abundance of the products which they yield, and the best way of extracting them from the hive, without showing any particular solicitude as to the preservation of the bees themselves; still another class of apiarians have had more particularly in view the prosecution of researches in the natural history and economy of bees. The hive invented by Huber was in his time a great advance for the purpose last named He gave it the name of "ruche en livre ou en feuillets" from its opening and shutting somewhat in the manner of the leaves of a book. It had, however, many inconveniences which are remedied in some hives of more modern construction, and Huber's leaf-hive is now rarely used, although it may claim the distinction of having been the first of the frame hives which are now, with many modifications, generally acknowledged to be the only ones capable of giving the maximum of prosperity to the bees and producing a large honey harvest, combined with affording facilities for observation and manipulation. The old cylindrical straw skep or hive is still generally used among the cottagers of England, although abandoned in many other countries. While very excellent for warmth and ventilation, it has the disadvantage that its interior is inaccessible for information; and the fixity of its combs precludes many manipulations which the skilful apiarian is called upon to perform. This was well known to the ancients, who, to remedy it, fitted the crowns of their hives with movable wooden bars, from which the bees built their combs, but still they were attached by their sides to the hive and required to be cut away before they could be removed,—these operations greatly disturbing the bees. In 1851, Dzierzon in Germany, and Langstroth in America, two of the most skilful apiarians of the present day, simultaneously designed or invented the bar-frame hive, the principle of which, with many varieties of detail, is found in all the best hives now in use. A well-known English example of this kind of hive is the "Woodbury" (fig. 4), named after its designer, Mr Woodbury of Exeter. This consists of a square wooden box, 14½ inches in diameter (inside measure), and 9 inches deep, covered by a top or crown-board either loose or lightly screwed down. This board has a circular hole in the centre, 2½ inches in diameter, for feeding purposes, and when not in use is covered with perforated zinc or a block of wood. The floor-board is 18 inches square, with an entrance cut in it forming a channel about 4 inches wide and ⅜ths of an inch deep. At the part where the front of the hive crosses it gradually slopes upwards inside the hive. An alighting-board for the bees is fixed to the front of the floor-board opposite the entrance, and projects 3 or 4 inches; a wooden ridge-roof covers all. The interior of the hive is fitted with ten frames; they are made of light lath, about ⅞ths of an inch wide, the top bars being ⅜ths and the sides and bottom rails 5/16ths of an inch in thickness respectively. The top bars are 15¼ inches in length, and project into notches cut into rabbets at the back and front of the hive to receive them. The rabbets are ⅜ths of an inch deep, and the notches in them are of the same depth, so that the projections in the bars rest flush in them, leaving a space of ⅜ths clear above the frames, over which the bees can travel. The ten frames occupy equal portions of the interior space; if this be divided into ten equal divisions, the centre of each will be exactly the point at which the centre of each bar-frame should rest; these points will be 1 7/10 inches apart. In these frames it is intended that the bees shall build their combs; and when they have done so, any frame may be quietly lifted out of the hive with all the bees upon it, whether for examination or for division of the stock for an artificial swarm. To induce the bees to build straight in the frames a thin strip of comb is usually attached to the underside of the top bar, or a thin line of molten wax poured down the centre of the bar will answer the purpose, as the bees will follow the guide thus laid. For the purpose of providing storage-room for honey an upper storey, called a "super," is added to the hive, of the same diameter but of less height, 3 to 5 inches usually sufficing, as when filled it may be taken off and an empty one substituted. Before a super be placed in position, the crown-board should be removed, and a thin board, called an "adapter," substituted; this, in place of the round central hole, has near each side a long aperture, ⅜ths of an inch wide, which gives passage to the workers, but not to the queen and drones—the latter being useless there, and it being desirable the queen should not oviposit in the super.

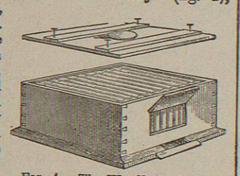

Fig. 4.—The Woodbury Frame Hive.

Elegant supers are made of glass globes, or propagating glasses, which the bees will readily use if enticed into them by a few pieces of clean white comb.

Many improvements have been made on the Woodbury hive, tending still further to the comfort and well-being of the bees, as well as to the furtherance of scientific study; and, perhaps, the hive that may be said to combine most of these advantages is one designed by Mr Frank Cheshire, and known as the "Cheshire Hive" (figs. 5 and 6).

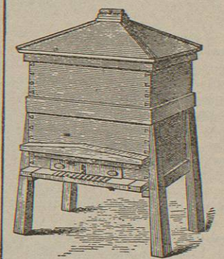

Fig. 5.—The Cheshire Frame Hive.

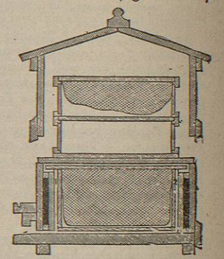

Fig. 6.—Section of Cheshire Hive.

To afford the bees the maximum of comfort and to economize their heat, the walls of this hive are made double, enclosing an air space. The Woodbury frames are used, but rest on the thin edge of a strip of zinc within the hive at the back and front, which prevents the bees fixing them with propolis. The floor-board is constructed to slide in a groove beneath the hive, and the entrance can be enlarged or diminished at pleasure by a pair of sliding-shutters; the hive is complete with stand and roof, and altogether leaves little to be desired.

The adoption of frame hives has greatly facilitated the scientific study of the insects' habits, the artificial multiplication of colonies, and the appropriation of their surplus stores without injury to the bees. It is quite a secondary consideration what size or pattern of frame is used, or how the frames are suspended in the hive, provided the principle of movable frames be adopted; and although much ingenuity has been exercised by scientific men to design a hive embracing every possible advantage regardless of cost, the roughest timber and coarsest workmanship will give as good results as the most elaborate. Frame hives are exceedingly well calculated for procuring artfficial

swarms. They allow us to judge by inspection whether the population be sufficient to admit of division, if the brood be of the proper age, if drones exist or are ready to be produced for impregnating the young queens,—all of which circumstances are material to the success of the operation. Wooden hives are generally made square, but not invariably so. The "Stewarton hive" (fig. 7), largely and successfully used in Scotland, is octagonal, and the "Quinby hive" of America is much deeper from back to front than it is wide. The Stewarton is not properly a frame, but a bar-hive, although frames are sometimes fitted to it. It usually consists of three octagon breeding-boxes, 14 inches in diameter by 6 inches deep, each furnished with nine bars placed equidistant, the spaces between being occupied by movable slides of wood working in grooves in the bars. The hive has shuttered windows back and front, handles to lift, and hooks to weigh with, as well as little buttons to prevent displacement; each breeding-box has an entrance-way 4 inches wide and half an inch high, with a sliding-door to close it wholly or partially. There are also two supers or honey boxes, the same diameter as the stock boxes, but only 4 inches deep; these are furnished with wider bars, seven in number, and a floor-board completes the whole, which, being made of but ½ inch wood, requires protection from the weather.

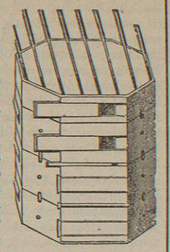

Fig. 7.—The Stewarton Hive.

For those persons who are unable to handle bees with impunity, but are yet desirous of studying their economy, a glass covered observatory hive has been deemed a necessity. Several have been designed for this purpose, but none of them have been found to be a healthy abode for the bees,—glass being a cold and ungenial material, on which the moisture of the hive condenses during the winter to the detriment of health of the inhabitants. In the summer, however, bees may be kept in a glass hive without great loss, although with no gain; such a hive may be constructed of a double sash, thickly glazed back and front, of just sufficient width for one comb only and space to allow the bees free passage over both sides of the comb. A very excellent hive in English use is that known as the "Woodbury unicomb," which is so constructed that six frames may be taken out of an ordinary hive, and hung up in a double perpendicular row between the two sashes, permitting their return in the autumn to their original hive. Egress and ingress is given to the bees by a tunnelled channel to the centre of the hive on the floor line; and by means of a turn-table the hive may be revolved to bring both sides under alternate observation, together with all its inhabitants and their works. The common straw hive, or skep, of the cottagers is too well known to require description, and although it is greatly inferior to frame hives, it will doubtless long retain a place from its easy make and little cost. A great improvement now generally in use is the adoption of a round hole in the centre of the crown, about 2½ inches in diameter, which will permit the bees access to the super, and afford facilities to the bee-master for feeding his stock. The capacity of these hives should be about a bushel, when the apiary is situated in a good honey locality.

To a German apiarian we are indebted for the invention of a machine called the honey-extractor, which, with some subsequent improvements, forms a most important aid in large apiaries to increase the yield of honey. By this appliance the frames of full honeycomb are in a few seconds emptied of their contents without injury to the combs, which are ready at once to be returned to the hive to be refilled, thus saving to the bees great labour in comb-building, and enabling them to take the utmost advantage of a favourable honey-time, which usually is but short. Honey is saved too, which the bees eat in comb-building; for it has been calculated that bees consume 20 lb of honey in producing 1 lb of wax. There are various patterns of the machine, but the principle of all may be said to be the same, that of centrifugal force. The apparatus consists of a cylindrical metal reservoir, with a tap at the bottom; and within is contained a perpendicular quadrangular frame, two sides of which are covered with wire-netting, and against these the full honeycombs, with their cells previously uncapped, are placed. This framework is then set revolving by means of a handle and cog-wheels, or other motive power, when the honey is flung out against the sides of the cylinder, and the combs completely emptied to be returned to the bees to clean and refill. The loss of this honey, and the excitement caused by the cleaning the wet combs, seem to induce the bees to work their hardest to replace their stores; and with a strong colony an enormous amount of honey is obtainable in a good locality and season. It has been recorded that one stock in America gathered 600 lb in a single season, and harvests of 200 lb and 300 lb are not uncommon there.

Bee-Keeping.

We shall now give a short exposition of the modern, humane, and scientific system of bee-keeping, which is probably destined at no distant day to supersede the ignorance and cruelty of past ages.

Stocking frame hive.

A description has already been given of examples of the best movable bar and frame hives, and the system they represent should alone be adopted, *i.e.*, every comb in the hives should be movable and interchangeable. In stocking these it is usual, first, to hive the swarm in an old-fashioned straw skep; and in the evening, after all the bees are quietly settled, suddenly to shake them down against the entrance of the hive or on the top of the frames, when the astonished insects will immediatly take refuge in their future home. Should continuous bad weather occur after hiving a swarm, the bees must be fed, for, as they have as yet no stores, they will otherwise starve.

For feeding bees a multitude of appliances have been invented, but they may all give place to a common wide mouth pickle bottle; this is filled with syrup, the mouth tied over with a double foid of net, or placed inverted on a piece of perforated zinc or vulcanite over the feeding-hole of the crown-board of the hive. The supply can be regulated to the bees by the number and size of the holes through which they are allowed to suck. In cold weather when much moisture would be hurtful in the hive, barley-sugar may be advantageously used as a substitute for syrup. The former is made by boiling, for ten minutes, 2 lb of loaf-sugar in a pint of water, a little vinegar being added to prevent crystallization. The prosperity and profit of an apiary in a great measure depend on judicious feeding. It is bad economy to stint the bees in food. In the early spring slow and continuous feeding (a few ounces of syrup each day) will stimulate the queen to oviposit, by which means the stocks are rapidly strengthened and throw off early swarms. Upon the emergence of these, if a young fertile queen be immediately supplied, the hive is ready again to swarm in a remarkably short time. It is a singular fact that if stimulating feeding has been for some time pursued, and the supply be intermitted and nothing coming in from the fields, the bees will destroy all the young larvæ and eggs, instinct seeming to teach the wise insects that the calls on the resources of the colony in the way of food for the young will be more than it can bear.

An abundant supply of water is essential to the healthy condition of bees. They consume a large quantity, and often stop to drink at the edge of stagnant pools, and seem even to prefer putrid and urinous waters to purer streams, as if their saline and pungent qualities were grateful to them.

Where the bee-keeper has the use of a honey-extractor, and a large produce of honey is his desideratum, the combs can be emptied as fast as they are filled; and at the close of the season the bees may be deprived of the whole of their honey if syrup be supplied to them in its place. This is of much less value, and answers every purpose for winter stores. No hive should be trusted to the exigencies of winter with a less weight of sealed comb than 15 lb. Honey may also be gathered into supers; and the bees in good seasons will readily build their combs there, but should be enticed to do so with a few pieces of nice white decoy-comb placed within. The management of the Stewarton hives may be described as follows:—Two of the breeding-boxes having had their bars furnished with guide-comb, are lashed together, the sliding-door of the upper one run in and the slides of the lower withdrawn, when the two boxes become virtually one; a prime swarm of bees is introduced, and eight or ten days thereafter, another prime swarm being hived in the third breeding-box, it is placed under the other two. The lower of the two first boxes, now the central, has its door run in and the slides of the lower withdrawn. The second swarm of bees will soon run up and fraternise with the others, and the next morning the lowermost box may be removed, and the entrance opened of the one above. The space provided by the two boxes will be found ample for breeding; and when full, the strong stock formed by the double swarm will soon be glad to occupy the super then to be added, to which communication should be afforded by withdrawing the outer slide on each side only. Should the season prove favourable the super will soon be filled, and when nearly so another should be placed on the top, and the first may be removed as soon as the honey cells are sealed over. All supers must be warmly wrapped up or padded, or the bees will be found reluctant to occupy them.

By the judicious management of supers, and the use of the honey-extractor, swarming may be in a great measure controlled; for if many swarms issue, the result must be that little honey will be gathered, all the energies of the reduced population being exerted to procure food for and attend to the young. A super put on the hive before the bees have made preparations for swarming by the construction of queen cells, &c., will generally prevent swarming, but not invariably. The bee keeper must, therefore, decide whether he prefers an increase of his stocks or a large honey harvest, and manage his bees accordingly.

Artificial swarming.

It often happens that bees give every indication of an intention to swarm, and cluster idly outside the hive in large numbers for days or even weeks before they really emigrate,—all this time keeping their owner in suspense, and possibly the swarm comes off at last without being observed. This is very tantalising, but may all be prevented by means of artificial swarming, the mode of proceeding for which varies according to the kind of hive in use. Considering, first, straw skeps, the common hive of the country, the operation to be pursued is known as "driving." This is not new, having been described by Dr Warder in the last century. The mode usually adopted is as follows:—Towards noon, on a fine day, when many of the bees are abroad, inject at the hive's entrance a puff or two of tobacco smoke, and with the hands give a smart smack on each side. The effect is that the whole of the inhabitants are struck with extreme terror; and after, perhaps, an alarmed sally to the entrance, every bee rushes to the cells to fill itself with honey. Allowing two or three minutes for them to effect their purpose, the hive is boldly inverted and an empty hive of the same size placed on it mouth to mouth. A long towel is now bound round the junction to confine the bees, and the operator, with two sticks or the palms of his hands, keeps up a continuous smart rapping on the sides of the full hive, and after a few minutes the bees will all stream up into the empty hive, generally not more than fifteen minutes having elapsed before the first hive is denuded of its inhabitants. It should now be placed on the stand of some other strong stock (previously removed), whose returning bees will form a population to nurse the young and rear a queen if one be not supplied by the apiarian. If the swarm is to be at once sent away to a distance exceeding 1½ miles, the hive may be returned to its old stand, and so be peopled by the remainder of its old inhabitants who were at work. But if the swarm is to remain near, it should be placed on the old stand, as the bees, on their next flight, will return to the locality they know so well. "Driving" should also be pursued in the autumn, when it is desired to appropriate the honey of the hive. The driven bees should then be added to another stock, which they will advantageously strengthen. Where frame hives are in use, the following method may be adopted:—First, lift out the frames and search until the queen be found, when she, with the frame she is on, must be placed in the centre of a new hive, and be flanked on both sides by another comb as full of sealed brood as can be obtained. Fill up both hives with new frames furnished with empty combs, or guide-combs only if the former be not available, and shake into (or before the entrance of) the hive where the queen is sufficient bees to form a large swarm. Many will fly back to their old home, but all the young bees will remain. This hive should then be removed to some distance and the old one replaced. If the swarm is to be sent to a distance, the bees may be simply shaken off the combs into (or in front of) a new hive (taking care the queen is with them), which should be temporarily placed on the spot where the old one has just stood. The bees will enter it, and when all is quiet it should be removed and the old one reinstated. The bees that return from the fields will form a population for the domicile which they will find in the familiar place. Before in any manner operating on bees, it is advisable to puff a little smoke into the hive. This alarms them and causes them to fill their honey-pouches, and a bee in this state never volunteers an attack; but it is always prudent to cover one's face and hands, as home-returning bees are sometimes inclined to resent the disturbance to their family. India-rubber gloves, with gauntlets and veil of leno, will afford ample protection; the latter should be a simple bag, open at top and bottom, but with half a yard of elastic sewn in the top, through which should be passed the crown of a broad-brimmed hat, the coat should be buttoned over the lower part. Bee-keepers who meddle much with their bees soon become accustomed to stinging and do not suffer much. Experiments have been made to ascertain the number of stings required to inoculate the blood, and it has been stated that about thirty, at the rate of three or four a day, will suffice, after which the effect of the bee-poison is trivial. Persons unaccustomed to the poison, however, often suffer severely.

We conclude by observing that the honey-bee (*Apis mellifica*) is supposed to be of Asiatic origin. It was imported from Europe to America, where it is now found wild in great numbers, and at a vast distance from human habitations. An excellent treatise, *The Honey-Bee, its Natural History, Physiology, and Management*, was published in 1827 by Dr Edward Bevan. It contains some of the best practical remarks on the subject that are anywhere to be met with, and gives a fair account of the labours of the author's predecessors, Reaumur, Hunter, Huber, Keys, Vicat, and Dunbar. The Rev. L. L. Langstroth, of New York, has also written a very excellent volume on *The Hive and Honey-Bee*. To Pastor Dzierzon, the Baron von Berlepsch, and Von Siebold of Germany, we are indebted for many accurate and valuable observations on physiology and hive management; and a *Manual of Bee-keeping*, written in 1875 by Mr John Hunter, secretary of the British Beekeepers' Association, contains much practical information on scientific and profitable bee-keeping. We may add that the above association, established in 1874 under the presidency of Sir John Lubbock, is the first vigorous effort made in England to extend and improve this neglected although valuable branch of rural economy. (J. H.)

BEECH, a well-known tree, the *Fagus sylvatica*. For the cultivation and properties of it see ARBORICULTURE, vol. ii. p. 317. The name beech is from the Anglo-Saxon *boc, bece*, or *beoce* (Ger. *Buche*, Swedish, *bok*), words meaning at once a book and a beech-tree. The connection of the beech with the graphic arts is supposed to have originated in the fact that the ancient Runic tablets were formed of thin boards of beech-wood. "The origin of the word," says Prior (*Popular Names of British Plants*), "is identical with that of the Sanskrit *bôkô*, letter, *bôkôs*, writings; and this correspondence of the Indian and our own is interesting as evidence of two things, viz., that the Brahmins had the art of writing before they detached themselves from the common stock of the Indo-European race in Upper Asia, and that we and other Germans have received alphabetic signs from the East by a northern route, and not by the Mediterranean." Beech-mast, the fruit of the beech-tree, was formerly known in England as buck; and the county of Buckingham is so named from its fame as a beech-growing country. Buckwheat (*Bucheweizen*) derives its name from the similarity of its angular seeds to beech-mast. The generic name *Fagus* is derived from φάγω, to eat; but the φηγός of Theophrastus was probably the sweet chestnut (*æsculus*) of the Romans. Beech-mast has been used as food in times of distress and famine; and in autumn it yields an abundant supply of food to park-deer and other game, and to pigs, which are turned into beech-woods in order to utilize the fallen mast. In France it is used for feeding pheasants and domestic poultry. Well-ripened beech-mast yields from 17 to 20 per cent. of a non-drying oil, suitable for illumination, and said to be used in some parts of France and other Continental countries in cooking, and as a substitute for butter.

BEECHEY, FREDERICK WILLIAM, a distinguished naval officer and navigator, son of Sir William Beechey, R.A., was born in London, in 1796. In 1806, at the age of ten, he entered the navy, and was for several years engaged in active service during the wars with France and America. In 1818 he served under Franklin in Buchan's Arctic expedition, of which at a later period he published a narrative; and in the following year he accompanied Parry in the "Hecla." In 1821 he took part in the survey of the Mediterranean coast, under the direction of Captain, afterwards Admiral, Smyth. He and his brother, H. W. Beechey, made an overland survey of the north coast of Africa, of which a full and valuable account was published in 1827. In 1825 he was appointed to the "Blossom," which was intended to explore Behring's Straits in concert with Franklin and Parry. He passed Behring's Straits and penetrated as far as lat. 71° 23′ 31″ N., and long. 156° 21′ 30″ W., reaching a point only 146 miles west of that reached by Franklin's expedition from the Mackenzie River. The whole voyage lasted more than three years; and in the course of it Beechey discovered several islands in the Pacific, and an excellent harbour near Cape Prince of Wales. A full narrative of his voyage was published in 1825–28. From 1835 to 1847 Captain Beechey was employed on the coast survey of South America and Ireland. He was then appointed by Government to preside over the Marine Department of the Board of Trade. In 1854 he was made rear-admiral, and in the following year was elected president of the Geographical Society. He died on the 29th Nov. 1856.

BEECHEY, SIR WILLIAM, R.A., a fashionable portrait-painter, born at Burford in December 1753, was originally bred as a conveyancer, but a strong love for painting induced him to become a pupil at the Royal Academy in 1772. Some of his smaller portraits gained him considerable reputation; he began to be employed by the nobility, and in 1793 became associate of the Academy. In the same year he was made portrait-painter to Queen Charlotte, an appointment which increased his celebrity. He painted the portraits of the members of the royal family, and of nearly all the most famous or fashionable persons of the time. What is considered his finest production is a review of cavalry, a large composition, in the foreground of which he introduced portraits of George III., the Prince of Wales, and the duke of York, surrounded by a brilliant staff on horseback. It was painted in 1798, and obtained for the artist the honour of knighthood, and the rank of R.A. The earlier portraits of Beechey were carefully drawn and well finished; but in his later days the extent of his employment rendered him less careful in his design. His works are generally vigorous, but are wanting in grace and dignity. He was a good, but not an eminent portrait painter. He died in January 1839, at the advanced age of eighty-six.

BEELZEBUB. The name of the supreme god among all the Syro-Phœnician peoples was Baal, *i.e.*, *lord* or *owner*; and by adding to it *zebub*, insect, the proper name Baal-zebub was formed, the god of Ekron according to 2 Kings i. 2, the fly-god, the averter of insects, similar to the Ζεὺς ἀπόμυιος, μυίαγρος, and the Hercules μυίαγρος; so that Clemens Alexandrinus speaks of a Hercules ἀπόμυιος worshipped in Rome. Hug's hypothesis that this Philistine god was the dung-beetle, the *Scarabæus pillularius*, worshipped in Egypt, cannot be accepted. Beelzebub was so named not from his form, but from his supposed power of driving away noxious flies. In the New Testament the word is applied to Satan, the ruler or prince of the demons (Matt. x. 25, xii. 24, 27; Mark iii. 22; Luke xi. 15, 18, 19). But the best Greek MSS. read Βεελζεβούλ, Beelzebul, in the Gospels,—an orthography followed by the latest critical editions, though the Syriac and Vulgate versions have Beelzebub, which is also recommended by Jerome. What is the origin of Beelzebub? The most obvious derivation of it is בַּעַל־זְבוּל, *Baal* (or *lord*) *of the dwelling*, a name of Saturn among the Phœnicians, according to Movers, synonymous with בַּעַל־מָעוֹן. So it may mean *Baal of the heavenly dwelling* or *habitation*, just as Satan is termed in the epistle to the Ephesians (ii. 2) "prince of the power of the air." Others suppose that Beelzebul arose from Beelzebub by a pun on the part of the later Jews, who wished to throw ridicule on idols by forming the appellation *lord of dung*,—זְבָל or זֶבֶל meaning *dung* in the Targumic and Talmudic dialects. This is improbable, because Beelzebul was not a current name in Jewish literature. Somewhat different is the opinion of Lightfoot, based upon various Talmudic passages, in which *zebul*,