—the carob bean of commerce.

Sacaline, a forage and ornamental plant of recent introduction, is a great favorite with bees. It blossoms profusely during August, is a hardy perennial, and thrives in wet and also fairly in dry situations, withstanding the ordinary summer drought of the Eastern States because of its deeply penetrating roots.

Buckwheat is an important honey and pollen producer. Its blossoms appear about four weeks after the seed is sown, hence it may be made to fill in a summer dearth of honey plants.

HOW TO OBTAIN SURPLUS HONEY AND WAX.

Good wintering, followed by careful conservation of the natural warmth of the colony, the presence of a prolific queen—preferably a young one—with abundant stores for brood rearing, are, together with the prevention, in so far as possible, of swarming, the prime conditions necessary to bring a colony of bees to the chief honey flow in shape to enable it to take full advantage of the harvest. In addition it is only necessary to adjust the surplus honey receptacles in time, making the space given proportionate to the strength of the colony, and, while continuing to prevent as far as possible the issuance of swarms, to remove the accumulated honey fast enough to give abundant storage room. « 30 »

EXTRACTED HONEY.

To secure extracted honey, the requisite number of combs may be in one long hive, or in stories one above another. Preference is most generally given to the latter plan. The brood apartment is made in this case to hold eight to twelve Langstroth frames, and a second, and sometimes a third or even a fourth story, may be added temporarily. These added stories may be for full-depth frames, or, for convenience in handling and in order to be able to control more

closely the amount of space given, they may be half the usual depth, and but one of the half-depth stories added at a time. If numerous sets of combs are at hand, or if it is desirable to have others built, additional stories are put on as fast as the combs already occupied by the bees are filled. Before removing the filled combs time should be allowed the bees to ripen and cap the honey; hence enough combs are necessary to give the bees storage room while they are capping others, the honey in combs that are quite or nearly sealed over may be considered sufficiently ripened to be removed from the hive.

FIG. 9.—Quinby uncapping knife.

It should also be taken promptly, in order to keep the various grades or kinds separate. However, when the combs of a given super are completely filled and sealed it may be marked and left on the hive if more convenient to be extracted later.

The cells are uncapped by means of a sharp knife, made especially for this purpose (fig. 9), and the combs are then made to revolve rapidly in the honey extractor (fig. 10). The centrifugal force exerted on the honey throws it out, leaving the comb cells uninjured, or so slightly injured that they are wholly repaired within an hour or so after the return of the comb to the hive. The chief advantages of this method of harvesting over that of crushing the combs are at once apparent when it is known that each pound of comb saved represents several pounds of honey (consumed in its construction), and may, with care be used over almost indefinitely in securing surplus honey. Furthermore, extracted honey is of much finer quality than that obtained by crushing the combs and straining out the liquid part, since it is free from crushed bees, larvæ, pollen or "bee bread," etc., which not only render strained honey dark and strong in flavor, but also make it liable to fermentation and souring.

« 31 »

The extracted honey is run into open buckets or tanks and left, covered with cheese cloth, to stand a week or so in a dry, warm room not frequented by ants. It should be skimmed each day until perfectly clear, and is then ready to be put into cans or barrels for marketing, or to be stored in a dry place. Square tin cans, each made to hold 60 pounds of extracted honey, are sold by dealers in apiarian supplies. This style of package is a convenient one to transport, and is also acceptable to dealers. Wooden shipping cases are usually constructed so as to hold two of these cans. Barrels and kegs may be used, especially for the cheaper grades of honey used chiefly in the manufacture of other articles. They should be dry, made of well-seasoned, sound wood, and the hoops driven tight and secured, as well-ripened honey readily absorbs moisture from wood, causing shrinkage and leakage. They should also be coated inside with bees-wax or paraffin. This is easily done by warming the barrels and then pouring in a gallon or two of hot wax or paraffin, and, after having driven in the bungs tightly, rolling the barrels about a few times and turning them on end. The work should be done quickly and the liquid not adhering to the inner surfaces poured out at once, in order to leave but a thin coating inside.

The surplus combs are to be removed at the close of the season and hung an inch or so apart on racks placed in a dry, airy room, where no artificial heat is felt. Mice, if permitted to reach them, will do considerable damage by gnawing away the cells containing pollen or those in which bees have been bred, and which therefore contain larval and pupal skins. Moth larvæ are not likely to trouble them until the following spring, but upon the appearance of milder weather their ravages will begin, and if the combs can not be placed under the care of the bees at once they must be fumigated with burning sulphur or with bisulphide of carbon.

COMB HONEY.

The main difference to be observed in preparing colonies for the production of comb honey, instead of extracted, is in the adjustment of the brood apartment at the time the supers are added. After the colony has been bred up to the greatest possible strength, the brood apartment should be so regulated in size, when the honey flow begins and the supers are added, as to crowd many of the bees out and into the supers placed above.

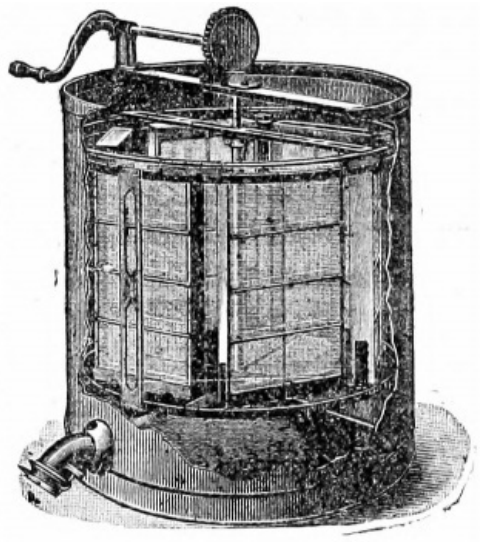

FIG. 10.—Automatic reversible honey extractor.

« 32 »

On each hive a super is placed (fig. 11) holding 24 to 48 sections, each section supplied with a strip or a full sheet of very thin foundation. It is best not to give too much space at once, as considerable warmth is necessary to enable the bees to draw out foundation or to build comb. A single set of sections is usually sufficient at a time. When the honey is designed for home use or for a local market, half-depth frames are sometimes used, the same as those often used above the brood nests when colonies are run for extracted honey, but for the general market pound sections (fig. 12) are better adapted.

It is the practice of many to have nice white comb partially drawn out before the main honey flow begins, or even the season before, feeding the colonies, if necessary, to secure this; and, when the honey yield begins, to supply sets of sections with these combs having cells deep enough for the bees to begin storing in as soon as any honey is collected. Earlier work in the sections is thus secured, and this, as is well known, is an important point in the prevention of swarming. Mr. Samuel Simmins, of England, has long contended for this use of partially drawn combs, and though it forms a feature of his system for the prevention of swarming it has been too often overlooked. Comb foundation is now manufactured with extra thin septum or base and with the beginnings of the cells marked out by somewhat thicker walls which the bees immediately thin down, using the extra wax in deepening the cells. This is not artificial comb, but a thin sheet of wax having the bases of the cells outlined on it. Complete artificial combs have never been used in a commercial way, although there exists a widespread belief to this effect, which is founded on extravagant claims that have appeared from time to time in newspaper articles.

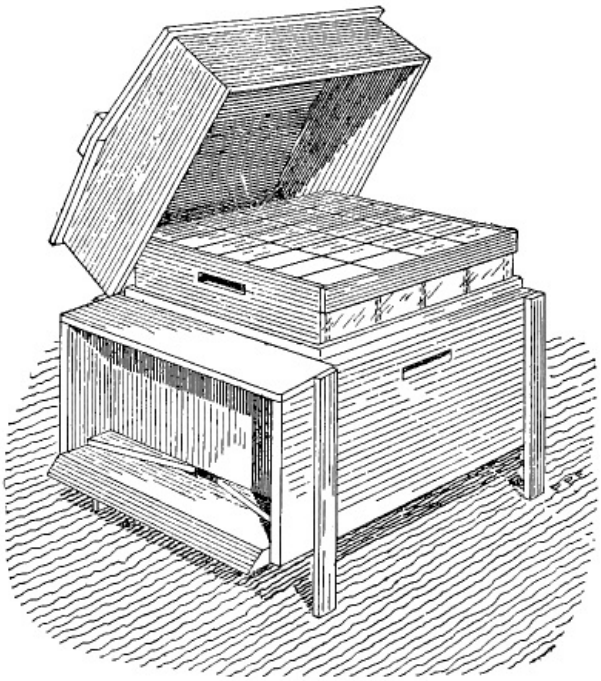

FIG. 11.—Langstroth hive—super above holding 28 sections for comb honey.

« 33 »

If the brood apartment has been much contracted when the supers were added, the queen may go into the sections and deposit eggs unless prevented by the insertion of a queen excluder (fig. 13). This, merely a sheet of zinc with perforations which permit workers, but not the queen, to pass, is placed between the brood apartment and the supers. The great inconvenience of having brood in some of the sections is thereby prevented. When the honey in the sections has

been nearly capped over, the super may be lifted up and another added between it and the brood apartment. Or, should the strength of the colony not be sufficient, or the harvest not abundant enough to warrant the giving of so much space, the sections which are completely finished may be removed and the partly finished ones used as "bait sections" to encourage work in another set of sections on this hive or in new supers elsewhere. The objections to the removal of sections one by one, and brushing the bees from them, are (1) the time it takes, and (2) the danger that the bees when disturbed, and especially if smoked, will bite open the capping and begin the removal of the honey, thus injuring the appearance of the completed sections.

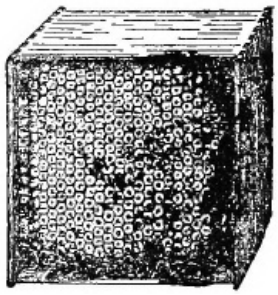

FIG. 12.—Comb honey stored in pound section—size 4¼ by 4¼ inches.

A recent valuable invention, the bee escape (fig. 3), the use of which is explained on pages 15 and 16, when placed between the super and the brood nest, permits the bees then above the escape to go down into the brood apartment, but does not permit their reentering the super. If inserted twelve to twenty-four hours before the sections are to be removed, the latter will be found free from bees at the time of removal, provided all brood has been kept out of the supers.

Grading and shipping comb honey.—Before marketing the honey it should be carefully graded, and all propolis ("bee-glue"), if there be any, scraped from the edges of the sections. In grading for the city markets the following rules are, in the main, observed. They were adopted by the North American Bee-Keepers' Association at its twenty-third annual convention, held in Washington, D. C, in December, 1892, and are copied from the official report of that meeting:

Fancy.—All sections to be well filled; combs straight, of even thickness, and firmly attached to all four sides; both wood and comb unsoiled by travel stain or otherwise; all cells sealed except the row of cells next to the wood.

No. 1.—All sections well filled, but with combs crooked or uneven, detached at the bottom, or with but few cells unsealed; both wood and comb unsoiled by travel stain or otherwise.

In addition to the above, honey is to be classified, according to color, into light, amber, and dark. For instance, there will be "fancy light," "fancy amber," and "fancy dark," "No. 1 light," "No. 1 amber," and "No. 1 dark."

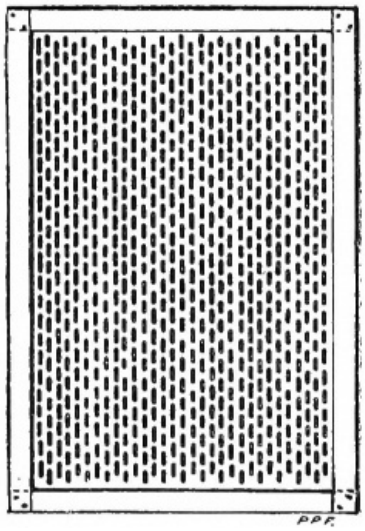

FIG. 13.—Perforated zinc queen excluder.

The sections, after grading and scraping, are to be placed in clean shipping cases having glass in one or both ends (fig. 14). Several of these may be placed in a single crate for shipment. To prevent breaking down of the combs it is best to put straw in the bottom of the crate for the shipping cases to rest on, and the crates should be so placed as to keep the combs in a perpendicular position. The crates are also likely to be kept right side up if convenient handles are attached to the sides—preferably strips with the ends projecting beyond the corners. Care in handling will generally be given if the glass in the shipping cases shows.

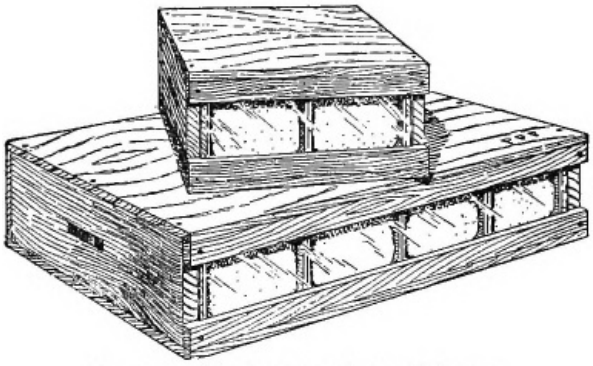

FIG. 14.—Shipping cases for comb honey.

Owing to the appearance of statements of a sensational character to the effect that complete

honey combs are manufactured by machinery and filled with sweets lower in price than honey (glucose, cane sugar, or mixtures of these), then sealed over and sold in the market as genuine honey, a strong suspicion exists regarding the comb honey commonly offered for sale. Wide circulation has been given to these wild stories by sensational newspaper writers, and even monthly periodicals, usually far more discriminating and accurate, have repeated them. Some writers have even tried to locate the "comb honey factories" in given cities, but investigation has always shown that the locations were mythical. The forfeit of $1,000 which a reputable firm has had standing for fifteen years past for a pound of manufactured comb honey of a nature to deceive the buyer still remains unclaimed.

The National Bee-Keepers' Association, at its annual convention held in St. Louis in 1904, offered also a like forfeit of $1,000 for satisfactory proof of the existence of such a thing as manufactured comb honey. But no claimant has come forward, notwithstanding the $2,000 which awaits his proof. The fact is, there is no truth in the "yarn," and no one has thus far shown the thing possible. The comb honey in the markets is pure and wholesome—a healthful and nourishing sweet, easier to digest than cane sugar or any of the sirups so commonly sold. It is worth a place on the tables of all who can afford to use it.

PRODUCTION OF WAX.

No method has yet been brought forward which will enable one, at the present relative prices of honey and wax, to turn the whole working force of the bees, or even the greater part of it, into the production of wax instead of honey; in fact, the small amount of wax produced incidentally in « 35 » apiaries managed for extracted or for section honey is usually turned into honey the following season; that is, it is made into comb foundation, which is then employed in the same hives to increase their yield of marketable honey. It is even the case that in most apiaries managed on approved modern methods more pounds of foundation are employed than wax produced; hence less progressive bee keepers—those who adhere to the use of box hives and who can not therefore utilize comb foundation—are called upon for their wax product. As each pound of wax represents several pounds of honey, all cappings removed when preparing combs for the extractor, all scrapings and trimmings and bits of drone comb, are to be saved and rendered into wax. This is best done in the solar wax-extractor (fig. 15), the essential parts of which are a metal tank with wire-cloth strainer and a glass cover, the latter generally made double. The bottom of the metal tank is strewn with pieces of comb, the glass cover adjusted, and the whole exposed to the direct rays of the sun. A superior quality of wax filters through the strainer.

Another method is to inclose the cappings or combs to be rendered in a coarse sack and weight this down in a tin boiler partly filled with rain water or soft spring water and boil slowly until little or no more wax can be pressed out of the material in the sack. Melting in an iron receptacle makes the wax dark colored. A special utensil made of tin, for use as a wax-extractor (fig. 16) over boiling water, can also be had. The bits of comb are placed in this, in an inside can having fine perforations, through which the steam from below enters and melts out the wax, which drips from a spout into another receptacle partly filled with water, from the surface of which the cake of wax may be removed when cold.

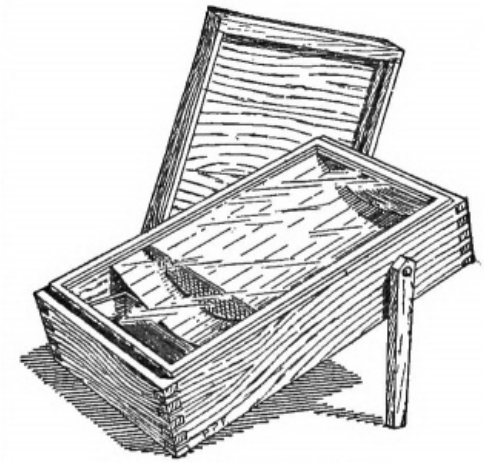

FIG. 15.—Solar wax-extractor.

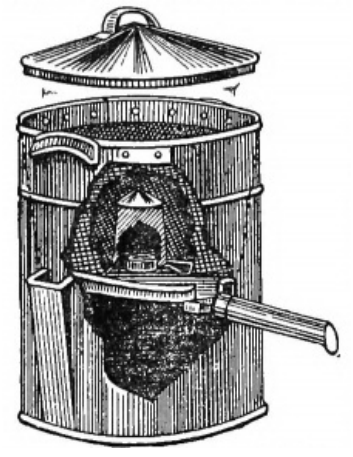

FIG. 16.—Steam wax-extractor.

THE WINTERING OF BEES.

How to bring bees successfully through the winter in the colder portions of the United States is a problem which gives anxiety to all who are about to attempt it for the first time in those sections, and even many who have kept bees for years still find it their greatest difficulty. It may « 36 » happen occasionally that a queen, apparently young and vigorous in the autumn, will die during the winter, when a young one can not be reared, and as a result the colony will dwindle away. Such losses are, however, rare, and, aside from the possible results of fire, flood, or violent storms, are about the only ones which can not be avoided by careful attention to right methods in

wintering. Insufficient or poor winter stores, hives faulty in construction, lack of protection from cold and dampness, too much or too little ventilation, too great a proportion of old bees or too great a proportion of young ones, overmanipulation late in the season, etc., are the most important and most easily detected causes of loss in wintering bees. In some instances colonies supposed to have been placed in the same condition under which others have wintered well become diseased and die or dwindle away without prominent signs of disease. It is evident, however, that some condition existed in one case which was not present in the other, or that, in spite of some unfavorable condition, the favorable ones combined, in the first instance, to render the wintering successful.

In the South wintering in the open air on the summer stands is the only method followed, while in the colder portions of the country, although with proper precautions bees may be wintered successfully in the open air, many prefer to house them in special repositories built with double walls, or to place them in darkened cellars, or in clamps. Indoor wintering should be confined to regions where there are several weeks, at least, of continued severe weather. When all conditions are right, consumption of honey will be less indoors and loss of bee life less than with the methods usually practiced in outdoor wintering. Under proper conditions, however, especially when abundant protection has been given, colonies out of doors will consume no more food nor meet with greater losses in numbers than those wintered under favorable conditions indoors. In wintering indoors certain essential conditions are, in a measure, beyond the control of the bee keeper, hence must be left to chance, and certain other conditions and emergencies liable to arise, though easily understood and met by the man of experience in this direction, are yet very likely to be overlooked by the novice or to be puzzling and disastrous to him. For these reasons it is safer for him to keep closer to the natural method at first and try outdoor wintering.

In wintering out of doors the conditions within the control of the bee keeper are more readily perceived and easier to meet, and though the original work of preparation for good wintering out of doors is greater per colony, yet the work during the winter itself and the following spring is likely to be less; moreover, the feeling of greater security, as well as the greater certainty of finding the colonies in good condition to begin gathering in the spring, are points well worthy of « 37 »
consideration. In other words, indoor wintering should be left to such experienced bee keepers as may prefer it and are located in cold climates, while novices, wherever located, should first endeavor to meet the requirements of successful outdoor wintering; that is, to prepare the colonies so that Nature, whatever her mood as regards the weather, will bring her tiny charges safely through the perils and vicissitudes of the winter months.

GENERAL CONSIDERATIONS.

Whatever method be followed in wintering, certain conditions regarding the colony itself are plainly essential: First, it should have a good queen; second, a fair-sized cluster of healthy bees, neither too old nor too young; third, a plentiful supply of good food. The first of these conditions may be counted as fulfilled if the queen at the head of the colony is not more than two years old, is still active, and has always kept her colony populous; yet a younger queen—even one of the current season's rearing, and thus but a few weeks or months old—is if raised under favorable conditions, much to be preferred. The second point is met if brood rearing has been continued without serious interruption during the latter part of the summer and the cluster of bees occupies, on a cool day in autumn, six to eight or more spaces between the combs, or forms a compact cluster 8 or 10 inches in diameter. Young bees, if not weir protected by older ones, succumb readily to the cold, while quite old bees die early in the spring, and others, which emerged late in the summer or autumn preceding, are needed to replace them. The third essential—good food—is secured if the hive is liberally supplied with well-ripened honey from any source whatever, or with fairly thick sirup, made from white cane sugar, which was fed early enough to enable the bees to seal it over before they ceased flying. The sirup is prepared by dissolving 3 pounds of granulated sugar in 1 quart of boiling water and adding to this 1 pound of pure extracted honey. Twenty to 26 pounds for outdoor wintering in the South, up to 30 or 40 pounds in the North, when wintered outside with but slight protection—or, if wintered indoors, about 20 pounds—may be considered a fair supply of winter food. A smaller amount should not be trusted except in case much greater protection be furnished against the effects of severe weather than is usually given. A greater amount of stores will do no harm if properly arranged over and about the center of the cluster, or, in case the combs are narrow, wholly above the cluster. In many instances it will be a benefit by equalizing in a measure the temperature in the hive, as well as by giving to the bees greater confidence in extending the brood nest in early spring.

« 38 »

INDOOR WINTERING.

A dry, dark cellar or special repository built in a sidehill or with double, filled walls, like those of an ice house, may be utilized for wintering bees in extremely cold climates. It should be so built that a temperature of 42° to 45° F. (the air being fairly dry in the cellar) can be maintained during the greater part of the winter. To this end it should be well drained, furnished with adjustable ventilators, and covered all over with earth, except the entrance, where close-fitting doors, preferably three of them, should open in succession, so as to separate the main room from the outside by a double entry way. The colonies, supplied with good queens, plenty of bees, 20 to 25 pounds of stores each, and with chaff cushions placed over the frames, are carried in shortly

before snow and severe freezing weather come.

Any repository which is damp or one whose temperature falls below freezing or remains long below 38° F. is not a suitable place in which to winter bees. When in repositories, the bees have no opportunity for a cleansing flight, nor do they, when the temperature rises outside, always warm up sufficiently to enable the cluster to move from combs from which the stores have been exhausted to full ones; hence in a cold repository they may possibly starve with plenty of food in the hive. As a rule, colonies would be better off out of doors on their summer stands than in such places.

OUTDOOR WINTERING.

Cold and dampness are the great winter enemies of bee life. A single bee can withstand very little cold, but a good cluster, if all other conditions are favorable, can defy the most rigorous winters of our coldest States. But if not thoroughly dry, even a moderate degree of cold is always injurious, if not absolutely fatal. Dampness in winter is therefore the most dangerous element with which the bee keeper has to contend. The matter would, of course, be quite simple if only that dampness which might come from the outside were to be considered, but when the air of the hive, somewhat warmed by the bees and more or less charged with the moisture of respiration, comes in contact with hive walls or comb surfaces made cold by outside air, condensation takes place, and the moisture trickles over the cold surfaces and cluster of bees, saturating the air about them or even drenching them, unless by forming a very compact cluster they are able to prevent it from penetrating, or by greater activity to raise the temperature sufficiently to evaporate the surplus moisture, or at least that portion near them. But this greater activity is, of course, at the expense of muscular power and requires the consumption of nitrogenous as well as carbonaceous food. Increased cold or its long continuance greatly aggravates conditions.

« 39 »

Nature has provided that the accumulation of waste products in the body of the bee during its winter confinement should be small under normal conditions, but unusual consumption of food, especially of a highly nitrogenous nature like pollen, necessitates a cleansing flight, or diarrheal difficulties ensue, combs and hives are soiled, the air of the hive becomes polluted, and at last the individual bees become too weak to generate proper warmth or drive off the surplus moisture which then invades the cluster and brings death to the colony; or, what is more frequently the case, a cold snap destroys the last remnant of the colony, which has been reduced by constant loss of bees impelled by disease to leave the cluster or even to venture out for a cleansing flight when snows and great cold prevail.

The problem then is: *To retain the warmth generated by the bees, which is necessary to their well-being, and at the same time to prevent the accumulation of moisture in the hive.* A simple opening at the top of the hive would permit much of the moisture to pass off, but of course heat would escape with it and a draft would be produced. Absorbent material about the cluster creates, without free ventilation, damp surroundings, and again the temperature is lowered. It is only necessary, however, to surround the bees with sufficient material to protect them fully against the greatest cold likely to occur, and to take care also that this enveloping material is of such a nature and so disposed as to permit the free passage of the moisture which would otherwise collect in the interior of the hive, and to permit the escape into the surrounding atmosphere of such moisture as enters this material from within. This packing should also be fully protected from outside moisture.

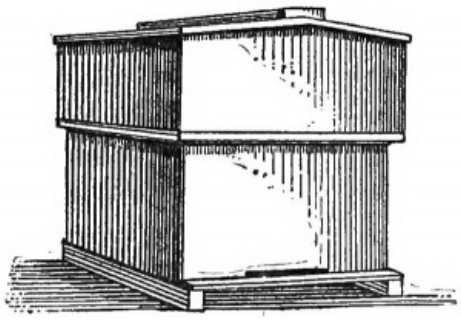

FIG. 17.—Double-walled hive adapted to outdoor wintering as well as summer use below 40° north latitude in the United States. Thickness of each wall, ⅜ inch, space between walls, 2 inches, packed with dry chaff or ground cork.

South of Virginia, Kentucky, and Kansas single-walled hives may be employed in most localities with good success in outdoor wintering. On the approach of the cool or the rainy season a close-fitting quilt should be laid over the frames and several folded newspapers pressed down on this, or a cushion filled with dry chaff or some other soft material may be used instead of paper. The cover or roof should be absolutely rain-proof, yet between this cover and the cushion or papers should be several inches of space with free circulation of air. In order to permit this ventilation above the top packing, the cover should not rest upon the cap or upper story all of the way around, or if it does, an auger hole in each end, protected by wire-cloth against the entrance of mice, should give free passage to the air. In the more northern portion of the section referred

« 40 »

to some further protection is advisable (fig. 17), and is really necessary in the mountainous parts of the same territory if the best results are to be obtained. Farther north, and especially in the cold Northwest, much greater protection becomes an absolute necessity. Quilts with newspapers or thin packing above do not alone suffice. The side walls of the hive may be made of pressed straw (fig. 18). These, with top packing, if kept dry outside, are excellent for outdoor wintering, even in climates so cold that ordinary wooden hives do not afford sufficient protection.

In the severest climates, however, still greater protection on all sides of the colony is needed, and packing with chaff or other soft material is decidedly the best plan. The thickness of this surrounding packing should be from 2 inches to 8 or 10 inches for single colonies, according to the severity of the climate, but if four or more colonies are grouped for the winter, so as to make the natural warmth generated mutually advantageous, somewhat less packing will be sufficient. A most important point is to have the soft warmth-retaining packing come in close contact with the edges of the combs, and above all *not to have a hive wall, either thick or thin, between this material and the bees*. A good plan is to construct an open framework or skeleton hive of laths, cover it with sacking, or, preferably, some less fuzzy cloth which the bees will not gnaw, and after placing it in an outer wooden case large enough every way to admit of the necessary packing about the colony, to fill in on all sides with some dry, porous material (fig. 19). If the frames are shallow, like the Langstroth, it is better to construct the inner case so as to place them on end, and thus give a deeper comb for the winter. Layers of newspapers may come next outside the cloth covering of the framework. Wheat chaff answers well to complete the packing. Wool is to be preferred, but is of course too expensive unless a waste product. Ground cork, waste flax, hemp, sawdust, etc., in fact, any fine porous material, if thoroughly dry, may be used.

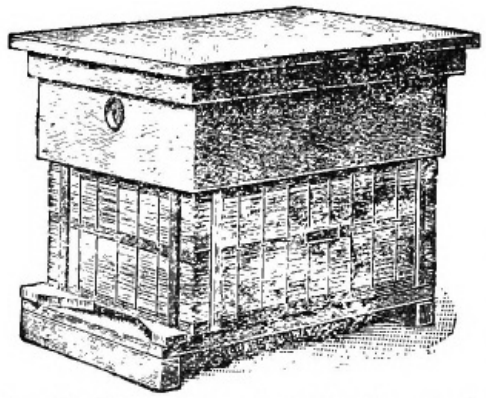

FIG. 18.—The American straw hive
(Langstroth principle) of Hayek Brothers.

A board passageway 3 or 4 inches wide and three-eighths of an inch high should connect this inner apartment and the flight hole of the outer case, thus affording an exit for the bees whenever the weather may permit them to fly. When these preparations have been completed, the hive is ready for the combs, which, with adhering bees, are taken from the summer hive and inserted in the winter hive. A quilt is then laid on the frames and the top packing put on. This, for convenience, may be held in a cloth-bottomed tray. It is quite important, as already mentioned, that air be allowed to circulate freely above the packing. The outside case must be quite rain-proof or else wholly protected from the rain by a roof.

All other necessary conditions having been complied with shortly after the gathering season closed, the combs may be lifted from the summer hives and placed in these specially arranged winter cases before cold weather wholly stops the bees from flying out. Thus prepared for the winter the colonies will need but slight attention from October until March, or, in the North, even later, and the losses will be limited to the small percentage of cases due to failure of apparently good queens.

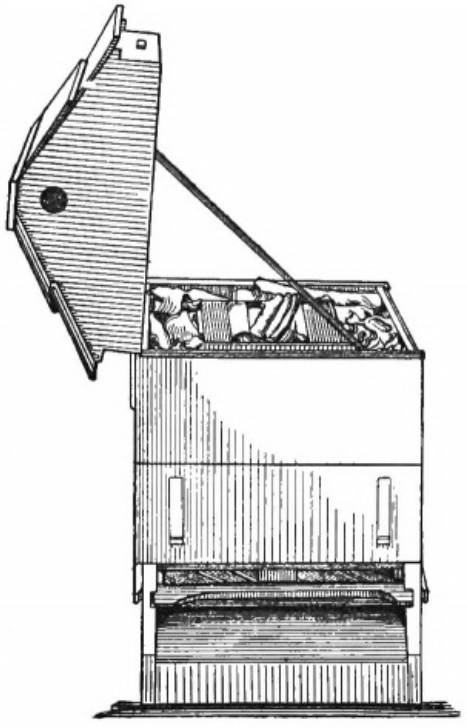

FIG. 19.—Colony of bees with newspapers packed between inner and outer cases and brood frames on end for the winter.

THE RISK OF LOSS THROUGH DISEASE AND ENEMIES.

Winter losses through disease superinduced by unfavorable surroundings which it is within the power of the bee keeper to avoid have already been considered. But one other very serious disease has been widespread.

FOUL BROOD OR BACILLUS OF THE HIVE.

This is a highly contagious affection which, as it mainly affects the developing brood in the cells, is commonly known as "foul brood." It is due to a microbe (*Bacillus alvei*) whose spores are easily transported from hive to hive by the bees themselves, by the operator, in honey, or in combs changed from one hive to another. Once established in an apiary, it usually spreads, unless speedily and energetically checked, until all of the colonies in the neighborhood are ruined and even exterminated. The most apparent symptoms are the turning black of larvæ in open cells, many sealed cells with sunken caps, frequently broken in and containing dead larvæ or pupæ in a putrid condition, brown or coffee-colored, jelly-like or ropy in consistency, and giving off an offensive odor. The disease, though known to exist in nearly all countries, can hardly be said to be common. The writer, in an experience of over thirty years in bee keeping in several States of the Union, as well as in a number of foreign countries, has met the disease but rarely, and has had but one experience with it in his own apiary, it having been in this instance brought in by a neighbor who purchased bees at a distance. It was easily cured, without great loss. Thus the beginner's risks of disaster in this direction are, if he be forewarned, comparatively small. He may, furthermore, gain assurance from the fact that, should the disease invade his apiary, prompt and intelligent action will prevent serious loss.

The following is the treatment for a colony which still has sufficient strength of numbers to be worth saving: The bees are to be shaken from their combs just at nightfall into an empty box, which is to be removed at once to a cool, dark place. They are to be confined to the box, but it must be well ventilated through openings covered with wire cloth. During the first forty-eight hours no food should be given to them, and during the second forty-eight hours only a small amount of medicated sirup—a half pint daily for a small colony to a pint for a strong one. This food is prepared by adding one part of pure carbolic acid or phenol to 600 or 700 parts of sugar sirup or honey. At the end of the fourth day the bees are to be shaken into a clean hive supplied with starters of comb foundation. This hive is to be placed outside on a stand some distance from all other colonies, and moderate feeding with medicated sirup or honey should be continued for a few days thereafter.

The combs of diseased colonies which contain brood may be assembled over a single one of these colonies, or, if the amount of brood be too great for one colony to care for, over several such diseased colonies, until the young bees have emerged. All of the honey is then to be extracted. While it is wholesome as food, it should not be offered for sale, lest some of it be used

in feeding bees or be inadvertently exposed where foraging bees might find it and carry to their hives the germs of this disease, harmless to other creatures but so fatal to bee life. A good use for this honey is to employ it in making vinegar. One and one-third pounds added to each gallon of rain water or soft spring water and allowed to ferment for three months in a warm place makes a quality of vinegar quite equal to the best cider vinegar. Provision for the free circulation of air through the cask should be made. This is easily secured by placing the cask, not completely filled, on its side and boring an auger hole in each end near the upper side, the holes to be covered with cheese cloth or fine gauze, to keep out insects.

If the honey containing the germs is to be used for feeding bees, it is to be diluted with half its own quantity, by measure, of water and kept at the boiling point for three hours in a water bath—a vessel within another containing water.

The combs from which the honey has been extracted, as well as all of the pieces built by the bees during their four days' confinement, may be melted into wax, by thorough boiling in soft water. This wax should be kept liquid for 48 hours or longer, to allow all impurities to settle. These will include the foul brood spores, which may then be removed with, the impure wax by « 43 » scraping or cutting away the bottom of the cake. These scrapings should be burned. The same disposition had better be made of the frames from which the combs containing germs were removed.

In all of this work the utmost care should be exercised to avoid the dripping of honey about the apiary or the exposure of implements, receptacles, or combs smeared with or containing honey from the diseased colonies. It may even be better, in order to save time and possible risk, where but few combs and a comparatively small amount of honey are involved, to destroy all of these immediately after their removal from the hive. The old hive and all utensils used about the diseased colony should be disinfected by washing in a solution of corrosive sublimate—one-eighth ounce in one gallon of water—and should afterwards be exposed to the air and sun for some time. If healthy colonies are to be manipulated immediately after handling diseased ones the hands of the operator must also be disinfected by washing in the solution just mentioned.

Those who care to try and save combs and brood should employ the remedial method developed by the late Professor Cheshire. This is explained in full in his work on bee keeping,[C] and a brief statement of it may also be found in "The Honey Bee," Bulletin No. 1, new series, of the Bureau of Entomology, United States Department of Agriculture. Notwithstanding these remedies, some will prefer, where healthy colonies of bees can be bought at moderate prices, to burn diseased bees, combs, and frames rather than spend time to effect a cure, and risk, as they fear they may, the further spread of the pest. To kill the bees thus is, however, neither profitable, humane, nor necessary, for if confined as described above and separated at once from the other colonies, this work being done at nightfall, when all of the bees are in their hives, the risk of spreading the disease will not thereby be increased, nor is the labor much greater than that involved in the removal of combs and bees for burning. And if it be found that the diseased colonies are weak in numbers and seem, therefore, individually hardly worth saving, this need not be taken as an excuse for the death sentence, as several colonies may be smoked and shaken together into the same box to make a single strong colony, the best queen of the lot having been selected and caged in the box in such a way that the workers can release her within a few hours by eating through candy.

[C] "Bees and Bee keeping," by Frank K. Cheshire, F. L. S., F. E. M. S., London, 1888, Vol. II, pages 554-575.

BEE PARALYSIS.

Among other diseases of a bacterial nature paralysis is most noticeable, although not to be dreaded as foul brood. It affects the adult bees only, producing a paralyzed condition of their members and a swelling up of their bodies. The diseased bees, often set upon by other workers, « 44 » lose the hairy covering of their bodies, and, black and shiny in appearance, may often be seen wriggling away from their hives to die. In such cases the working force of the affected colony frequently becomes so greatly reduced as to preclude any return in the form of honey or swarms during the given season. The source from which the bees obtain the original infection is unknown, but, once in the apiary, it is spread mainly by the entrance of affected workers into healthy colonies, and probably also by the visits which bees from healthy colonies make to the diseased ones, the latter often being so weakened in numbers as to be unable to protect their stores from healthy bees out on robbing expeditions.

Ordinary paralysis may generally be cured by strewing powdered sulphur over the combs, bees, and along the top bars of the frames, the precaution first having been taken of removing all unsealed brood. This brood would be killed by the application of sulphur, but as there is no danger whatever of spreading the disease by the transfer of brood or honey from one hive to another, provided absolutely every one of the adult bees has first been shaken or brushed from the combs, the latter may be given to healthy colonies which need strengthening.

Another simple plan for getting rid of the disease and yet utilizing the available strength of the affected colonies is to close their hives at night and move them a mile or more, locating them, if possible, outside of the range of other bees. As the brood in these colonies remains healthy all that is sealed or even well advanced in the larval stage may have the bees shaken from it and be distributed among the remaining colonies of the apiary. The bees of the diseased colonies thus

become rapidly reduced in numbers, and several of the colonies themselves may soon be combined, the best queen being selected to continue egg deposition. Eventually the diseased apiary becomes, by the removal of the developing brood and the death of the old bees, reduced to nothing. None of the queens should be saved nor should any of the adult workers be returned to the healthy apiary.

A combination of the sulphur cure with the last plan mentioned—that of getting rid of the disease through the removal of brood combs from affected colonies—is really, all in all, the best procedure. When a fairly strong colony has been made up by shaking the adult bees of two or more together and this removed to an isolated locality, the application of sulphur may be made before any brood has been started. It is well, also, to replace the queen with a vigorous one from stock entirely unrelated to the diseased bees. Should any signs of the disease reappear, constant removal of the brood should be followed, as mentioned in the preceding paragraph.

Other bacterial diseases, though existing, have developed only very locally or have been too limited in the amount of injury inflicted to require special mention here.

INSECT AND OTHER ENEMIES.

The bee or wax-moth (*Galleria mellonella* Linn.) is regarded by those unfamiliar with modern methods in bee keeping as a very serious enemy to success in this work. It was frequently such when only the common black bee was kept and the old way of managing, or rather of trusting to luck, was followed. But with the better races now introduced and with improved hives and methods, and especially with the care that is now given to have no colonies queenless long at a time, the wax-moth larvæ are no longer regarded with great concern.

Some species of wasps take a little honey at times—more particularly when hives are opened—and they annoy the bees; others capture and eat workers, as do also the large ant-like "cow-killers" (Mutillidæ), and certain predaceous flies (Asilidæ), true bugs (Phymatidæ), and neuropterous and orthopterous insects (Libellulidæ and Mantidæ). The larvæ of certain beetles (Dermestidæ and Tenebrio) feed upon pollen and the cast-off skins of developing larvæ and pupæ, and certain of the Meloid larvæ attach themselves to the bodies of bees as parasites. Ants (Formicidæ) and cockroaches (Blattidæ), which gather above the quilts and between the quilts and the tops of the frames in order to be benefited by the warmth of the cluster of bees, sometimes help themselves to honey, and their presence annoys the bees more or less. Some of the insects here mentioned are only found locally, the predaceous ones being confined mainly to the South, while it may be said that the general welfare of strong colonies is not often materially affected nor the return noticeably reduced through the attacks of any of them.

Spiders, toads, and lizards destroy, in addition to many injurious insects, also some bees, and should be tolerated in the vegetable garden rather than in the apiary.

Swallows, kingbirds or bee martins, mice, skunks, and bears only occasionally commit depredations in the apiary.

Properly constructed hives enable the bees to limit in a great measure the injury which these various enemies might inflict, and the avoidance of overswarming, with care to insure the constant presence of a prolific queen and a supply of food suited to the needs of the colony at the time, will keep it populous and therefore in shape to repel attacks or to make good most of the unavoidable losses.

ROBBER BEES.

Robbing is sometimes a more serious matter, although it very rarely happens that a little careful attention just at the right time on the part of the bee keeper would not avoid all serious trouble on this score. When bees find nothing to gather during weather when they can still fly out they are easily tempted to appropriate the stores of weaker colonies. Exposure of combs of honey at such times may even occasion a combined attack upon a good colony otherwise quite able to take care of itself. It is then that the greatest destruction ensues, for such a colony will defend itself vigorously, and a pitched battle, with perhaps fifty or sixty thousand Amazons on either side, leaves the ground literally strewn with dead and dying.

If the invaders conquer, every drop of honey is taken from the few vanquished that are likely to be still alive; and in turn the despoilers invariably fight among themselves as to the possession of the booty. When the robbing takes place during the absence of the owner, the condition of the robbed colony may not attract immediate attention, and during warm weather moth larvæ gain full possession of the combs within a few days. When this condition is observed, the whole damage is very likely to be attributed to the moth larvæ. Colonies that have been left queenless for some time, and those weakened by disease or by overswarming, are especial marks for such attacks. Of course these defects should be remedied whenever observed, but meanwhile, if legitimate field work is likely to be interrupted, every colony should be assisted in protecting itself against assault by having its hive made secure and the entrance such a narrow pass as to enable a few workers to repel attack there.

Should robbers get well started before being observed, the entrance of the hive should be narrowed at once, and wet grass or weeds may be thrown loosely over it, or a pane of glass may be stood against the front of the hive in a slanting manner to confuse the intruders. In extreme

cases the attacked colonies may be removed to a cellar for a few days, plenty of ventilation being given during confinement, and a new location, apart from other colonies, selected, on which they are to be placed just at nightfall; or, instead of putting them in the cellar, they may be taken a mile or more away and returned only when the danger has passed. With these precautions, little loss is to be feared on this score.

In general, the intelligent owner who gives careful attention to certain important points in bee management finds that he very rarely has disease to contend with, and that the reduction of profits through the depredations of bee enemies is not, in most parts of the Union, a serious discouragement. Altogether it seems to the writer that the risks in these directions are even less in bee keeping than those usually met in the keeping of other animals, which, like bees, are legitimately made to contribute to the wealth of the individual and of the nation.

LEGISLATION AFFECTING APIARIAN INTERESTS.

Many States have in recent years passed laws having for their purpose the eradication or suppression of contagious diseases among bees. State and county inspectors have been appointed under these laws, whose duty it is to go about and ascertain where diseased colonies of bees are located, and recommend the treatment to be given, or in some cases to carry out this treatment, even to the complete destruction of colonies or apiaries where the virulence of the attack seems to warrant it. Where these laws have been conscientiously and energetically executed, much has been accomplished toward freeing the apiaries of the given State from disease.

« 47 »

Some States have passed laws making it a misdemeanor to spray fruit trees during the time of blossoming, since thereby bees are poisoned, and besides the injury to the apiarist the pollination of the fruit blossoms is seriously interfered with.

Laws against the sale of adulterated goods as genuine, known commonly as pure-food laws, are in operation in some of the States, and where bee inspectors or bee keepers have taken the pains to have these laws applied to the marketing of honey, a check has been put upon the selling of adulterated honey in the liquid form, which has been practiced to a greater or less extent and still occurs in some of the city markets.

In general, the rights of bee keepers to own and cultivate bees, either within the limits of cities or on farms adjoining those devoted to grazing and general stock raising, are becoming more clearly defined through decisions of supreme and county courts. In this connection the work of the National Bee-Keepers' Association should receive mention.

This organization is in no sense a trades union, but has for its purpose the defense of its members against unjust attacks upon their legal rights, the suppression, in so far as possible, of the sale of adulterated honey, the securing of legislation for the protection of its members and favorable to the general advance of the industry, as well as the dissemination among its members of advanced ideas in bee management and information regarding the marketing of apiarian products. The membership fee of one dollar per annum entitles every honey producer to membership and participation in all of the benefits enumerated, as well as to the published report of the annual convention held by the association. The membership numbers nearly 2,000 at the present time, and the influence of this large body of intelligent beemasters is already being appreciably felt in the general advance of the industry in this country.

JOURNALS TREATING OF APICULTURE.

As a matter of general information, the following list of journals relating to apiculture is given. It comprises all those published in this country at the present time.

The American Bee Journal, Chicago, Ill.
Gleanings in Bee Culture, Medina, Ohio.
The Bee Keepers' Review, Flint, Mich.
The American Bee Keeper, Falconer, N. Y.
The Progressive Bee Keeper, Higginsville, Mo.
Western Bee Journal, Kingsburg, Cal.
The Rural Bee Keeper, River Falls, Wis.

« 48 »

FARMERS' BULLETINS.

The following is a list of the Farmers' Bulletins available for distribution, showing the number

and title of each. Copies will be sent to any address on application to any Senator, Representative, or Delegate in Congress, or to the Secretary of Agriculture, Washington, D. C. The missing numbers have been discontinued, being superseded by later bulletins:

No. 16 Leguminous Plants.
No. 22 The Feeding of Farm Animals.
No. 24 Hog Cholera and Swine Plague.
No. 25 Peanuts: Culture and Uses.
No. 27 Flax for Seed and Fiber.
No. 28 Weeds: And How to Kill Them.
No. 29 Souring and Other Changes in Milk.
No. 30 Grape Diseases on the Pacific Coast.
No. 31 Alfalfa, or Lucern.
No. 32 Silos and Silage.
No. 33 Peach Growing for Market.
No. 34 Moats: Composition and Cooking.
No. 36 Potato Culture.
No. 36 Cotton Seed and Its Products.
No. 37 Kafir Com: Culture and Uses.
No. 38 Spraying for Fruit Diseases.
No. 39 Onion Culture.
No. 41 Fowls: Care and Feeding.
No. 42 Facts About Milk.
No. 43 Sewage Disposal on the Farm.
No. 44 Commercial Fertilizers.
No. 45 Insects Injurious to Stored Grain.
No. 46 Irrigation in Humid Climates.
No. 47 Insects Affecting the Cotton Plant.
No. 48 The Manuring of Cotton.
No. 49 Sheep Feeding.
No. 50 Sorghum as a Forage Crop.
No. 51 Standard Varieties of Chickens.
No. 52 The Sugar Beet.
No. 54 Some Common Birds.
No. 55 The Dairy Herd.
No. 56 Experiment Station Work—I.
No. 67 Butter Making on the Farm.
No. 68 The Soy Bean as a Forage Crop.
No. 69 Bee Keeping.
No. 60 Methods of Curing Tobacco.
No. 61 Asparagus Culture.
No. 62 Marketing Farm Produce.
No. 63 Care of Milk on the Farm.
No. 64 Ducks and Geese.
No. 65 Experiment Station Work—II.
No. 66 Meadows and Pastures.
No. 68 The Black Rot of the Cabbage.
No. 69 Experiment Station Work—III.
No. 70 Insect Enemies of the Grape.
No. 71 Essentials in Beef Production.
No. 72 Cattle Ranges of the Southwest.
No. 73 Experiment Station Work—IV.
No. 74 Milk as Food.
No. 76 The Grain Smuts.
No. 77 The Liming of Soils.
No. 78 Experiment Station Work—V.
No. 79 Experiment Station Work—VI.
No. 80 The Peach Twig-borer.
No. 81 Com Culture in the South.
No. 82 The Culture of Tobacco.
No. 83 Tobacco Soils.
No. 84 Experiment Station Work—VII.
No. 85 Fish as Food.
No. 86 Thirty Poisonous Plants.
No. 87 Experiment Station Work—VIII.
No. 88 Alkali Lands.
No. 89 Cowpeas.
No. 91 Potato Diseases and Treatment.

No. 92 Experiment Station Work—IX.
No. 93 Sugar as Food.
No. 94 The Vegetable Garden.
No. 95 Good Roads for Farmers.
No. 96 Raising Sheep for Mutton.
No. 97 Experiment Station Work—X.
No. 98 Suggestions to Southern Farmers.
No. 99 Insect Enemies of Shade Trees.
No. 100 Hog Raising in the South.
No. 101 Millets.
No. 102 Southern Forage Plants.
No. 103 Experiment Station Work—XI.
No. 104 Notes on Frost.
No. 105 Experiment Station Work—XII.
No. 106 Breeds of Dairy Cattle.
No. 107 Experiment Station Work—XIII.
No. 108 Saltbushes.
No. 109 Farmers' Reading Courses.
No. 110 Rice Culture in the United States.
No. 111 Farmers' Interest in Good Seed.
No. 112 Bread and Bread Making.
No. 113 The Apple and How to Grow It.
No. 114 Experiment Station Work—XIV.
No. 115 Hop Culture in California.
No. 110 Irrigation in Fruit Growing.
No. 118 Grape Growing in the South.
No. 119 Experiment Station Work—XV.
No. 120 Insects Afflicting Tobacco.
No. 121 Beans, Peas, and other Legumes as Food.
No. 122 Experiment Station Work—XVI.
No. 123 Red Clover Seed: Information for Purchasers.
No. 124 Experiment Station Work—XVII.
No. 125 Protection of Food Products from Injurious Temperatures.
No. 126 Practical Suggestions for Farm Buildings.
No. 127 Important Insecticides.
No. 128 Eggs and Their Uses as Food.
No. 129 Sweet Potatoes.
No. 131 Household Tests for Detection of Oleomargarine and Renovated Butter.
No. 132 Insect Enemies of Growing Wheat.
No. 133 Experiment Station Work—XVIII.
No. 134 Tree Planting in Rural School Grounds.
No. 135 Sorghum Sirup Manufacture.
No. 136 Earth Roads.
No. 137 The Angora Goat.
No. 138 Irrigation in Field and Garden.
No. 139 Emmer: A Grain for the Semiarid Regions.
No. 140 Pineapple Growing.
No. 141 Poultry Raising on the Farm.
No. 142 Principles of Nutrition and Nutritive Value of Food.
No. 143 The Conformation of Beef and Dairy Cattle.
No. 144 Experiment Station Work—XIX.
No. 145 Carbon Bisulphid as an Insecticide.
No. 146 Insecticides and Fungicides.
No. 147 Winter Forage Crops for the South.
No. 148 Celery Culture.
No. 149 Experiment Station Work—XX.
No. 160 Clearing New Land.
No. 161 Dairying in the South.
No. 152 Scabies in Cattle.
No. 133 Orchard Enemies in the Pacific Northwest.
No. 154 The Home Fruit Garden: Preparation and Care.
No. 155 How Insects Affect Health in Rural Districts.
No. 156 The Home Vineyard.
No. 157 The Propagation of Plants.
No. 168 How to Build Small Irrigation Ditches.
No. 169 Scab in Sheep.

No. 161 Practical Suggestions for Fruit Growers.
No. 162 Experiment Station Work—XXI.
No. 164 Rape as a Forage Crop.
No. 166 Culture of the Silkworm.
No. 166 Cheese Making on the Farm.
No. 167 Cassava.
No. 168 Pearl Millet.
No. 169 Experiment Station Work—XXII.
No. 170 Principles of Horse Feeding.
No. 171 The Control of the Codling Moth.
No. 172 Scale Insects and Mites on Citrus Trees.
No. 173 Primer of Forestry.
No. 174 Broom Com.
No. 175 Home Manufacture and Use of Unfermented Grape Juice.
No. 176 Cranberry Culture.
No. 177 Squab Raising.
No. 178 Insects Injurious in Cranberry Culture.
No. 179 Horseshoeing.
No. 181 Pruning.
No. 182 Poultry as Food.
No. 183 Meat on the Farm.—Butchering, Curing, etc.
No. 184 Marketing Live Stock.
No. 186 Beautifying the Home Grounds.
No. 186 Experiment Station Work—XXIII.
No. 187 Drainage of Farm Lands.
No. 188 Weeds Used in Medicine.
No. 189 Information Concerning the Mexican Cotton Boll Weevil.
No. 190 Experiment Station Work—XXIV.
No. 191 The Cotton Bollworm—1903.
No. 192 Barnyard Manure.
No. 193 Experiment Station Work—XXV.
No. 194 Alfalfa Seed.
No. 195 Annual Flowering Plants.
No. 196 Usefulness of the American Toad.
No. 197 Importation of Game Birds and Eggs for Propagation.
No. 198 Strawberries.
No. 199 Corn Growing.
No. 200 Turkeys.
No. 201 Cream Separator on Western Farms.
No. 202 Experiment Station Work—XXVI.
No. 203 Canned Fruits, Preserves, and Jellies.
No. 204 The Cultivation of Mushrooms.
No. 206 Pig Management.
No. 206 Milk Fever and Its Treatment.
No. 207 Game Laws for 1904.
No. 208 Varieties of Fruits Recommended for Planting.
No. 209 Controlling the Boll Weevil in Cotton Seed and at Ginneries.
No. 210 Experiment Station Work—XXVII.
No. 211 The Use of Paris Green in Controlling the Cotton Boll Weevil.
No. 212 The Cotton Bollworm—1904.
No. 213 Raspberries.
No. 214 Beneficial Bacteria for Leguminous Crops.
No. 215 Alfalfa in the Eastern States.
No. 216 Control of the Cotton Boll Weevil.
No. 217 Essential Steps in Securing an Early Crop of Cotton.
No. 218 The School Garden.
No. 219 Lessons Taught by the Grain Rust Epidemic of 1904.
No. 220 Tomatoes.
No. 221 Fungous Diseases of the Cranberry.

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Illustrations moved so as not to split paragraphs. The listing of publications was

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