When the zinc is used up a new disk is inserted, and it is best then to put in new paper.

The electromotive force is the same as that of the Daniell element. M. Trouvé has made many applications of this battery, notably to medical apparatus and to the purposes of military telegraphy. In Fig. 47 is represented the form for the latter purpose. The battery is composed of three hard rubber boxes, superposed, and each containing three elements. This has sufficient power to work a sounder over several miles. It may be carried upside down or in any position.

New Form of Leclanché Battery.—In this battery the depolarizing element consists of an agglomeration of powdered carbon, peroxide of manganese and gum-lac. This mixture, subjected to hydraulic pressure, forms the blocks seen on opposite sides of the carbon. The zinc rod is separated from the carbons by a triangular piece of rubber or other insulating material, and the whole is bound together, as

FIG. 46.

FIG. 47.
TROUVÉ'S MOIST BATTERY.

shown in the cut, by means of bands of rubber or other non-conducting material. It will be seen that there is a recess in the inner face of each depolarizing block. The internal resistance of the battery will not be greater than that of the liquid contained between the depolarized and the carbon plate.

It is stated that these batteries have been used in telegraphy for 18 months without attention.

These elements will rest indefinitely charged, the internal chemical action being null when the current is not closed. The depolarizing action of the agglomerated plate is so great that a single fragment clamped to a thin plate of polarized carbon is sufficient to depolarize it entirely in less than a minute.

Carbons.—A piece of clean coke, or a piece of carbon from a gas retort, may be used in these batteries. While it is best to buy the carbon from dealers in electrical apparatus, it may be prepared as follows: Take clean finely ground coke, mix with it pulverized coking coal, ram the mixture

FIG. 48.—NEW FORM OF LELANCHÉ BATTERY.

into an iron mould, and expose to the heat of a furnace until the gas is expelled from the coal. The mould and its contents are allowed to cool before the carbon is removed. The carbon is now dipped into a sirup of sugar dissolved in water, and subjected to heat, which is sufficient to carbonize the sugar.

Care of Carbons and Porous Cups.—After long use the porous cells and the carbons should be soaked in warm water.

Amalgamation.—The zinc in all batteries, except the Daniell and its modifications, must be amalgamated. This is easily accomplished by first dipping the zinc in dilute sulphuric acid (acid, 1 part; water, 15 or 20 parts) to remove scale and dirt, and afterward spreading on a little mercury, which soon spreads and covers the entire surface of the zinc.

Bunsen's or Grove's batteries may be amalgamated by pouring a few drops of mercury into each cell containing the zinc. The zincs will remain amalgamated as long as any mercury remains in the cell.

Volt.—The unit of electromotive force is called a volt. It does not differ materially from that of a Daniell cell.

Ohm.—The unit of resistance to the passage of an electric current is called an ohm, and is about equal to that of a cylindrical copper wire 1-20 of an inch in diameter (No. 20, Birmingham gauge) and 250 feet in length, or of 330 feet of iron wire, No. 9 (0.155 inch diameter) of average quality.

Weber.—The weber is an electrical unit by means of which electricians are enabled to convey definite information regarding the strength of a current. A volt divided by an ohm equals one weber.

NEW YORK PATHOLOGICAL SOCIETY.

November, 1878.

DR. J. C. PETERS, President, in the Chair.

A SURGEON LOSES HIS RIGHT HAND—REMARKABLE FORTITUDE.

DR. BRIDGON presented a second specimen, which consisted of the right hand, which had been severed by a heavy cutting-knife in a bookbindery. The victim of this unfortunate accident was Dr. Leavitt, of this city, who exhibited a coolness and fortitude under the great mental and physical strain which constituted the remarkable feature of the case. On the afternoon of October 29 the patient paid a visit to a bindery, in which he was peculiarly interested; and while standing by the machine, accidentally set in motion, the knife came down upon his right hand, severing it just below the wrist and through the second row of carpal bones. Dr. L. promptly seized the stump, controlled the hemorrhage, covered the wound with bandages, and then wrapped the right hand in a towel and rode in a street-car from Fourteenth street to Fifty-first street, a distance of nearly two miles. Dr. Bridgdon was asked by Dr. Hadden to see the case in the evening, when a consultation was held with Drs. Hadden, Geo. F. Shrady, and Beckwith, resulting in a decision to amputate at the wrist-joint. During the consultation the patient himself discussed the practicability of merely trimming the stump and not sacrificing the carpus. The skin was so extensively separated from the dorsum of the wrist that it was impossible to cover these bones, there being barely enough integument upon the palm for a stump of the wrist. After the operation was determined upon the patient busied himself in arranging his room, in fixing the operating-table, and attending to many other details. He carried his personal interest in the operation to the extent of requesting that no ether should be administered to him. This wish, for obvious reasons, was not gratified. The amputation was performed in the usual way, and a flap was made from the palm of the hand.

EPITHELIOMA—BLEPHAROPLASTY.

DR. NOYES exhibited a small specimen of epithelial growth removed by operation from the eyelids, which was of interest in connection with the means used to fill up the gap which was left. The patient was a lady aged 50 years. Nineteen years ago she noticed a small growth on the inner border of the lower lid, near the punctum. This remained stationary for ten or twelve years, when it began to spread along the border of the lid and at the same time broke down in ulceration. Within the past year the disease extended itself over the lachrymal sac, involved the inner portion of the upper lid, and made in all a tumor the size of a hazel nut. Two-thirds of the lower and one-third of the upper lid were occupied by the disease as well as the adjoining side of the nose. The operation of removal was performed without difficulty, the tumor shelling out from the underlying tissues easily. The lachrymal sac was exposed, but was not opened. Actual cautery was employed along the inner portion of the wound. In order to fill up the deficiency of the growth occasioned by the extirpation, a vertical incision was first made in a line with the inner canthus and along the side of the nose to the reflection of the mucous membrane of the gum. From the outer canthus an incision was also extended horizontally across the malar bone to within a half inch of the ear. The flap thus created was dissected up and slid inward toward the nose, thus restoring the lower lid. A space was left on inner canthus and inner portion of upper lid. An attempt was made to fill up this space by transplanting a severed portion of skin from the arm, according to the method proposed by Mr. Wolf of Glasgow. But sloughing of this piece occurred, owing, as Dr. Noyes thought, to the fact that actual cautery had been previously used in that portion of the bed of the wound. Union occurred by first intention throughout the flap for the lower eyelid. A second attempt to fill up the vacancy of inner portion of upper lid was made shortly afterward. An incision from the upper limit of the gap was made horizontally across the root of the nose, and then at right angles downward. The flap thus created was turned upon itself edgewise and accurately adapted to the edges of the gap. Her recovery was complete and satisfactory. The tumor was examined by Drs. Bull and Satterthwaite, and found to be an epithelioma.

REMOVAL OF MELANOTIC EPITHELIOMA FROM EYEBALL, SAVING THE EYE.

DR. NOYES presented a small malignant tumor which he removed from the exterior of the eyeball, and at the same time preserved the eye. The patient was a gentleman, aged forty-eight years, who first noticed a small black speck on the white of the left eye seventeen years ago. This remained stationary for twelve years, and then grew slowly for five years. Within the past year the increase had been very rapid, presenting a black raspberry appearance, overlapping the outer third or more of the cornea and nearly as much of the adjacent sclerotic. On looking at it, the first impression was that it grew from the interior of the eye; but a closer examination showed that the eye was perfect, and that the eyeball was not affected. The patient came to Dr. Noyes after having seen other ophthalmologists, who advised enucleation of the eye. It struck Dr. Noyes, however, that the tumor could be detached from the surface of the globe, and he accordingly made the attempt. The

operation was performed by a curved scissors, and was entirely successful. The tumor grew from the episcleral tissue and from the limbus. The surface of the wound was easily covered by dissecting up the edges of the conjunctiva and bringing them together. The growth was examined by Drs. Bull and Satterthwaite, and found to be a melanotic epithelioma. Dr. Noyes concluded the presentation of this interesting specimen by an exhaustive review of the literature of the subject.

IMMENSE VESICAL CALCULUS.

DR. WEIR presented an immense vesical calculus removed by Dr. C. T. Gardner, of Providence, R. I. It weighed twelve and a half ounces, measured in its several diameters three and three-eighths inches, three and one-eighth inches, and two and a quarter inches, and had for a center a small oxalate calculus, the periphery being made up of phosphates. The operation for its removal was commenced with the lateral incision, but was afterwards extended into the bi-lateral section, as the instruments on hand were insufficient to crush it *in situ*. The patient, a man of 49 years, did well after the operation; a rectal fistula that formed from sloughing spontaneously closed.

Until he had looked this afternoon into Eve's "Surgical Cases," Dr. Weir was under the impression that the stone exhibited was the largest that had successfully been removed entire in this country by the perineal section. But he found in that work a record of a calculus removed by Dr. Mettauer, of Virginia, weighing sixteen ounces, with recovery of the patient. Abroad, Mr. Hadmer, of Norwich, England, has the credit of having in 1746 successfully extracted a stone weighing nearly fifteen ounces. Mr. Mayo, of Winchester, England, removed one of fourteen and a half ounces, but it was broken before extraction.—*Medical Record*.

ORIGIN OF YELLOW FEVER.

At the recent meeting of the American Public Health Association Dr. A. N. Bell, of New York, remarked in substance, as follows:

During my naval service in the Mexican War, and subsequently on the Gulf Coast, the Spanish Main, in the West Indies, on the coast of Africa and neighboring islands; and since, on Bay Ridge and Fort Hamilton in 1856; in charge of the floating Yellow Fever Hospital, and my connection with the New York Quarantine—at home and abroad, ashore and afloat—I have, like my friend, Dr. Dowell, seen a good deal of yellow fever, and had excellent opportunities for studying its topography in various places. And during the while I have read everything concerning it I could get hold of, but with convictions the very opposite of his. I am thoroughly of the opinion that the conditions of yellow fever are, in general, putrefying organic matter, moisture, and high temperature, and wherever these conditions combine in the greatest abundance, there yellow fever is most wont to prevail, and with the greatest degree of malignancy. And so far from having my convictions shaken in this regard by the reports we have here heard, they have been greatly strengthened. Filthy soil, foul water, foul traffic, foul vessels, and high temperature have been the prevailing conditions throughout. And under these conditions, on evidence which I feel bound to accept, I believe the disease frequently has occurred *de novo* in the United States.

Of its history on this continent, and in the West Indies, it has been contemporary with European settlement. Oviedo records a great mortality from it among Columbus's people in St. Domingo in 1494. Herrera, Ulloa, Ferreyra de Rosa, and other Spanish and Portuguese historians all make record of yellow fever in American settlements before there was any commerce between this country and Africa, or any other alleged primitive sources of this disease. And in more recent times, but yet so long ago that commercial intercourse was much more easily traced than during the last fifty years, yellow fever frequently occurred in various parts of this country, when favored by local conditions, in exceptional seasons, when it was wholly impossible to trace it to foreign origin, and under similar circumstances I hold it is continually liable to occur.

All efforts at freezing out infected ships hitherto have failed. The cold cannot be made to penetrate into the bilge, the timbers, and crevices, the places in which lodge the deposits of soakage from the filthy waters of foul harbors in hot climates. Moreover, it is the common practice of the navy, in sending infected vessels to cold climates, to have them hooded over, and the depth of the hold and the housed-in conditions are such as to preclude the possibility of a freezing temperature where it is especially needed. Dr. Bell expressed his continued faith in steam heat as a disinfectant for ships, and his surprise that it had not been used on board the ill-fated *Porter*. The fear of moisture on account of condensation of the steam, he says, is a fallacy; the surfaces thus subjected to steam become so heated that, immediately on opening the hatches, the moisture is dispelled with great rapidity and completely. Of the degree of heat necessary to kill yellow fever, he considers steam heat of 180 degrees for two or three hours amply sufficient. Dr. Bell here related his first observation in the use of steam with the effect of disinfection in 1848. The United States steamer *Vixen*, while infected with yellow fever, was steamed for the purpose of killing cockroaches. The result was twofold, the death of the vermin, and non-recurrence of the fever. Since that time it had frequently been used by himself and others for the special purpose of disinfection, and, so far as he knew, without failure in any instance.

PHILADELPHIA HOSPITAL.

Clinic of DR. F. F. MAURY—Reported by Dr. C. W. Dulles.

SINUS OF THE LEG.

ON the inner aspect of this young man's leg you see two openings, with purplish, unhealthy-looking margins, from which a small amount of semi-purulent matter can be pressed. The origin of this trouble he associates with a gunshot injury, and it has now lasted a long while.

The appearance of the openings would lead us to suspect—especially in this location—that they communicate with dead bone. If this be the case we must remove it; if not, if we have but a sinus here, a free incision will enable us to ascertain this, and also put it in the best condition for healing.

We begin by applying Esmarch's bandage. This consists of a roller of rubber, which is applied tight, and without reverses, from the very extremity of a limb to a point above where an operation is to be performed; and a piece of rubber tubing, which is drawn very firmly about the limb several times and fastened just above the last turn of the roller, which is then removed from this point downward. The

roller drives out of the limb almost every particle of blood, and the tube, acting as a tourniquet, prevents its return. We thus have the means of doing tedious, and otherwise bloody, operations without any hemorrhage to interfere with our work or hide it from our eyes. This is of special value in operations upon the bones, and I consider Esmarch's bandage as one of the greatest achievements of modern surgery. For my own part, I may say, too, that I have never seen any evil results from its employment, such as other surgeons have reported, and have no fear of it.

Now, in proceeding with our operation, I make a free incision between these openings, as I have over and over again charged you to do. Make an exploratory incision in the skin, free. Don't be afraid. Then I examine with my finger—the best probe possible—the bottom of this tract, and I find no dead bone; we have only a sinus here. I now scrape out a large quantity of caecoplastic lymph to freshen the walls of the sinus, and put it in a good condition for repair.

In all this, you see, there has not been a drop of blood lost—not a drop. But now, as my resident slowly loosens the rubber tube, you see the pallid limb growing rosy. The blood is returning to it, and comes welling up from the raw surface I have made. I do not check this at once, for I believe the depletion will do good; but after it has continued for a while, if it do not cease spontaneously, we will insert a piece of sponge soaked in equal parts of Monsell's solution and water, and leave it in for a day. In this way we shall expect to secure the healing of this sinus before long.

CURE OF ONYCHIA MALIGNA.

DR. GAETANO (*Journ. des Sci. Med.*, from "*Il Morgagni*") was called to a little girl ten years of age who had suffered horribly for six months with peri- and subungual ulceration of the right index finger. Having softened and raised up the nail as much as possible, he dropped a concentrated solution of morphia upon the sore, with which he kept it in contact a quarter of an hour. He then covered the diseased part with very finely powdered nitrate of lead and enveloped the finger with a bandage. The pain was almost immediately relieved, and the patient slept soundly that night for the first time in a long period. The bandage was removed at the end of five days, and the ulcer was found about one-half healed. The application was repeated, and by the end of five days more complete cicatrization had taken place. In two other cases results as favorable were obtained by Dr. Gaetano, the applications being made more or less frequently as the case seemed to demand.—*Amer. Med. Bi-Weekly*.

TRADE DISEASES.

FROM a comprehensive view of the circumstances directly answerable for the production of disease, Dr. Arlidge constructs the eight following classes, some of them of wide-spreading influence, others of very limited operation. In his recent address before the British Medical Association, so far as they refer to manufactures and the arts, they are called "trade diseases."

1. The evolution of dust.
2. The evolution of unwholesome vapors and gases.
3. Materials of an irritant or poisonous nature acting through the system or only locally.
4. Over-heated air, whether dry or laden with moisture.
5. Compressed air and rarified air.
6. External conditions acting upon the organs of special sense.
7. Over-exertion of particular parts of the body.
8. Mechanical appliances productive of bodily injury.

The most widely spread source of disease flowing directly from the labor pursued is assuredly the evolution of dust. Its presence and action are observed in all textile factories; in potteries; in mining, whether for coal or metallic ores; in cutlery manufacture; in cutting and polishing stone, ivory, and mother-of-pearl; in the grinding of flour; and, in fact, in many other small trades that need not be specified. The other causes are, however, wide-reaching, and not a physician but can recall cases brought about by them.

It will be noted that all or nearly all of them are preventable; and were the attention of inventors more prominently called to the matter, and stimulated by offers from those interested in the good of the community, no doubt there is hardly a trade but could be prosecuted innocuously. There is here a field for practical philanthropy which asks cultivation, and the benefit of any discovery in which will extend world wide. As it is an excellent mode of stimulating investigation, will not some one offer a "prize" for the most useful discovery in this branch?—*Med. and Surg. Reporter*.

KEEPING FRUIT.

At a recent meeting of farmers and others for the discussion of the keeping of fruit, the following items of experience were brought out, which, if facts, may be of some interest to many of our readers.

Apples packed in caliche plaster rotted very badly and quickly. The dry plaster absorbed enough moisture from the apples to dampen it and get up a degree of heat sufficient to spoil the fruit. Dry earth kept apples in fair condition to appearance, but the flavor was spoiled. Buckwheat chaff had been found excellent for packing fruit, as it contains very little starch. Wheat bran is objectionable on account of its abundance of starch, which soon moulds and spoils the fruit. Dry, forest leaves have been used with fair results for packing apples. Oak leaves are among the best for this purpose. Several bushels of fall apples having been stolen by a hired man, were buried in a large hay mow and then deserted for several months. In mid-winter they were discovered and found in a very good state of preservation. Taking a hint from this, fifty barrels of winter apples are now packed in straw in a cool, dry cellar as an experiment. Apples are so cheap and plenty this season that it costs very little to try an experiment, which if successful, may prove of great value. Cellars should be ventilated at the bottom, that the whole of the air may be changed. A brick taken out from the bottom of the chimney flue makes a good opening for the escape of damp air in a cellar. Dry sand had been successfully used for keeping grapes from harvest time till winter.

One gentleman showed a squash which had been kept in a warm closet, apparently sound, for nearly two years. Several experiments were reported in attempting to change the bearing year of apple trees, but generally with little success, owing to the depredations of insects which multiply so largely in bearing years, and are always ready to destroy the whole crop on the following year, when the product is limited.—*N. B. Farmer*.

[AMERICAN MILLER.]

A STUDY OF WHEAT.

THE old theory, that says the best mechanics in the world are those who work most faithfully from morning to night at the drudgery of their work, and know or care for nothing else, is fast giving way, and to-day that mechanic can obtain the best situation who is most thoroughly acquainted with his work, in all the minuteness of its details, having a complete knowledge—from the intricate mechanical problems down to the mere drudgery of the business. Is there any class of workers to whom this can be applied better than to the miller?

A miller who desires to be considered successful—not particularly from a money point of view—should be familiar

FIG. 1.—CROSS SECTION OF WHEAT STRAW. A, Vascular Bundles. B, Spiral Vessels. Drawn with Camera Lucida, X 75.

FIG. 2.—LONGITUDINAL SECTION OF WHEAT STRAW. Showing a Vascular Bundle. A, Spiral Vessels. B, Pitted Vessels. C, Regular Parenchymatous Cells. Drawn with Camera Lucida, X 375.

FIG. 3.—EPIDERMIS OF WHEAT STRAW. A, Rows of Stomates. B, Opposite, or over the Vascular Bundles seen at A, Fig. 1. Drawn with Camera Lucida, X 75.

FIG. 4.—EPIDERMIS OF WHEAT STRAW. Same as Fig. 3, magnified more. A, Stomates or Breathing Places. Drawn with Camera Lucida, X 375.

with the structure of every part of his mill—know the power of the stones—just how much margin he has for safety in the steam boilers—know how much strain can be brought to bear on the great leather belts, and be able to recognize and remedy at once any defect. He should know what grains he can run through his mills with safety, either to the mill

or to his reputation as a miller. If it is his ambition to have the purest flour in market, he must know just what wheat to accept, not only the variety of the wheat, but the purity of that wheat, for the very best variety of wheat will not give pure white flour if the greater part of it is smut, or if it has been troubled with any of the numerous parasites which live on wheat. Then, for these reasons, our model miller should have a knowledge of the different diseases to which wheat is subject, such as smut, blight, rust, mildew, brand, and ergot. A study of these diseases, together with the history, geographical distribution, and microscopic structure of wheat, will constitute the present series of articles.

Wheat has been cultivated from the earliest antiquity, and now furnishes the principal breadstuff of all civilized countries. It is not known to what country it originally belongs; some even have claimed that it was planted upon the earth at the time of the Creation. It is certain that it was cultivated in Egypt nearly two thousand years before the Christian era, as we read in the Old Testament, and Chinese history tells us wheat was introduced into China 2,700 B. C. by one of the Chinese emperors. In every country where wheat would grow at all, it has steadily increased in proportion as the country has become civilized and settled. Hostile armies have aided in transporting it from one country to another, and Mexico owes its first introduction of wheat to the brutal conqueror Cortez. It was introduced and cultivated in Peru under the directions of the Spanish lady Maria de Escobar, and the North American Colonies began to cultivate it at the earliest period of their settlement. It was first sown on the Elizabeth Islands, of Massachusetts, by Goshold, at the time he explored the coast, in 1602. It was sown in Virginia, together with other grains, in 1611, however it was not cultivated to any great extent, because the raising of tobacco was entered into with so much zeal; but in 1651, a premium was given for its culture, when it received a great impetus.

In 1620, wheat, together with rye, barley, and other grains, was exported from Manhattan Island to Holland. It was first introduced into the valley of the Mississippi in 1718. The New England States and New York did not raise scarcely any more wheat than necessary for their own use until after the Revolutionary war, but large quantities were exported from New Jersey to Europe, and from Illinois to New Orleans. The price per bushel in 1635 was sixty cents, while in 1680, in Maine, it was sold for \$1.25. At the present time wheat is cultivated over nearly the whole world, being limited only by the rigid cold of the North, and the intense heat of the South. We find it exported in large quantities from the United States, Russia, Hungary, Turkey, Denmark, and Chili. Next to the United States, it is most extensively cultivated in Russia. The great increase in the Pacific States is worth noticing. In 1850, only 17,200 bushels were raised. Now, we are told, there are many farms of from 2,000 to 4,000 acres, while farms of from 20,000 to 40,000 acres are by no means few, entirely given up to the growth of wheat. This is due principally to the fact that the summers are long and devoid of heavy rains.

Regarding wheat with a botanical interest, we will find it in the family of *Gramineæ*—the family of grasses—and belonging to the species *Triticum vulgare*. Of this there are two distinct sub-species, known as Summer and Winter wheat—the Summer, *Triticum aestivum*, and the Winter, *Triticum hybernium*. Each of these sub-species is divided into many varieties, as Treadwell, Diehl, Clawson, Tappahannock, etc. In wheat *Triticum* there is but a single spikelet at each joint; its two glumes placed transversely, and it is from three to several flowered; the lower palea is pointed or furnished at the tips with awn, of variable length; stamens, three. The sub-divisions into Spring and Winter, seem to be the result of cultivation more than anything else, for several different experimenters have been able to produce the Winter variety from the Spring, after several successive trials, and the reverse is also true.

De Candolle—a botanist of high authority—believes wheat to be the result in growth of the cultivation of a wild grass. He even claims that this grass is still growing in certain localities in Central Europe. Many different varieties have been cultivated. One gentleman in France, who has experimented largely with this grain, has succeeded in raising 322 entirely different varieties. The difference between varieties consists in the size of the plant, its shape, habit of growth, in its foliage, in the size or shape of the spike or head, and in the size, form, color, and heaviness of the grain.

There are about twelve varieties in this country. The same variety is found in different localities under different names, so we have many purely local names. So a certain variety may grow luxuriantly in one locality, and be nearly, if not quite, a failure, in another, due to the soil, climate, and various other causes, singly or combined. But all farmers know that a good soil is as necessary for a good yield of wheat as for any other grain. Of course, pure, clean seed is a most indispensable aid to insure a fine crop, and plenty of skill should be exercised in keeping out all foreign seeds. The weeds which are the most troublesome to wheat are cockle (*Lycnie githago*), and chess or cheat (*Bromus secalinus*), which is sometimes so abundant that some farmers take it to be degenerate wheat. In New York a great deal of trouble is experienced from the presence of redroot or gromwell (*Lithospermum averse*). Then wheat is troubled with rust, smut, the weevil, the Hessian fly and wheat moth.

Wheat retains its vitality only from three to seven years, and the stories, so generally believed, of wheat being found in Egyptian mummies, thousands of years old, capable of growth, etc., are now discredited. It is believed the cunning Arabs hide these seeds there to deceive the unsuspecting and susceptible traveler, for very recently there have been found Indian corn, and dahlia tubers, exhibited by these sons of the desert as grains and roots which for centuries have been quietly sleeping, waiting only for moisture and sunlight to awaken them to life and growth. 'Tis fortunate for the happiness of our poor Arabs that they are entirely ignorant of the fact that Indian corn and dahlia tubers were not known until after the discovery of America.

Before we take up the minute structure of wheat itself, let us study the microscopic structure of the plant, for every part shows beauties under this aid to the eye, which, without it, would never be mistrusted to exist. Every part of the stem, the root, and head, and seed, would, of itself, form a study, but with limited time and space we can at most only hope to obtain a general idea of the minute structure of each part. Many interesting questions could be answered here, were we not intending only to give the microscopic structure, as: How does wheat grow? How does it assimilate the elements, even minerals, of the soil, transforming material so unlike itself and storing away its starch in the tip of the root at one end and in the center of the kernel at the other? How is moisture gathered from the soil and carried to the extreme end of the head? All these and similar questions are found well explained in our veg-