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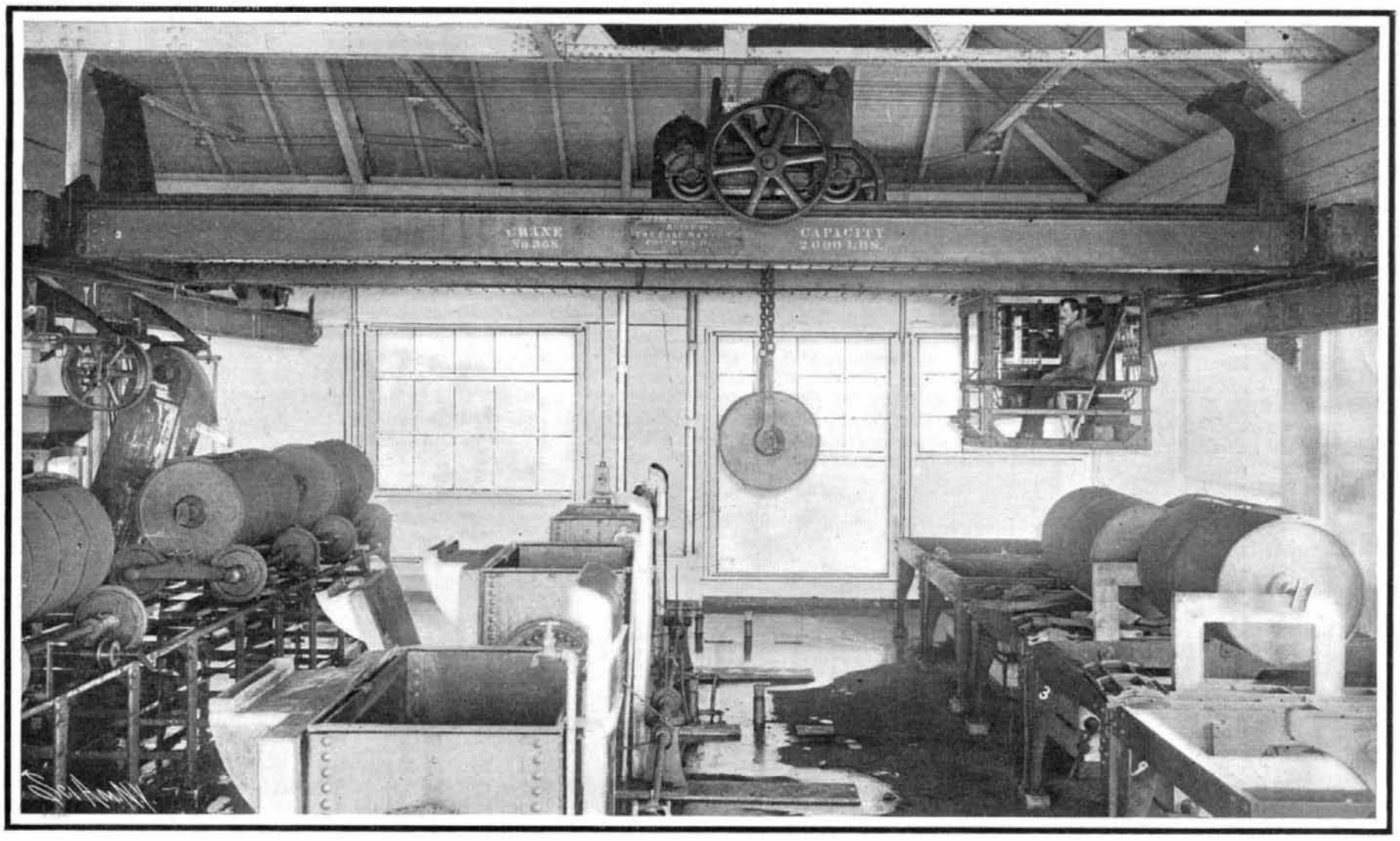
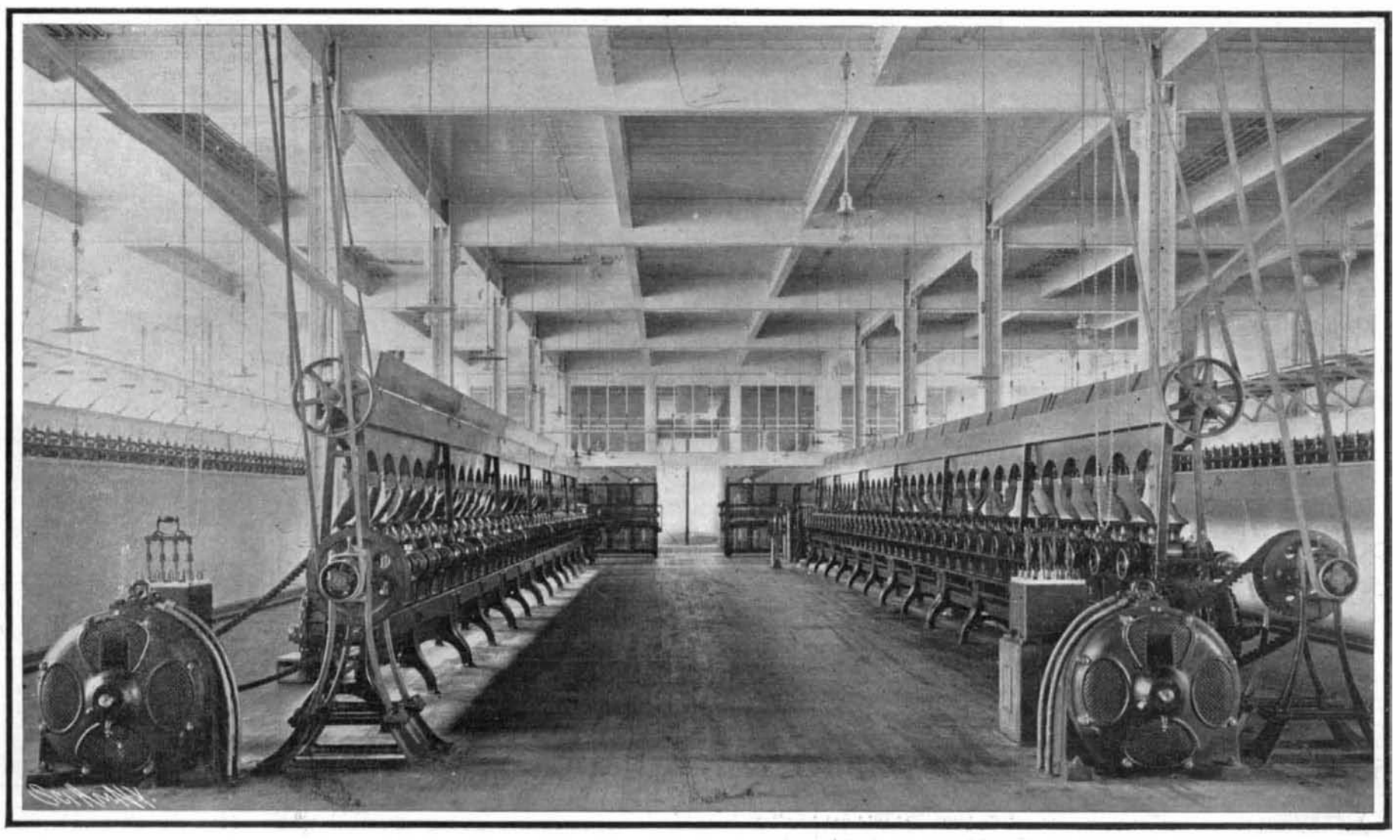


Cooking the Cleaned Grain by Steaming.



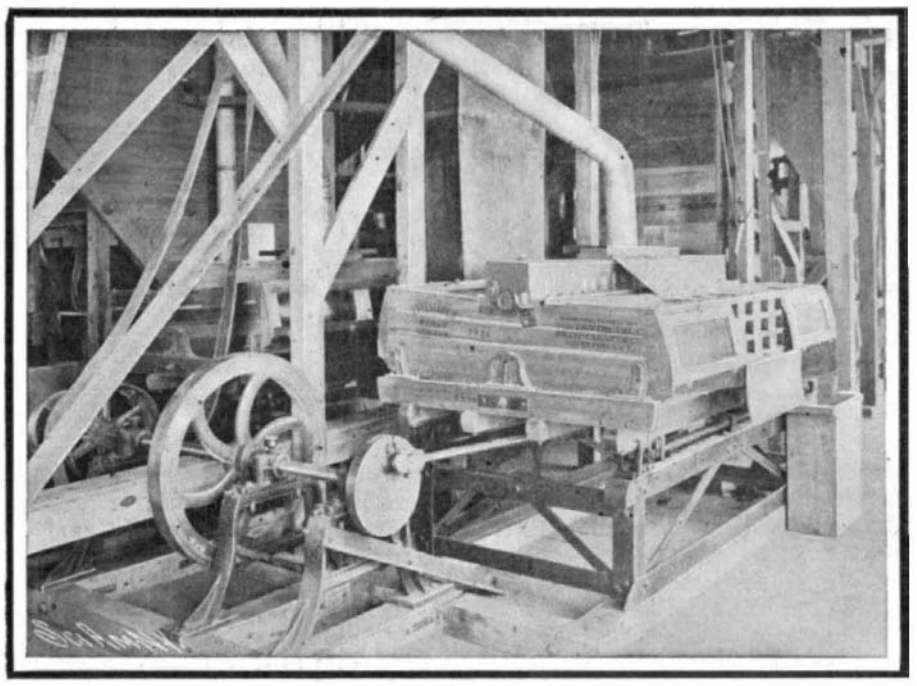
Shredding Machines Which, After the Steaming Process, Roll the Whole Wheat Kernel Into Shreds.

THE MANUFACTURE OF CEREAL FOODS WITH THE AID OF ELECTRICITY.—[See page 24.]

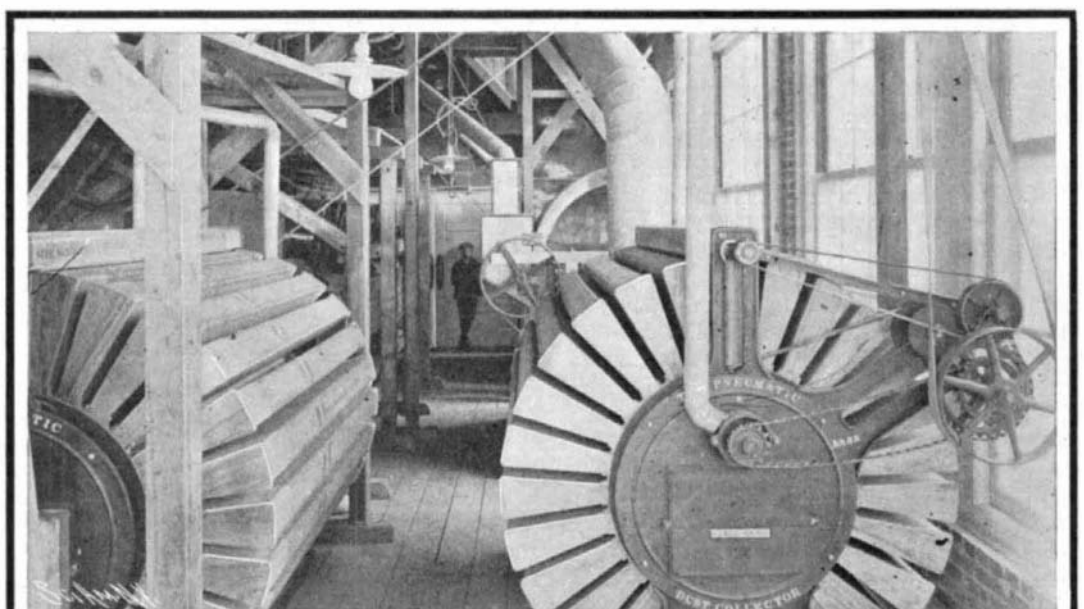
THE PREPARATION OF CEREAL FOODS.

By a cereal food we are to understand a preparation of grain by which its natural properties may be conserved or enhanced by proper treatment to render it more adapted for human needs. The original cereal food was oatmeal, which has been used for centuries by the Scotch, and Sir John Froissart describes a large bag of ground oats, which every horseman carried on his saddle, and the metal plate used to prepare the coarse but not unwholesome meal. As methods improved, the product improved, until at last we had an excellent article, which began to be called a "breakfast" food. Then experimenters devised new ways of treating not only oats, but wheat and other grains as well, and soon these articles began to form an appreciable item in the total output of breadstuffs. Having described the great wheat fields of the West, their cultivation and the garnering of the grain and the manufacture of white flour, we come to the consideration of cereal foods, where the grain is treated so as to preserve the original qualities, and at the same time render it more digestible by a process of cooking and filamenting, or shredding, by which an article is produced which at first sight seems to be a form of macaroni woven into oblong shape and baked. The composition of a grain of wheat is much more complex than is generally supposed, each of its several layers and properties having a definite purpose for its being, and all of which are necessary for the perfect nourishment of mankind. The wheat kernel, even though ground and left as a whole, if without preliminary treatment, produces a flour which the human system finds difficult to assimilate. However, in the process to which we refer, the entire wheat kernel receives a peculiar treatment previous to shredding, which tends to break down the cellulose structure, and so change the starchy properties as to make the entire berry easily and naturally digested and assimilated, and this without the addition of a single foreign substance, which when used robs the bodily functions of their intended and much-needed exercise.

There is located at Niagara Falls, N. Y., a most interesting plant operated entirely by electricity, and, in fact, a large part of the product is baked by electricity generated by water from the adjacent Niagara River. The plant of the Natural Food Company is termed a "conservatory," and the name is particularly appropriate, when it is stated that the eight hundred and forty-four windows contain thirty thousand lights of glass. The building presents the appearance of having glass walls, through which streams an abundance of sunlight, making artificial light necessary only on the darkest days. Every evening, however, the electric lights are turned on, thanks to the never-failing power of Niagara, and the effect is so remarkable that it is not inaptly called "A Castle of Light." The products, which, by the bye, are far from being limited to a breakfast food, are two varieties having a common base. First, the thick, oblong cakes made of elongated shreds of wheat and termed "Shredded Wheat Biscuit;" and second, a flat, crisp cracker called "Triscuit." The system of baking these crackers, which is done by electricity, while in rapid motion along an electric carrier belt, is particularly interesting, as it is the first use made of the electrical current in commercial baking, and we have been able to secure photographs of this unique mechanism.



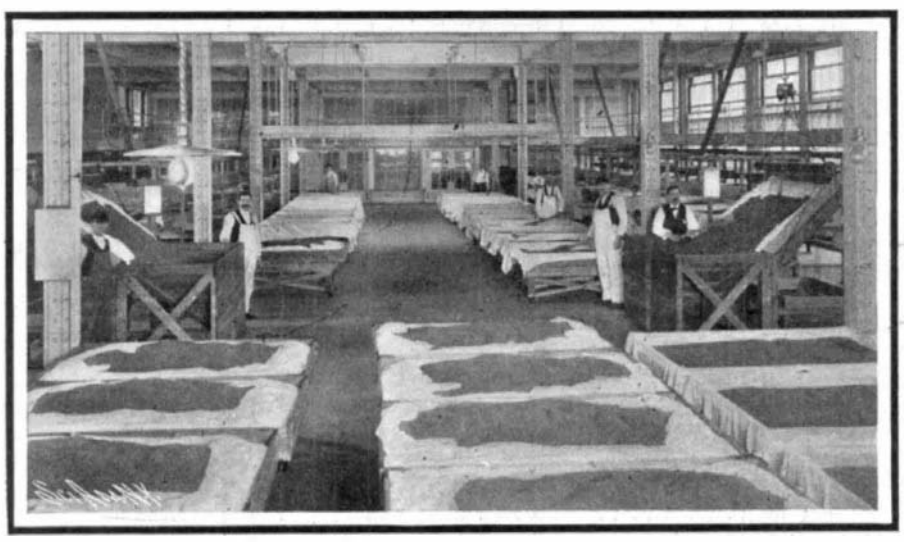
Stoner for Removing Cockle and Other Foreign Substances from the Wheat.



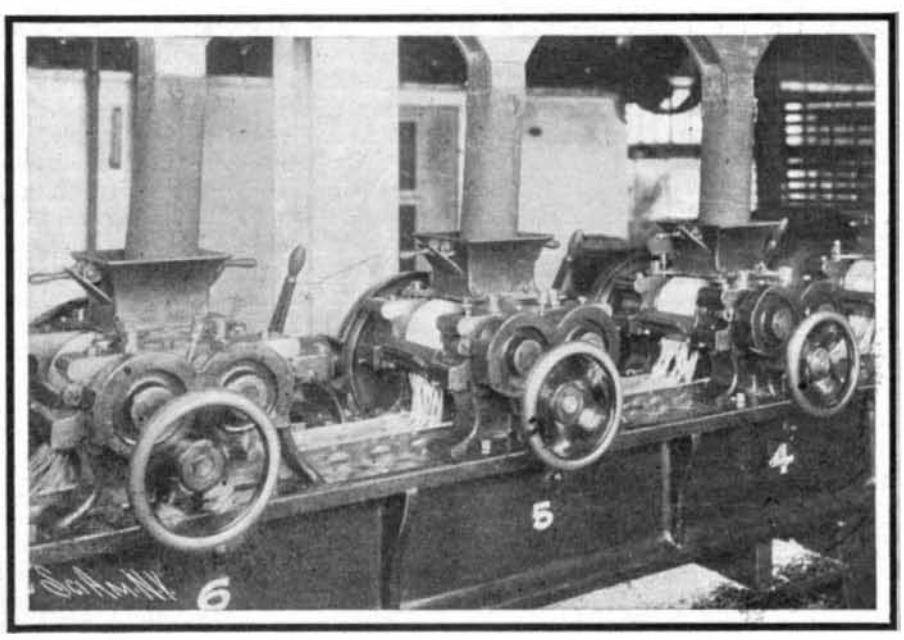
Dust Collectors in Which the Air Used in Cleaning the Wheat is Purified.

The building proper is of large size, being 463 feet long with additional sections, the total floor area being about five and one-half acres. It is built of light-colored brick, which helps to emphasize the gospel of cleanliness, which is preached in a practical manner in this plant. The construction admits of a great abundance of light, but not air; for the central tower is the only air inlet in the building, large fans serving to change the air every few minutes in all departments. This system enables the air not only to be filtered, but to be kept cool in summer and warm in winter without the danger of drafts which might jeopardize the health of the employes. To insure the integrity of this air-lock, as it were, the windows are double-glazed. Being situated in the most beautiful residence section of the city, the company, it seems, does not desire to establish direct railway connections, the wheat and finished products now being conveyed to the cars in specially constructed steel wagons, though a tunnel connecting the conservatory and the main line of the railroad is one of the possibilities.

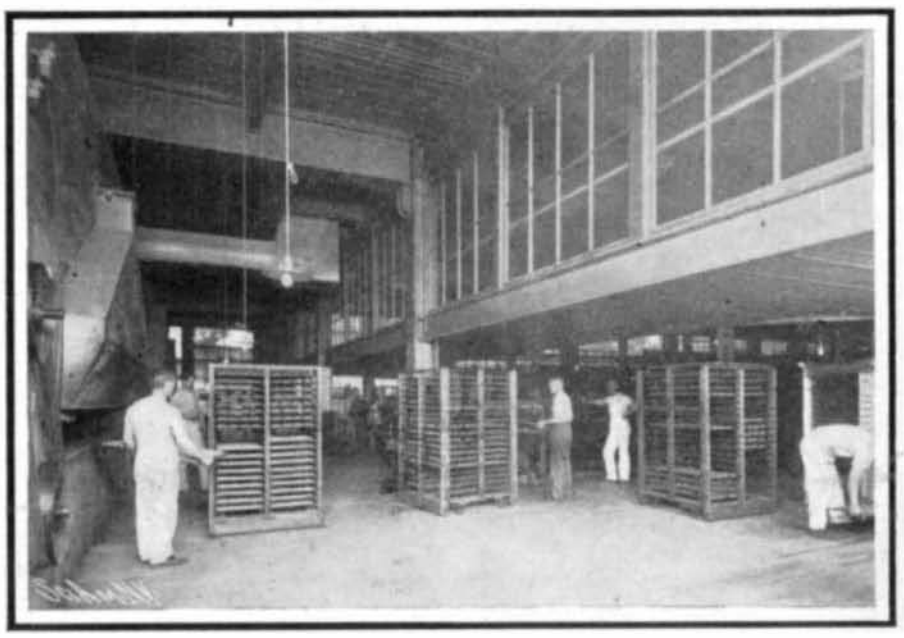
The grain, when it reaches the building, is elevated to the top story and is automatically weighed. It then descends from story to story until as a food it leaves the lower one packed in cartons in boxes. All grain is more or less dirty; there is dust, little bits of binder wire, the "beard" of the kernel, and more or less cockle. To remove these impurities, the best practice of the miller and maltster is employed. Seeders which resemble an inclosed sieve remove the cockle, magnetic separators take out the iron, and strong air currents remove the dust, which in turn is mechanically taken from the air, and thus not being allowed to circulate in the room. These curious-looking machines never fail to impress the visitor. The grain is then washed in sterilized



Drying the Thoroughly Cleaned and Cooked Grain Before Shredding.



A Battery of Shredding Rolls.



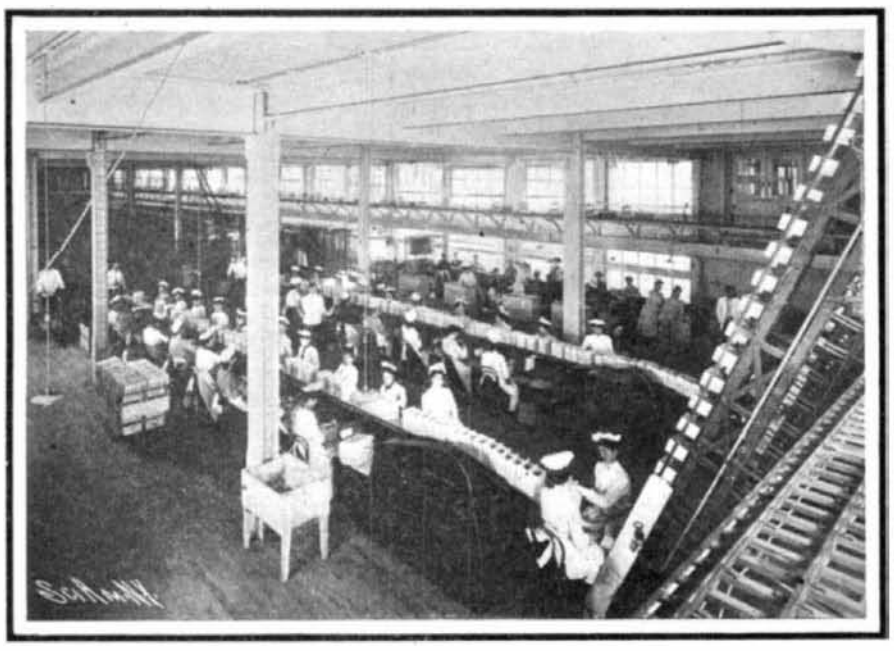
Ovens, Transfer Racks and Ends of Evaporators.

THE MANUFACTURE OF CEREAL FOODS WITH THE AID OF ELECTRICITY.

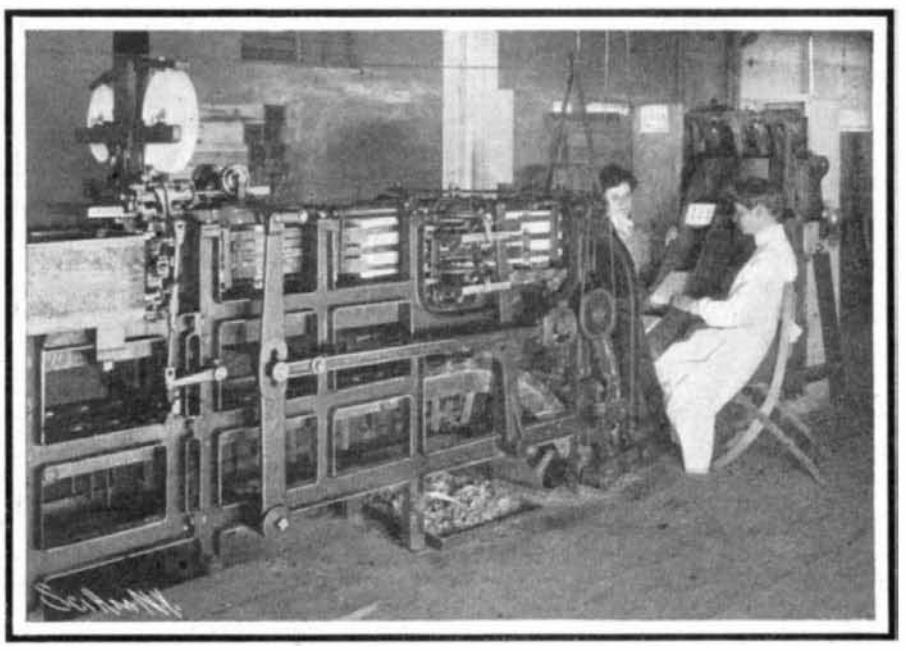
water, and is then cooked for thirty minutes by live steam, the kernels being contained in cylindrical wire sieves. Any organisms which might have adhered to the grain are destroyed. The swelled kernels are now softened to such an extent that if the shredding process were begun, they would be reduced to a pulp. It is therefore necessary to dry or cure the grain, so that the kernels will lose some of their moisture, and become rigid enough to stand the subsequent process of shredding. For this purpose the grain is spread on clean cloths, and is exposed to cool air for twenty-four hours. The kernels are turned from time to time with paddles, for they are not touched by hand at any stage of the process of manufacture, although the finished product is necessarily put into paper cartons by hand. Conveyors take the ripe berries to the floor below, where they are fed into the hoppers of the great shredding machines, each 88 feet long and actuated by a 40-horse-power motor. The shredding machines consist of 36 pairs of rollers, and a cutting and panning device. The rolls consist of a steel roller having lines or corrugations cut upon the surface; this roller antagonizes a smooth roller, and the wheat kernel is caught between the two and rolled out into a long shred, which drops upon an endless belt. Shredder No. 1 delivers one layer, shredder No. 2 the second layer, and so on, until at the end of the thirty-sixth shredder there is a corresponding number of layers. This long band of white filaments is now brought by the endless belt to the cutting device, which separates it into oblong cakes of the proper size, presses them, and finally drops them onto an automatically-advanced pan holding 48 biscuits. When the latter is filled, it is taken to a large oven consisting of a drum carrying pan-holders suspended, so that the pan will be horizontal at all times, irrespective of the rotary motion of the drum—very much like the cars in a Ferris wheel. This drum is inclosed in brick walls, so as to form an oven. The biscuits are thus kept constantly in a moving current of hot air, until to all external appearance they are done; but as in reality they have an underdone core, they are transferred to an oven of different type, where they remain for a longer period and in which the baking process is completed. The time required for cooking is thirty minutes, in addition to which the first oven bakes the biscuits for thirty minutes, and the second oven for one and one-half hours, consequently two and one-half hours are occupied in processes for rendering the wheat easily digested and assimilated.

The biscuits are now taken on the pans and put on racks, which are wheeled to the packing table, where girls, attired in spotless white aprons and caps, place them in cardboard packages or cartons, each holding twelve. These packages are then placed on an endless belt which carries them to a machine almost human in its operation. This machine turns back the flaps, glues them, pastes a strip of paper over the joint, and the endless belts pressing on the package as it passes through this long machine allow the glue to fairly set. Following this the cartons are packed in large wooden cases, which, too, are made by machinery, and the product is ready for shipment.

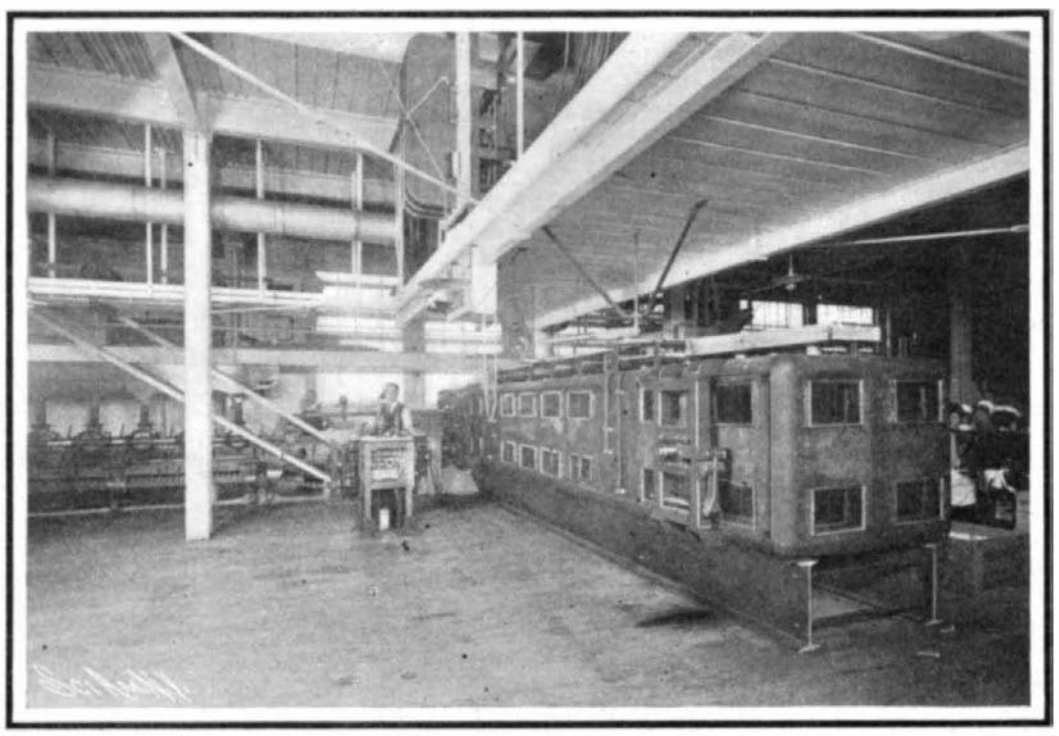
"Triscuit" is prepared on the same general lines, with the principal exception of the difference in the process by which it is baked, the finished product being a shredded wheat wafer instead of a biscuit. The various layers are compacted together by a special machine, the component parts of which somewhat resemble waffle-irons. Each bar is provided with a num-



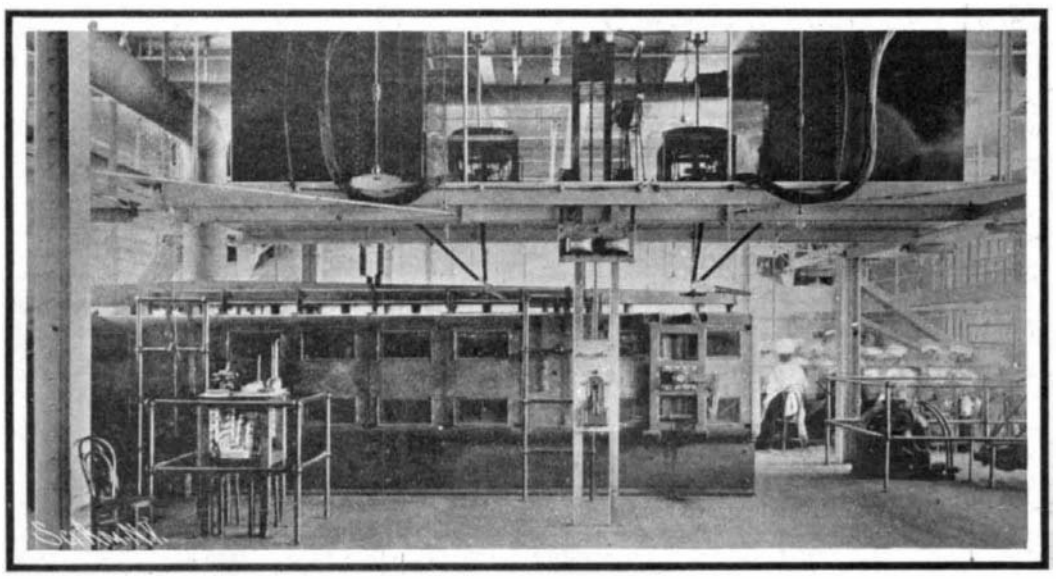
Packing Tables and Endless Carrier.



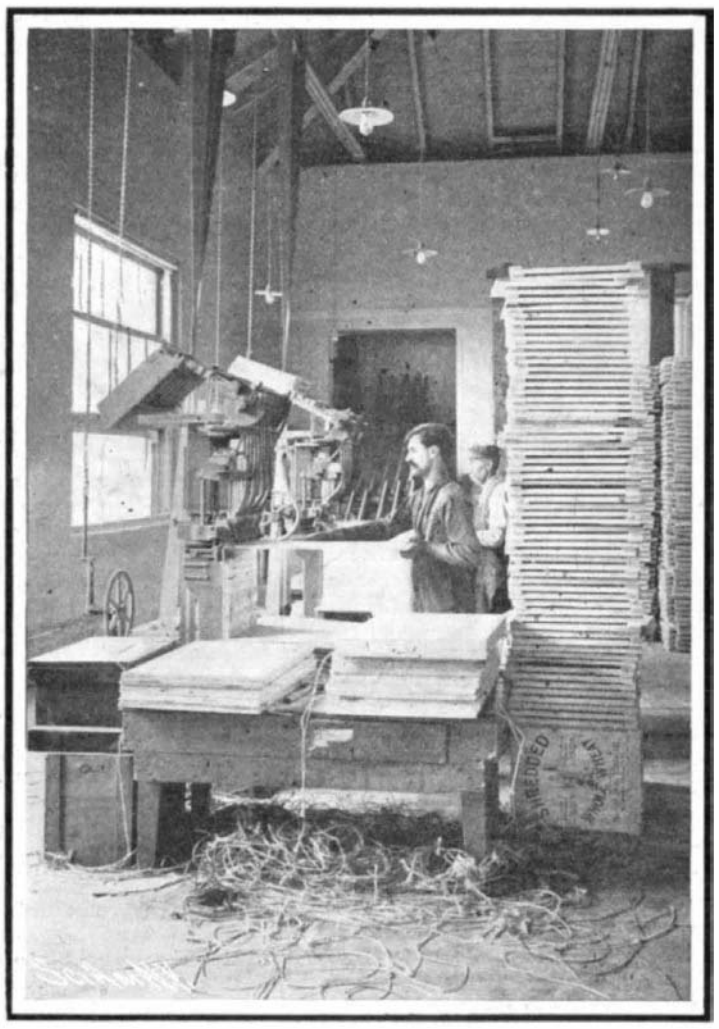
Where the Packages are Automatically Sealed.



End of Shredding Machine and One of the New Electric Ovens.



Electrically-Heated Mold.



Box-Nailing Machine.

THE MANUFACTURE OF CEREAL FOODS BY THE AID OF ELECTRICITY.

ber of sharp points which serve to indent the cracker. Current is provided to each bar, so that during the actual process of formation the cracker is baked. These forming and baking irons are carried upon an endless belt, which finally brings the cracker, or rather the sheet of crackers, to a device which cuts them apart, and, dropping on a belt, they are carried to the packing tables. Some idea of the activity of the shredding machines may be obtained when it is stated that the total number of shreds in one year's output for these two food preparations is 283,046,400,000 feet, or 53,607,272 miles, a length of shreds which would girdle the earth more than 2,144 times.

There are certain establishments where the comfort of the employe is considered without any sacrifice of self-respect on the part of the recipient, as notably in the case of some of our larger telephone companies; but in the plant of the Natural Food Company, to which we refer, even the enjoyment of the employes is carefully looked after. A beautiful lunch room is provided, and a very substantial meal, delicately served, is furnished without cost. There are flowers upon the tables, and an excellent piano is also in the room and is in daily use. The men have a similar lunch provided at a nominal cost. The shower and needle baths would be a credit to any athletic club, and the employes are given ample time to use them each week during their working hours. Various lectures and entertainments are provided, though with it all the whole plant is worked without too much suggestion of paternalism. A large lecture hall is also provided for the meetings of conventions of all kinds; and as Niagara Falls is practically the center of electrical industry, as well as being one of Nature's greatest handiworks, and easy of railway connections, it is in frequent use. Visitors are cordially welcome to this unique plant, which will remain a memorial of its founder, Mr. Henry D. Perky.

Life-Saving Equipment for Steam Vessels and Government Inspection.

BY J. H. MORRISON.

The shocking disaster of the sinking and burning of the large excursion steamboat "General Slocum" in the limits of this city, on the East River near 138th Street, on the morning of June 15 last, when about one thousand lives were lost, has strongly impressed the traveling public with the necessity of having all steam vessels better equipped with improved or more efficient fire-fighting apparatus and life-saving devices.

The accounts of the disaster show that the fire started in the forward part of the boat, near some crockery packed in hay, and within a very short time swept toward the midship, forcing the excursionists to jump overboard.

Aside from the regulations concerning protection from fire on steam vessels, the question of life-saving equipment is most urgent and important.

The first official notice thus far to be obtained of cork life preservers is in a report of a committee on the matter of a cork jacket life preserver in October, 1857, in which they say in part:

"While engaged in the consideration of cork life preservers, your committee would further state, that recent disasters have established their efficiency and reliability. Life preservers of this material, if properly made, and having sufficient buoyancy, fully comply with the requirements of the law, and are as desirable as any kind of life preservers now before the public. This opinion is, however, based upon the supposition that life preservers of this material are made in the form of a jacket, and the cork filling either in blocks or pieces.

"We desire further to state that in our opinion life preservers made in any form, and filled with cork dust or shavings, or the refuse of cork cuttings, are unworthy of confidence." And after passing a resolution to that effect, further said that "local boards are hereafter directed, when new life preservers are required, either in fitting out new steamers, or to supply the place of others which may be condemned, they shall not pass any form of life preservers, the filling of which is of cork dust or shavings, or the refuse of cork cuttings." The same opinion is held by the board in 1863, for the rules contain the same directions to refuse cork shavings, etc., as before mentioned; and in 1873 the rules say, "shall be made of good, sound cork blocks; . . . all not strictly in accordance with this rule shall be condemned by the inspectors." In 1876 there was a change in the rules, adding after "sound cork blocks," "and any other suitable material."

In 1855 they directed that all inflated life preservers, whether of India rubber or gutta percha, should be refused, as experience had shown that they did not satisfy the requirements of a proper life preserver. Tin life preservers a few years later were brought under the same censure, and were not received as in compliance with the law.

We have now before us the line marking the time of the indorsement of "sound cork block life preservers," made originally in 1857 and carried forward to 1876, a period of nineteen years. During all this time, there has not been found thus far on the record any occasion when the life preservers then in use were found wanting in buoyancy when put to the test.

It is perfectly clear how the early Board of Supervising Inspectors viewed the use of cork refuse, or the shavings of that substance, in a life preserver. There is nothing ambiguous in their report on the subject. They place themselves clearly on record. Looking at the rule after the addition of the words "and any other suitable material," it seems to leave a margin of discretion for a steamboat inspector greater than should be placed in his hands, be he either local inspector or assistant local inspector. Looking over the rules and regulations of 1904 of the Steamboat Inspection Service, it is found that under the head of life preservers, there were no less than five different manufacturers of granulated cork life preservers whose product was approved by the Supervising Board in 1885. The first granulated cork life preserver received official indorsement in 1878. When we view the records placed before us on this subject, it should be remembered that the original Board of Supervising Inspectors was largely composed of engineers of national reputation, not politicians. Between the advocates of "good sound cork blocks," and those for "granulated cork," we must await the trial of the "General Slocum" case by the Washington authorities.

Public feeling on this disaster of the "General Slocum" has been aroused to the same point of indignation as it was at the time of the "Henry Clay" disaster in 1852, with this difference, that at the earlier period there was in reality no law for the inspection of steam vessels; but the one that was passed by Congress thirty days later than that calamity had been in course of preparation for two or more years. At the present time we have abundant law on the subject, if of the right kind and faithfully carried out.

There has been considerable discussion since the late disaster on the point of the inspection of life preservers on our passenger steam vessels. There is a matter to be considered, as the law now stands, regarding this duty by the inspectors. The rules and regulations have contained the following provision for thirty years: "And it shall be the duty of the inspectors to see by actual examination that every such life preserver contains at least six pounds of good cork, which shall have a buoyancy of at least four pounds to each pound of cork." This it will be seen is an imperative order to inspect every life preserver; for it says: "It shall be the duty of the inspectors to see by actual examination that every such life preserver." New life preservers could be inspected at the factory where made. But how about those that have been on board of vessels? How are they to be tested, to find if they have lost their value of buoyancy by age? If every one on board of our steam vessels is to be annually inspected (and in the inspection district of New York by the last Annual Report of the Bureau, there are 218 inland steamboats and ferryboats over 100 tons each, and it is fair to assume that 800 life preservers would be an average for each of these vessels, as no official figures could be obtained just at this time) how long would it take an inspector to make an "actual examination" of 800 life preservers for each vessel? And how large a force of inspectors would it require to promptly perform the duty for all the vessels? If this has been a weak point in the service, it should by all means be corrected. To make a selection, as has been proposed, of say one in every twenty taken from different parts of the vessel, as a fair average of the whole equipment, and submit them to a test, and base their passage for inspection on this test, does not seem to comply with the law.

All questions affecting this disaster will be settled by an investigation before the Steamboat Inspection Bureau, and it is before this board that all technical questions will be brought out affecting all those concerned in the disaster, as well as the late inspection of the vessel. Some person or persons are responsible for this disaster, either now, or what led up to it; or the system of inspection may be so much at fault as to require being torn up root and branch. But let us wait for the decision of the responsible body, who will give this matter a thorough investigation, and who will finally locate where the blame lies.

[The coroner's jury in New York rendered a verdict on June 28 that the officers and directors of the Knickerbocker Steamboat Company, who owned the "General Slocum," together with the captain and mate, were responsible for the disaster.—ED.]

Interesting archeological discoveries have been made by MM. De Kerviler and Le Pontois during the excavation of an ancient tumulus on the estate attached to the chateau of Kerusseaux en Oueven, near Lorient. The archeologists found the extremities of two galleries, formed of parallel megaliths six feet high, and two vaults which apparently constituted the necropolis of an ancient tribe, among whom incineration and inhumation were practised concurrently. In addition to a pile of human remains there were found pogniards and knives in silex, axes in fibrolite, and some fine specimens of spherical pottery. M. De Kerviler estimates the date of the tumulus 2,000 years B. C.

Engineering Notes.

During the third quarter of the financial year American shipbuilders completed 177 vessels of 55,066 tons gross, as compared with 187 vessels of 58,588 tons gross in the corresponding period of 1903. Thirteen measuring 35,033 tons were steel steamers—a year ago the proportion was 20 of 41,803 tons—Atlantic and Gulf ports contributing seven of 17,874 tons, as compared with 11 of 15,382 tons, and the Great Lakes four of 16,744 tons, as compared with five of 17,398 tons. The grand total for the nine months is 232,133 tons, as against 230,187 tons in 1902-3.

A Select Committee of the House of Lords are considering a proposal to deepen the Manchester Ship Canal, and to raise the low-water level of the rivers Weaver and Mersey. Mr. Balfour Browne, K. C., in stating the case for the promoters, said that at present the depth of the canal was only 26 feet. In recent years the size of vessels had enormously increased, and a greater depth of water was now absolutely necessary. When the depth of the canal was fixed at 26 feet there were not half a dozen vessels built which could not get up the canal. Now hundreds of vessels were too large to navigate the canal. The deepening proposed would enable vessels of 11,500 tons deadweight to navigate the canal.

Those of our readers who are professionally concerned with the study of lateral earth pressures and related phenomena will find some interesting reading in a paper read before the American Society of Civil Engineers by Mr. E. P. Goodrich. There are many theories relative to the action of granular masses, the lateral pressures, planes of action, and planes of friction, but the results given by the formulæ evolved are somewhat at variance with each other, and with the results shown by such experiments as have already been conducted. The author of the paper to which we refer describes a comprehensive series of experiments which throw some new light on the subject generally, and will probably serve as the nucleus around which practicable working rules may be built.

The Cape to Cairo railroad, the inception of the late Cecil Rhodes, has reached the southern bank of the Zambesi River at the Victoria Falls. The first section of the project is now realized, over 1,600 miles of track having been laid down, stretching from Cape Town to this point. The construction of the single-span bridge which is to carry the track across the Zambesi gorge at a height of 420 feet is now being proceeded with, and the second section of the railroad will then be commenced. This section will run from the north bank of the Broken Hill, in the direction of Lake Tanganyika, a distance of 350 miles. Beyond that point no definite course has been decided, though there are several projected routes under consideration. According to Cecil Rhodes, this transcontinental railroad was to be 5,700 miles in length. While the track has been steadily constructed northward from Cape Town, the Egyptian end has been simultaneously proceeded with, and it is now 1,400 miles south of Khartoum. About another 2,000 miles of track has therefore yet to be laid before through railroad communication is established between Cape Town and Cairo.

Some interesting facts concerning the economy of operating motor-propelled trains upon the subsidiary and feeding sections of a trunk railroad, in comparison with the expense of maintaining and working similar lines by steam locomotives and short trains, have been furnished by the Taff Vale Railroad, of Great Britain. The type of train in operation upon this system has been described in the pages of the SCIENTIFIC AMERICAN, the train comprising a coach with the motor compartment placed at the fore end. The running cost per train mile by motor car equals 4.18 cents, as compared with 10.62 cents by steam locomotive and four carriages of the ordinary British type. The cost of repair and renewals of the motor car is much less than that of the other system, being only 2.92 cents per train mile, as against 12.44 cents for the steam-propelled train. The wages represent 3.86 cents in the former case, and 6.94 cents in the latter instance. Taken on the whole, therefore, it will be observed that the total cost per train mile of the motor car works out at only 10.96 cents, while the cost for the locomotive and carriages is 30 cents per train mile, representing a saving in the case of the former of 19.04 cents, or some 60 per cent cheaper. The economy thereby effected is very appreciable, and represents quite a considerable sum in the course of a year's operation. This result is highly encouraging, and will lead to a more extensive development of the motor-car system of handling short distance traffic. Already several of the other trunk railroads of the country, impressed with the figures obtained by the Taff Vale Railroad, are completing arrangements for the introduction of motor-propelled coaches upon their systems in those sections where the capacity of the traffic does not sufficiently warrant the employment of a locomotive and train, and wherein the working of the latter at present represents a heavy loss.

Patent Office Printing.

One of the most important branches of the work of the United States Patent Office is the printing of a liberal supply of copies of patents and the Patent Office Gazette.

The Norris Peters Company, of Washington, having special facilities for doing this work, have heretofore been awarded the contract almost every year for several years back, and have given universal satisfaction, not only to the Patent Office officials, but to all patent attorneys requiring duplicate photo-lithographic copies of drawings. We are informed this year a change has been made which is likely to create much inconvenience for attorneys.

It appears the usual course of advertising for bids for photo-lithographing and printing Patent Office work was pursued, and when the bids were opened on May 5 last, the Norris Peters Company was the only bidder. For some unexplained reason the bid was rejected by the board appointed to open bids, and new bids were advertised for, to be opened on June 15. On that date three bids were received and opened: One from Andrew B. Graham, one from the Sackett & Wilhelms Company of this city, and one by the Norris Peters Company.

The bid of the Norris Peters Company was the lowest on the first seven items, which embraces all of the work except the Official Gazette, and was about two thousand dollars less than the bid of the Sackett & Wilhelms Company, while on the Official Gazette the Sackett & Wilhelms Company were the lowest bidders. The board declined to divide the contract, but awarded the work to the Sackett & Wilhelms Company of this city as being the lowest bidders in the aggregate. It is believed that the work done by the Sackett & Wilhelms Company will be printed from aluminium, and not from stone, as has been done heretofore. In thus awarding the printing to a New York party, the drawings of the current issues of patents, etc., must be shipped by express to the Sackett & Wilhelms Company here, which is certain to cause great inconvenience to the attorneys practising before the Patent Office, as they will not be able to refer to drawings or to see them after they have passed to issue. Aside from this, there is the possible risk of loss of the original drawings through accidents or fire in transit, and the necessity of the office going to the expense of having every drawing photographed prior to being sent away for reproduction, as a check in the event of loss or possible change.

The printing required by the Patent Office has grown to such immense proportions that it is time a change was made in the methods pursued. There should be established a photographic and printing department in the Patent Office itself, equipped with every facility for rapidly reproducing drawings by the most modern machinery, supervised by a corps of experienced practical men, subject to the direction of the Commissioner of Patents.

It is a most unusual course to entertain bids from printing concerns located at distant points. If this plan is to be favored in the future, a printing establishment located on the California coast would have the same chance to be awarded a bid as one in Baltimore, only a few miles away. The consequent delay and inconvenience to attorneys and inventors is of no apparent importance. In the case of the Patent Office, it is a mistaken policy, which we suppose will be demonstrated as the contract is carried out. Attorneys and others should not be slow in lodging complaints with the Commissioner of Patents when their work is delayed or interfered with by reason of this change.

Newly-Discovered Property of Tin-Aluminium Alloy.

In a paper lately read before the Academie des Sciences, M. Hector Pecheux brings out a rather remarkable property which he observes in tin-aluminium alloys. If a rod of such alloy, having a freshly-filed surface, is placed in cold distilled water at 13 deg. C., an abundant supply of gas is given off from the filed part of the rod. This generally stops after two or three minutes. This phenomenon was observed with four alloys containing different proportions of the two elements. Analysis of the gas shows oxygen and hydrogen in the proportions of an explosive mixture. A rod of one or the other metal alone, or a rod which is not filed at the surface, will not cause the action. The rods he used were cast in a sand mold. Considering that on account of the sudden cooling in the mold the surface of the rod may have become tempered, he concludes that the action is due to this cause; at the surface of the rod the alloy takes the form of juxtaposed molecules of the two metals, and in the cold water these act like a series of thermo-electric elements of tin-aluminium (owing to the heating of the rod by the operation of filing), and the water is decomposed. This is due to the fact that the molecules of tin and aluminium have a considerable difference in specific heat (Al = 0.218 cal. Sn = 0.0562 cal.) and after the filing they have not the same temperature. Therefore they set up an electromotive force due to the thermo-electric action, and this stops when they become cooled by the water. If a filed rod is placed in an acid copper sulphate solution, bubbles of oxygen are given off and copper is deposited on the rod. A non-filed rod of tin or aluminium precipitates the copper, but no gas is given off. Sulphate of zinc produces a similar action, but gives off less oxygen.

Electrical Notes.

The power station which is being erected in London for the supply of the electric current to operate Mr. Yerkes' railroads is rapidly approaching completion. This power station when finished will be one of the largest of its type in the world. It is situated on the bank of the Thames at Chelsea. It is rectangular in shape, measuring 450 feet in length by 180 feet in width. It is erected in three tiers, and will have four chimney stacks, each 275 feet in height, with an internal diameter at the top of 12 feet. Brick has been employed throughout. A large river basin has been constructed, so that barges can come alongside the building, and unload the coal direct into the bunkers, a Temperley and a laced steel conveyor being built for this purpose. Large water filters have also been built, so that the water used in the boilers can be filtered first, thereby removing all impurities and reducing furring in the tubes to the minimum. The building has been divided into two sections. The riverside half contains the battery of sixty-four Babcock & Wilcox water-tube boilers, each of which develops about 1,200 horse-power. The boilers are erected in two tiers, with the coal bunkers above. Mechanical stokers and superheaters have been adopted. In the second part of the building the turbines and generators are installed. The plant will comprise eight turbines working eight generators, the power supplied aggregating 60,000 horse-power. The current will be of the alternating type, and the potential will be 11,000 volts. Nearly 20,000 tons of steel have been used in the construction of the building, and the foundations, which are of concrete and brick, are sunk to a depth of forty feet. Three electric railroads will draw their power from this station—the District, the Baker Street and Waterloo, the Great Northern, Piccadilly and Brompton, and in cases of emergency the Central London and the Metropolitan and District railroads. The total cost of the station will be $12,500,000.

In October, 1886, in a small room on the top floor of an old house in Pittsburg, Pa., three hundred incandescent lamps were lighted continuously for a period of about two weeks by alternating current, transmitted a distance slightly exceeding two miles, over a single-phase circuit comprising two copper wires of No. 4 B. & S. gage. The potential used was 1,000 volts, the frequency about 130 cycles per second, and the lamps were connected in parallel to the secondary circuits of half a dozen transformers. The ratio of transformation was 1,000 to 50. This was the first instance, in America at least, in which alternating current was used in transmitting electric energy beyond laboratory distances for the supply of translating devices connected in multiple arc. In the history of American industrial progress the Lawrenceville test, as it has been called, was an event of no little importance. Prior to the Lawrenceville test, distribution of electric energy to lamps or motors had been accomplished by continuous-current systems operating at potentials of 110 to 220 volts. The commercial significance of the Lawrenceville test is strikingly illustrated—although the impression conveyed by the illustration is a somewhat exaggerated one—by the story of the manager of a gold mine in Colorado, who, in 1896, was able to operate a stamp mill located at a distance of about three miles from his water power by alternating current transmitted to the motor over a circuit consisting of iron telephone wire of ordinary size. This was accomplished by using a high-potential single-phase alternating current. The cost of the telephone wire was about sixty dollars. It is stated that an estimate for a continuous-current plant to do the same work had been submitted by a manufacturer of continuous-current machinery, and that these plans called for the installation of copper circuits costing more than sixty thousand dollars.—L. B. Stillwell, in Cassier's Mag.

The British Admiralty seems to have met with some success in the utilization of liquid fuel upon war vessels. The torpedo-boat destroyer "Spiteful" has been passed into the Portsmouth Fleet Reserve, after satisfactorily undergoing her power trials. This vessel is only fitted for oil fuel, and is the first warship to be so equipped. The one great difficulty that has confronted the experimenters is the excessive smoke emitted by the consumption of oil, but this drawback has now been successfully overcome. No more smoke is emitted than with steam coal. One of the greatest advantages accruing from the use of liquid fuel is the economy in men. The number of stokers required for the vessel is decreased by ten or more. As the method adopted upon the "Spiteful" has proved so completely successful, the furnaces of two battleships are to be converted to burning liquid fuel immediately.

Correspondence.

The Colorado Cañon.

To the Editor of the SCIENTIFIC AMERICAN:

Your article last week on the Colorado Cañon was very interesting; but the Hance trail, while it may be the shortest, is not considered the safest and easiest. My daughters, two young ladies, were there in the summer of 1902, and went down the Bright Angel trail, a good portion of the way with horses, and the rest of the way on their own feet, without any ropes, and entirely without the assistance of the guide, except to show them the way, and scrambled up again, also without assistance, to their horses, and while the way was rough, at no point was it absolutely dangerous if proper caution is exercised. The horses were thoroughly trained, and went the whole distance without any guidance except to follow the guide's horse. My daughters let them take their own way, as instructed to do by the guide. S. S. MYERS.

Philadelphia, June 29, 1904.

Narrow-Gage Railroads.

To the Editor of the SCIENTIFIC AMERICAN:

I have read with interest the articles on narrow-gage railroads in your issues of May 21 and June 11.

I am well acquainted with the D. & R. G. R. R. of Colorado, and its construction was a wonderful achievement at the time it was built, some twenty-five years ago.

In 1899 I, as general manager of the E. P. & N. E. Railway, constructed the branch line known as the Alamogordo & Sacramento Mountain Railway in New Mexico. The distance from Alamogordo to Cloudcroft is 26 miles. The altitude of Alamogordo is 4,300, and of Cloudcroft 9,000 feet. The road is standard gage, 30 deg. curvature and 5.2 per cent gradient at its maximums. This road equals the D. & R. G. R. R. in its maximum of curvature, and exceeds it by 1.2 per cent in gradient, and has been in thoroughly successful operation ever since its completion. J. A. EDDY.

El Paso, Tex., June 21, 1904.

The New Element Europium.

In 1892 De Boisbaudran observed a spectrum in the case of certain solutions containing samarium which was characterized by three rays lying near together λ = 466.2, 462.7, and 459.3. These he supposed to belong to a new element and he designated it by the letters $Z\varepsilon$. In another case he observed with several similar products a fluorescent band which was included between the rays λ = 622 and 611. This element he designated by $Z\xi$. Later on, Demarçay succeeded in isolating a new earth from the oxides of this group and he called the new element *europium*. This latter element has the spectral characteristics of $Z\varepsilon$ and $Z\xi$. The solutions also have a slight absorption spectrum for which he determined the wave-length. The new element exists in a very small quantity as compared with samarium and gadolinum. It lies between these two in the series of rare earths. Demarçay obtained it by eighteen fractional operations.

More recently this work has been taken up by Messrs. Urbani and Lacombe, and they have separated the europium in sufficient quantity to determine the atomic weight. They used 610 grammes of oxides which represented the portion containing europium, coming from the treatment of one ton or more of monazite sands. These oxides contain samarium and gadolinum for the greater part. The europium was separated by a series of fractional operations which required three thousand crystallizations in all. The monazite sands are found to contain about 0.00002 of europium oxide. They also formed the sulphate of europium. After precipitating by alcohol, the neutral sulphate is crystallized from an aqueous solution and this salt has the formula $Eu_2(SO_4)_3.8H_2O$. It forms well-defined crystals of a slightly pinkish hue. It is not altered in the air, but takes the anhydrous form about 375 deg. C. The anhydrous sulphate is calcined at 1,600 deg. C., and becomes transformed into oxide. When thus prepared the oxide has a well-defined rose color, the oxide which is formed at a low tempera by calcining the oxalates is almost white. The atomic weight of europium has been calculated very closely by three different methods and the results are almost identical, fixing the atomic weight at 151.79, within a small percentage.

The Current Supplement.

The current SUPPLEMENT, No. 1488, opens with a very exhaustive and fully illustrated article on the Willamette Meteorite by Henry A. Ward. In an article by William J. S. Lockyer, "A New Epoch in Solar Physics" is described. Herbert G. Wells, whose scientific phantasies have earned for him an international reputation, discusses the discovery of the future. Mr. P. L. Sclater of the Royal Society tells much that is interesting of the Tasmanian wolf. The Zoelly steam turbine is fully described. The article by Messrs. Stromeyer and Baron on "Water Softeners" is continued.