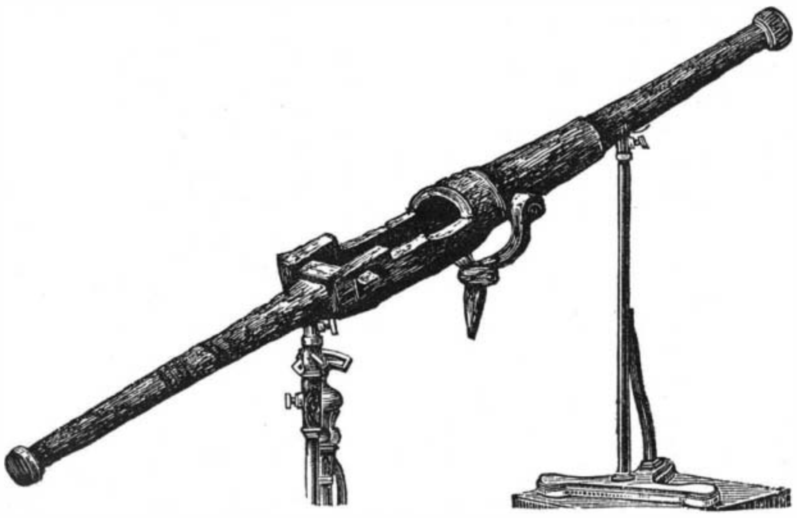
ANCIENT BREECH-LOADER.

We have been favored with a photograph, reproduced in the engraving herewith, showing an ancient piece recently fished up in the harbor of Santander, which appears to have attracted considerable attention. It is a wrought iron breech-loading piece—length of gun, 1·85 meters (6 feet); that of lever or tail piece, 0·85 meter (2 feet 9 inches); caliber, 50 mm. (nearly 2 inches). It will be seen, then, that this piece has four features that we generally associate with very modern guns: (1) It is wrought iron; (2) it is a breech-loader; (3) it is about 36 calibers long; (4) it is a pivot gun without provision for recoil. Those who are at all familiar with ancient pieces, however, know that these features were found at times. In the Rotunda Museum at Woolwich are several guns resembling the above in some features, among them an English gun of the fifteenth century, a Chinese gun taken in the last Chinese war, of unknown date, and a gun taken out of a vessel of the Spanish Armada. It is not easy to say exactly what was the office of this Santander piece. The spike pivot generally was fixed in a tripod, but no doubt might equally well have been fixed on the side of a ship. Probably the gun was a Spanish one of the fifteenth century. More than that can hardly be said, especially without seeing it. The effect of the sea water on it might tell something. Iron has been found so completely honeycombed by the action of the sea water that when shot were first taken out the finely divided mass of iron was so attacked by the oxygen of the air that the metal steamed and became hot. Indeed, this effect is said to have caused considerable alarm to the finder in one instance, who ran away from the shot on observing its strange behavior.—*The Engineer*.



AN ANCIENT BREECH-LOADER.

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Icebergs and Ice Fields in the Atlantic.

Usually the Atlantic ice fields have ceased to be a peril to navigation before midsummer. This year is an exception, not less in the long continuance of the ice floes and icebergs off Newfoundland than in respect to their early beginning and abundance.

The Signal Service monthly charts, prepared from reports of incoming shipmasters, show that in April the general drift of the North Atlantic ice was southeasterly, its eastern limit on that course running from longitude 50° west to about 41° west, in latitude 45° north; thence its trend was a little westerly until the southern limit was reached in about 39° north. The coasts of Labrador, Newfoundland, and Nova Scotia were blocked with ice. The chart for May shows a contraction of the vast triangular ice field, whose limits were shown to be still more contracted in June. The ice should have substantially disappeared by July, but it had not, nor had it at the beginning of August, when numbers of large icebergs were lingering off Cape Race. The practical lesson of the charts seems to be that transatlantic navigators will avoid delays and more serious danger from ice by keeping to the south of the latitude of New York until (or after) they reach the neighborhood of lat. 40° N., long. 40° W.

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Submarine Telephony.

An interesting telephonic experiment was recently made between Brussels and Dover. A submarine cable is practically a condenser, which, by its inductive action, materially interferes with the speed of signaling. The retardation, indeed, is so great as to reduce the speed to one-fifth that attained on air lines, the same instruments being used in both cases. It was feared that this condensation would prove, for a long while, a great difficulty in the case of telephonic currents, so transforming them as to render them unintelligible. The difficulty, however, has been overcome, the honor of the achievement belonging to a distinguished Belgian physicist, M. Van Rysselberghe. On June 9 the new telephonic apparatus, designed for the purpose of counteracting the effects of induction on air lines and condensation in submarine cables, was tried with success. M. Bordeaux, the engineer of the Submarine Telegraph Company, was stationed at Dover; M. Banneux, inspecting engineer of Belgian telegraphs, was at Ostend, and a third operator at Brussels.

Conversation was freely exchanged through the sixty miles of cable and two hundred miles of air line. The experiment is certainly very hopeful for ocean telephony.

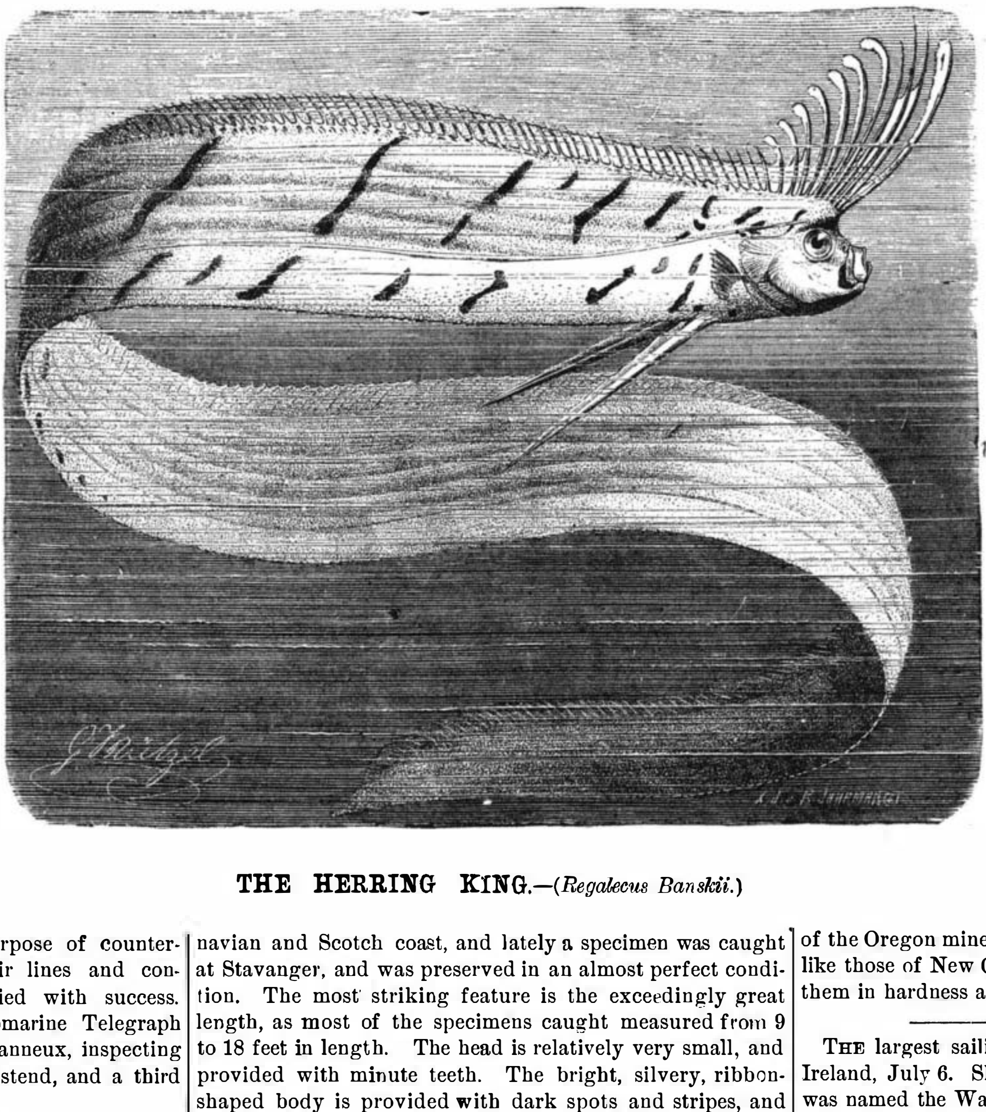
A Vigorous Mushroom.

The enormous power of cell growth was strikingly illustrated a short time since in a grain elevator at Buffalo, N. Y. The asphalt flooring was over a foot thick, in two layers. The upper layer was seven inches thick, laid hot, rolled down, and thoroughly cooled four years ago. Below was an old floor of tar and gravel, six inches thick. A curious bulge in the floor was first noticed, covering about a square foot. In six hours the floor was burst open, and a perfectly formed mushroom, with a stem two inches through and a very wide cap, made its appearance. Elsewhere the floor is smooth and unbroken.

THE HERRING KING.

The attention of scientists has frequently been called to the band fishes (*Tænioidei*), more on account of their odd form than for their value as a food fish. Their body is of an extraordinary length, and is flat like a band or ribbon, and is covered throughout with small, beautiful, bright and shining scales. The dorsal fin extends over the entire back, and the ventral fin is missing altogether, or consists of a few long thin or fragile bone spurs, which are in the front part of the body near the pectoral fins.

Among the band fishes the herring king (*Regalecus banskii*), which is found in the northern seas, always creates more or less of a sensation every time one is caught, and that is seldom and far between. As this fish lives in the greatest depths of the ocean it very rarely occurs that one is washed ashore. It was first discovered on the Norwegian coast in the neighborhood of Bergen, in 1776, and as the herring were passing along the coast at the time, the new fish was named the Herring King. Later this fish was observed on the Scandinavian and Scotch coast, and lately a specimen was caught at Stavanger, and was preserved in an almost perfect condition. The most striking feature is the exceedingly great length, as most of the specimens caught measured from 9 to 18 feet in length. The head is relatively very small, and provided with minute teeth. The bright, silvery, ribbon-shaped body is provided with dark spots and stripes, and the dorsal fin is of a mild pink color. The first spines or ossicles are of an uncommon length, and form a fan-shaped and exceedingly fragile head ornament, which was not found in a perfect condition in any of the specimens.



THE HERRING KING.—(*Regalecus Banskii.*)

A Venomous Lizard.

A great surprise has visited herpetological London, in the shape of a venomous lizard ! We have so long been accustomed to ridicule as "fabulous" the belief prevalent in some countries that certain lizards have a poisonous bite, that we are slow to commit ourselves to the recognition of a living lizard, "all of whose teeth are grooved and connected with poison glands," as we are informed at the Zoological Gardens. This startling reptile, presented by Sir John Lubbock, is from Mexico; it arrived on July 16, and has since drawn crowds of the zoologically curious to inspect it, and, at first, to doubt it ! As yet I have seen no printed or authentic account of the distinguished stranger; but, until more able pens shall give your readers a scientific description of it, I may briefly describe it as about one foot and a half in length, of a somewhat thickish form, and with a rather short, pointed tail. Except in color its aspect is not prepossessing. Heloderm is its name, *Heloderma horridum* scientifically. My only knowledge of the Greek language is that it is subservient to science, and zoologically defiant of gender and case, sometimes of spelling; therefore conjecturally *helo*, the first part of the generic name, may have reference to the pale yellowish or sunny color of this creature, as certain flowers, helianthemum, heliotrope, and helianthus, are named from *helios*, the sun, as our botany books instruct us; and *derm* is certainly skin. Heloderm is of a pale ocher or maize color, with a coarse reticulation of black marks all over it; and its specific *horridum*, deferentially inferring its terrible, dreadful qualities, is *not* given in slangy disgust, as is supposed to be the case with its neighbor, *Crotalus horridus*. "Horrid rattlesnake !" exclaimed a lady visitor in my hearing. "What's the use of calling *that* one 'horrid,' as if they are not all horrid !"

An interesting field of inquiry is now open to herpetologists in seeking for a "missing link" among the saurian tribe, and to discover by what singular modification one lizard has developed—not a single pair of fangs like its ophidian relatives, but—a whole row of grooved teeth, and by what process of evolution all these teeth are supplied with venom.

It would appear that this lizard is not altogether unknown, for—as the story goes—a gentleman in Mexico was once bitten by one of the species, his hand and arm in time becoming so seriously injured that amputation seemed the only hope for him, so he lost his arm but saved his life, and afterward entertained the regretful idea that he might have enjoyed the latter without the penalty of the former. The only deducible argument from this accident is that Heloderm's venom is very different from serpent venom, which rapidly, instantaneously decomposes the blood to the remotest extremity of the body, "acting on the nerve centers," as experimentalists tell us, and "destroying every vital function." However, those who unpacked the Heloderm fortunately escaped a bite, which is probably due to the fact that the reptile was languid or lethargic after its journey, for it was handled fearlessly—because unconscious of danger—by the keepers and others; but its dangerous qualities having been reported, it was tested with a frog, which died after a few savage bites, and then a guinea pig, which was convulsed and dead in three minutes after one bite on its leg.—*C. C. H., in Land and Water.*

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Nickel in Oregon.

At a recent scientific meeting in San Francisco announcement was made of the discovery in Southern Oregon of a large deposit of nickel ore, resembling that discovered in New Caledonia in 1864, the development of which by the French has so greatly extended the economical use of this metal. The New Caledonia minerals are known as garnierite and noumeite, both hydrated silicates of nickel and magnesia, occurring with chrome iron, steatite, and other minerals found only in serpentine. There are, likewise, two of the Oregon minerals, one dark, the other pale apple green, like those of New Caledonia, and closely corresponding with them in hardness and specific gravity.

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THE largest sailing vessel afloat was launched at Belfast, Ireland, July 6. She was built by Harland, Wolff & Co., and was named the Walter H. Wilson. Her measurement is 300 feet by 42½ feet by 25 feet. She will be classed 100 A1 at Lloyd's. She is built of iron, has four masts, three of which are square rigged, and is capable of carrying 4,000 tons dead weight

Specific Heat and Latent Heat.

Although the specific and latent heats of nearly every form of matter have been made the subjects of the most careful investigation by physicists, we fear that few practical men fully appreciate these two factors. They are apt to look upon such tables as they do upon tables that show the distances of the heavenly bodies. They know full well that these figures are the results of tedious labor and untiring patience, but they feel that they have no practical bearing upon their own work.

The melting point of metals and alloys, the specific gravity of solids and liquids, are factors of such importance to mechanics and inventors, to buyers and sellers, to manufacturers and consumers, to founders and designers, that tables of fusibility and density find their place in all handbooks and calendars, but rarely are the two other "constants of nature" placed therein. The heat of combustion receives recognition in the case of fuels, and men begin to talk more or less intelligently of "calorific intensity." Yet fusibility depends on the latent heat of fusion as well as on the temperature at which it melts. It is already pretty well known that the fuel consumed in boiling a liquid depends on the latent heat of the vapor; but that the *quantity* of heat required to heat a bar of iron red hot is any different from that necessary to heat a bar of copper to the same temperature, has probably escaped the serious attention of many an intelligent mechanic, and to those who have observed it the reason has not been quite evident.

The definition of specific heat given in our text-books is not one calculated to enlighten the common mind, or the treatment of the subject such as to interest the average reader. Knowing as we do that our readers are possessed of more than average intelligence, we have little fear of being able to make the subject of "specific heat" as clear as that of latent heat, or of the "heat of combustion." In any case our first care must be to explain, if we can, the difference between heat and temperature. Heat was formerly spoken of as "imponderable matter," because it could not be weighed. The world moves on, and we know that heat is not matter at all, but it can be measured like any other force, only the measure required is neither the imperial gallon nor the common yard stick. It is because we had to invent a new measure, which has not yet become familiar to all, that makes the measurement of heat seem difficult, if not utterly incomprehensible. Even a child notices that one thing feels hot and another cold, that what is cold to-day may be hot to-morrow, that boiling water feels quite different from ice, that a summer day is unlike a winter day, and that substances which have been near a fire feel warmer than those which have not. At first it was sufficient to call one day hot, another very hot, and a third warm, and a fourth quite warm, and so on. But some days the sun would pour down such a flood of heat that suffering humanity felt that the term "very hot" was not equal to the occasion, so they strung on a series of adjectives, such as "excessively hot," "awfully hot," etc., not forgetting the d——d hot. As these terms did not convey the same idea to different people, some measure was sought. It was known that liquids and gases expand when heated, and it was decided to use the expansion of mercury to measure the increase or decrease of heat. The thermometer does this; it goes up as it gets hotter, and down as it gets cooler. It gives no idea of *how much* heat there is in a substance, but only tells which of two bodies is the warmer. In ice water the mercury sinks to a certain point, in boiling water it rises to a given point. In our common thermometers these points are marked 32 and 212 respectively, the space between being divided into 180 equal parts. These parts are called arbitrary, but they are no more arbitrary than a pint or pound; neither have any existence in nature, as day and year have. If we cool a thermometer in snow and salt it goes down to its zero, marked 0, but by cooling it still more it goes still lower, showing that 0 does not indicate a point where there is *no heat* at all. Alcohol thermometers have been cooled to 100° below zero, and we have no reason to think that that is the limit of possibility. A substance that has a temperature of 100° is not twice as hot as one at 50°. A thermometer measures temperature, it does not measure heat; it is relative, not absolute.

One pound of boiling water will melt a given weight of ice, two pounds will melt twice as much ice; hence there must be twice as much *heat* in two pounds of water as there was in one pound, although the temperature is the same. There is more heat in a pound of water at 100° than in a pound at 50°, but how much more we do not know. There is more heat in a pound of water at 33° than in the same quantity of water at 32°. Although we have but little idea of how much that really is, we can take it for our unit and measure others by it. We could take a pound of water at 32° and put it over a gas flame, and see how much gas it would take to heat it to 33°, and this quantity of gas would give us a unit of heat. We should find it would take ten times as much gas to raise it from 32° to 42°, as to 33°, and we could call this 10 units of heat. But gas differs, burners differ, and there is a loss of heat, so it might take more *gas* at one time than another, but it does not take more heat, so it is conducive to accuracy to speak of units of heat, in preference to feet of gas, but perhaps our explanation will be clearer if we adhere to the gas method.

A cubic foot of gas may be burned so as to heat ten pounds of water 100°. The same quantity of gas will heat ten pounds of nickel ten times as many degrees. In other words, it only takes one-tenth as much gas to heat a pound of nickel from 35° to 45° as it would to heat a pound of water from 35° to 45°. Tin and antimony require but half as much heat (or we consume but half as much gas in heating them), say from 35° to 45°, as for nickel, while lead and platinum take less than one-third.

Space forbids our entering upon the practical application of these facts. A hint will suggest others. It is well known that all metals must be heated to the same temperature before they give out light. In other words, a bar of iron when red-hot has the same temperature as a bar of red-hot nickel or silver, about 1,000° Fahr. Supposing a mechanic enters his workshop on a cold morning when the temperature is at 40°. All his tools have that temperature. Suppose he picks up a bar of nickel and attempts to heat it red-hot. It must receive a certain very definite *quantity* of heat to effect this change of temperature. A bar of silver of the same shape and weight (it would differ a little in size) would require 53 per cent as much heat, and hence consume 53 per cent as much fuel, an item of some little importance when gas is used as fuel. Iron requires about 5 per cent more fuel than nickel, while copper takes 12 per cent less. A soldering copper, weighing 2 lbs., can be heated to the melting point of tin with the consumption of about 35 per cent less fuel than a block of iron of the same weight, if all the heat is utilized. Is not this a subject that is of more than theoretical interest? Can the practical man afford to neglect to take specific heat into his calculations?

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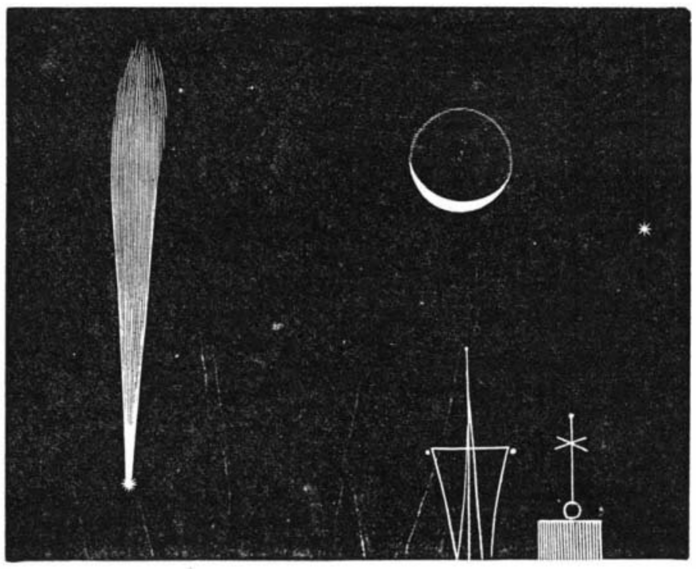
THE WELLS COMET, AS SEEN IN SYDNEY.

Concerning this visitor, Mr. Russell, the government astronomer, at Sydney, Australia, says: "The comet has lost much of the brilliancy it had when I first saw it on the 15th of June, but the tail has extended enormously. On the 19th it could be traced distinctly for 20 degrees upward, and with a slight curve to south; at its widest part it was fully 2 degrees. This evening (June 20) the comet is altogether much fainter, partly because of the moonlight, and partly because it is receding from the earth and the sun. I endeavored to get a determination of the spectrum, but could only make out a faint continuous spectrum and three bright bands, probably the usual comet spectrum, which is almost exactly the same as that of coal gas. Owing to the moonlight and faintness of the comet through haze, I could not get complete measures of the spectrum. It is satisfactory, so far, that the comet is simply composed of gas; how attenuated it must be will be obvious from the fact that on June 18 the nucleus passed close to two small stars, so that the tail passed between us and them, and I could not detect any difference in the light of the star when seen through the comet's tail or without any intervening cometary matter. The comet will probably be visible with a telescope until September; but, although it is a very fine comet, it has not attained the magnificence that the early observers anticipated. Like the great comet of 1880–1843, its perihelion is made very close to the sun, and a much finer display was expected than has been made, and it must now decrease is brilliance, although the tail may get longer. The comet was discovered on March 18, by Mr. Wells, Albany, New York.



THE WELLS COMET, AS SEEN AT SYDNEY AUSTRALIA.

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The Loss of Heat in Combustion.

In a note on the heat of combustion of hydrocarbons, published in the *Journal* of the Russian Chemical and Physical Society, Professor Mendeleeff shows that in previous determinations of the combustion heat of hydrocarbon compounds the correction due to the physical and chemical changes which accompany chemical reactions has been neglected. Thus, in burning fuel to carbonic acid, and passing this through incandescent carbon, there is obtained the reaction $CO_2 + C = CO + CO$, which shows that out of two volumes of carbonic acid we get four volumes of carbonic oxide; but this action is attended by an absorption of heat. The same result is obtained when water is passed through heated carbon, and $CO + H_2$ is produced. Therefore the professor says that in using calorimetric data of chemical reactions—*i.e.*, the records of the actual quantity of heat set free in the process of combustion, as measured by any form of calorimeter, these data should be cleared of the influence of the physical and mechanical processes which accompany the reaction. This is equivalent to stating that a certain proportion of the calorific intensity of combustion is not available for measurement in a calorimeter, or otherwise for actual duty, because it is absorbed in internal work. The correction is similar to that made when bodies are weighed in air, in the course of careful determinations of specific gravity. Another correction which should be made is that due to the change of volume, which, as in the case of $CO_2 + C = 2\,CO$, is a consideration quite apart from the production of the change of composition. The effect of these corrections, so far as they can be made in the present imperfect knowledge of the heat of combustion, has been to reduce and otherwise modify the data applicable to twenty different hydrocarbons.

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The Grape Worm.

What a host of enemies beset the grape vine! Root, stem, bud, leaf, tendril, blossom, fruit, and even the seeds, are each subject to the attacks of one or several insects. These, as a general thing, attack the vine before the fruit is ripe, and if, after all, the fruit matures, the wasps and the birds are ready to claim their share. Notwithstanding all this, we manage to have grapes, and in plenty, so bountiful is the vine, and so abundantly does it repay a little care in protecting it from its enemies. It is within a comparatively few years that the Western vineyardists found they had an insect which served their grapes much in the same manner that the codling moth does the apples; the caterpillar or "worm," living within the green fruit, and destroying it. It has on this account been called the "grape codling," but is more generally known as the grape berry moth. Thinking it to be a new species, Professor Packard named it *Penthina vitivorana;* but later observations show that it is most probably identical with a European insect, in which case *Lobesia botrana* will be the accepted scientific name.

When the grapes are examined early in July, a small spot will be found where the worm entered. If a grape thus marked is opened, there will be found within a small white caterpillar, with a cinnamon-colored head, which feeds upon the pulp of the berry, and usually eats out the contents of the seeds. If one grape is not enough, it fastens the remains of that to a sound one, by means of silken threads, and makes its way into the second berry. The result is that the berries thus attacked shrivel and die.

The worm is very active, and when the fruit is disturbed it will wriggle out of it, and let itself down by its silken thread. At maturity it is olive-green or dark brown, with a honey-yellow head, and it then leaves the ruined grape to seek a place on the leaves of the vine, where it forms its cocoon. Having selected a spot, it spins a covering of silk over it, and then cuts out an oval flap, which is attached on one side, as if hinged; this flap is rolled over, its free edge fastened to the leaf, thus forming a shelter, within which it in two days turns to a chrysalis. The cocoon is sometimes made by cutting two pieces and joining them together in the middle.

In about ten days the moth appears; it is of a slaty-brown color, with pale buff markings. There are two, if not three broods, the pupæ of the last brood passing the winter in the cocoons.

The insect has been especially destructive in Ohio, where one year it destroyed, so says the *American Agriculturist*, about half the grapes in the vineyards on the lake-shore; it is also abundant in Illinois and Missouri, attacking in preference the grapes with the most tender skins. As the last broods pass their winter in their cocoons on the leaves, it is evident that raking up and burning the fallen leaves will do much to diminish this pest. The habit of the worm of leaving the berry when alarmed, and suspending itself by a thread, may be turned to good account in capturing this insect where the number is not large.

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Comparative Weight and Yield of Eggs.

A correspondent of the *Country Gentleman* gives the standard yield and weight of eggs for the different varieties of domestic fowl as follows:

Light Brahmas and partridge Cochins, eggs 7 to the pound; they lay, according to treatment and keeping, from 80 to 100 per annum, oftentimes more if kept well. Dark Brahmas, 8 to the pound, and about 70 per annum. Black, white, and buff Cochins, 8 to the pound; 100 is a large yield per annum. Plymouth Rocks, 8 to the pound, lay 100 per annum. Houdans, 8 to the pound, lay 150 per annum; non-sitters. La Fleche, 7 to the pound, lay 130 per annum; non-sitters. Black Spanish, 7 to the pound, lay 150 per annum. Dominiques, 9 to the pound, lay 130 per annum. Games, 9 to the pound, lay 130 per annum. Crevecœurs, 7 to the pound, lay 150 per annum. Leghorns, 9 to the pound, lay from 150 to 200 per annum. Hamburgs, 9 to the pound, lay 170 per annum. Polish, 9 to the pound, lay 150 per annum. Bantams, 16 to the pound, lay 60 per annum. Turkeys, eggs 5 to the pound, lay from 30 to 60 per annum. Ducks, eggs vary greatly with different species, but from 5 to 6 to the pound, and from 14 to 28 per annum, according to age and keeping. Geese, 4 to the pound, lay 20 per annum. Guineas, 11 to the pound, lay 60 per annum.