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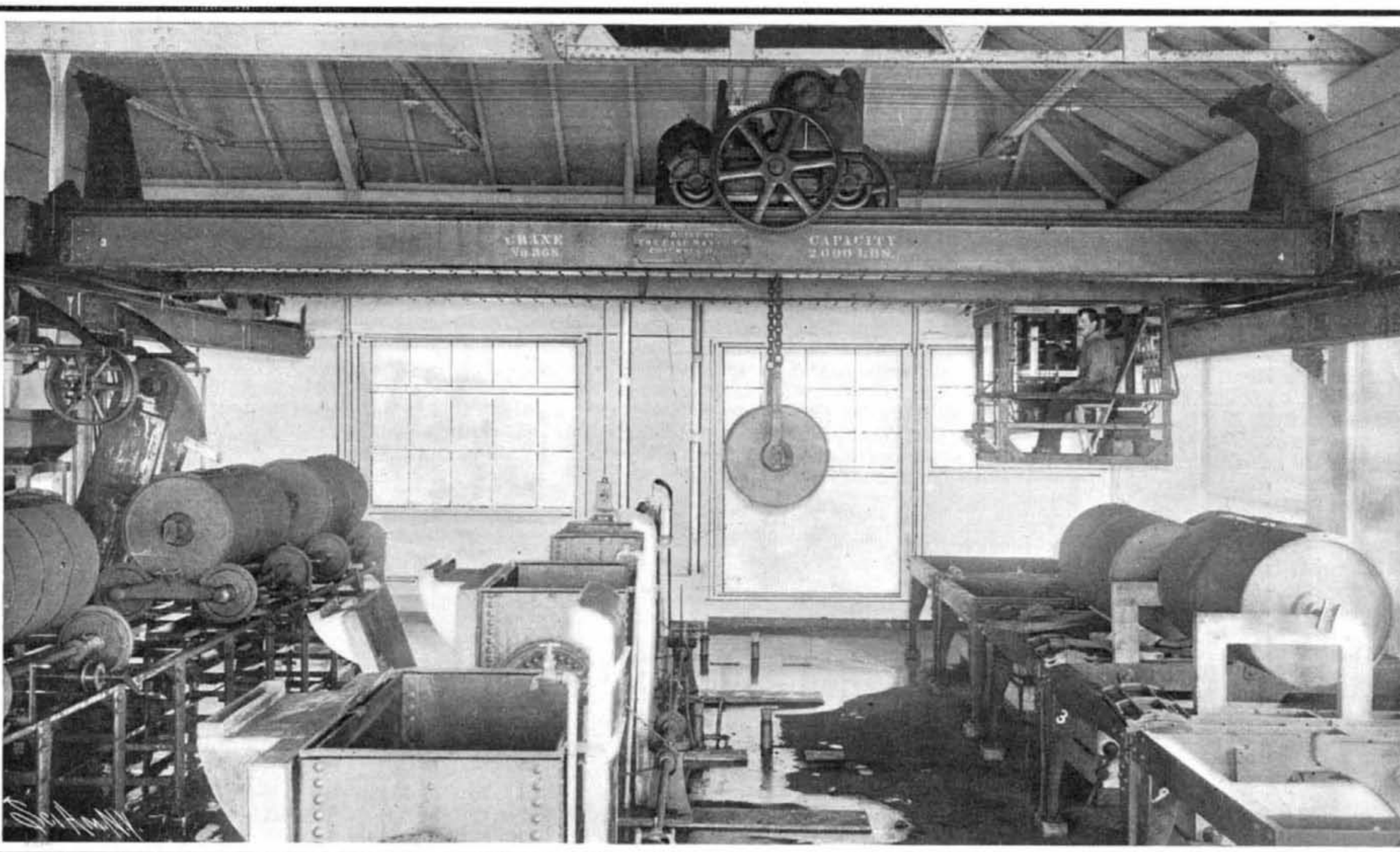
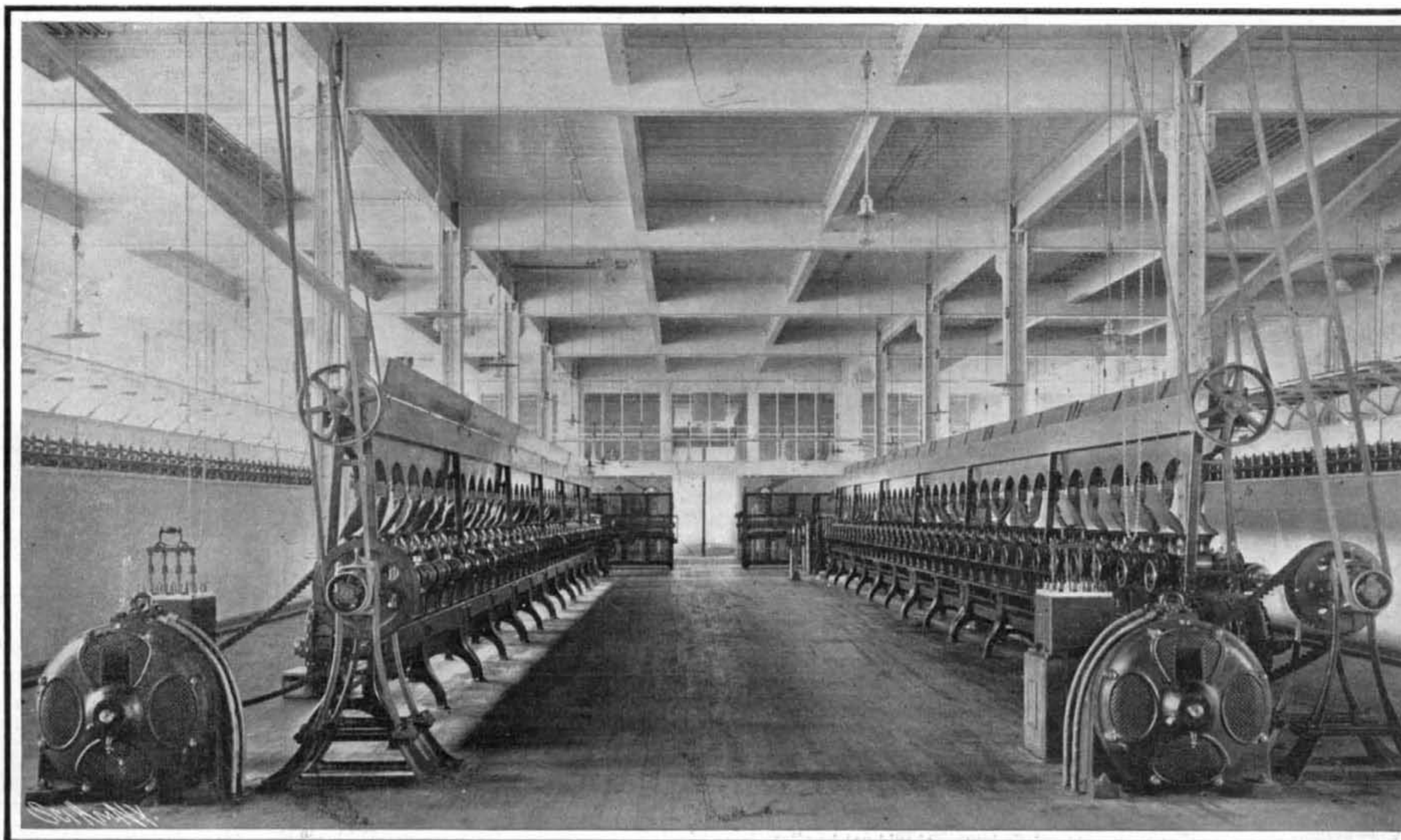


Cooking the Cleaned Grain by Steaming.



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.]

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NEW YORK, SATURDAY, JULY 9, 1904.

The Editor is always glad to receive for examination illustrated articles on subjects of timely interest. If the photographs are *sharp*, the articles *short*, and the facts *authentic*, the contributions will receive special attention. Accepted articles will be paid for at regular space rates.

SANTOS-DUMONT AND THE EXPOSITION AUTHORITIES.

It is a pity that so soon after the opening of the St. Louis Exposition, so disagreeable an incident should have occurred as that attending the act of vandalism which has put M. Santos-Dumont's airship out of commission. The announcement about the airship was quickly followed by the offer of a reward of $1,000 by the St. Louis officials, for the apprehension of the miscreant who committed the deed. This certainly was a step in the right direction, and indicated the purpose and intention of the authorities to protect exhibitors and competitors who have made entries at the Exposition. This was followed, however, by a disagreeable surprise in the extraordinary report rendered by the Chief of Police, accusing Santos-Dumont of himself having committed the outrage. This is certainly adding insult to injury. Santos-Dumont is no mere showman. He is a Brazilian gentleman, who from early youth has been the victim of a passion for aeronautics. He has spent a large private fortune in indulging this taste. He has built, launched, and successfully operated some dozen aerial vessels of various types. His success in the field of aeronautics has been pronounced, and has brought to him much recognition from French and other aeronautical societies. It will be remembered that he was the successful competitor for the Deutsch prize of 100,000 francs, having sailed successfully around the Eiffel Tower and back to the point of departure. Santos-Dumont has been before the public eye in France and this country for many years. To accuse him of committing a crime such as that imputed to him, on the flimsy evidence which up to date has been placed before the public by the Chief of Police at St. Louis, would seem unworthy of serious consideration, were it not that it were placing not only doubt, but stigma, on the name of one to whom those interested in aeronautics are greatly indebted. There is every reason to believe that Santos-Dumont is considered as the most formidable competitor for the great prize of $100,000, offered by the St. Louis Exposition officials. Does it stand to reason that after he had spent many thousands of dollars in constructing the "Santos-Dumont No. 7" for the special purpose of competing for this prize, that he would deliberately commit hari-kiri? The two main accusations brought against Santos-Dumont by the Chief of Police are: First, that he brought the airship to St. Louis for exhibition purposes, and not for purposes of competition; secondly, that he has lost courage, owing to the many accidents during past years in experiments made about Paris, and he was endeavoring to escape the dangers attendant upon the competition. With regard to the first charge, it may be stated that Santos-Dumont is no charlatan, and that it is a well-known fact that he has sunk a large fortune in his aeronautical experiments. At the time that he won the Deutsch prize, it was said that he distributed the large sum of money he received among the poor of Paris.

The reflection upon his courage can not be taken very seriously. His many repeated feats of daring and his long record of successful experiments stand as sufficient refutation of an accusation which seems as unworthy as it is discourteous. The incident will no doubt produce as disagreeable an impression among those who are interested in fair play in France as in this country.

Should any serious delay follow the repairing of the injury to the airship, the authorities, it would seem, should surely afford this visitor at the Fair an opportunity of making good the harm done, and of entering the competition under as favorable conditions as before the disagreeable incident occurred.

MACHINE GRINDING.

Any one who has ever stood by the side of an iron-planing machine or lathe and watched it slowly slugging off, or what is worse, perhaps, if the job is a hurried one, see it tediously skimming the surface for a finishing cut, must have wished that there was either another way of doing the work, or that the machine could be speeded up to get along a little faster, no matter whether he was pecuniarily interested or not. It seems a great waste of time to do so little; other people think so too, and reduce the amount of stock to be removed to its lowest terms, which does not expedite the work in the least. It takes just as long, so far as the speed of the tool is concerned, to remove a sixty-fourth of an inch as it does to remove a quarter of an inch; quicker feed can be used on the finishing cut, certainly, but the loss of time is in the type of tool employed on the work. Matters have been expedited somewhat by the introduction of new tool steels of late, but there are some drawbacks to the use of them upon the equipment of machine shops generally, the old tools not having power enough to take the cuts that the steel will stand; if it is necessary to get a new outfit of machine tools to use a better steel, old shops will be handicapped for some time to come. The milling machine is the alternative of the planing machine on regular work, but it can not compete with the latter for jobs of all sorts that come to machine shops usually, and the cutters lock up a good deal of money. It comes to this, then, that we must subdue our enthusiasm and stick to the standard machines, or take a chance with still another agent, and that is the grinding machine, which has undoubtedly a future before it. Recent improvements in the capacity and range of the grinder render it available for both large and small work in manufacturing and repair work as well, from chilled rolls 12 inches in diameter down to a quarter-inch rod. If proper precautions in the management of the grinder be taken there is no tool that can compare with it in truth of surfaces, and persons who are skeptical as to this fact may quickly satisfy them by turning a shaft in a lathe, smoking it in any way, and then putting the shaft in a grinding machine; the irregularities left by the lathe tool show in a most surprising manner. The first grinding machine was undoubtedly a grindstone, and even that is no mean adjunct now to finishing metals in the hands of skilled workmen. I have seen gun barrels "turned" on grindstones by merely screwing a dog on one end by which to handle them—which would caliper remarkably well as to rotundity and size. Cutlery never sees any other tool than grinding machines of one sort or another. As regards accuracy of surface and dimensions the machine grinder will do splendid work in the hands of those who know how to run it. Rolls for certain purposes have to be as nearly perfect as human hands can make them, and it is wholly within possibility to grind a pair of rolls, superpose them with slips of the thinnest tissue paper between and have the rolls "bite" them everywhere; not one can be withdrawn without breaking it. This comes pretty near absolute accuracy. But grinding machines have peculiarities of action which it is necessary to know before undertaking their use. Abrasion causes heat; if this is even sensible heat, perceptible to the touch, there will be a change of dimension in the work caused by expansion in different parts. On the start the shaft, or whatever the job may be, is cold, but as the emery wheel traverses the heat increases and the shaft gets larger, so that by the time the surface is finished there are various dimensions when the metal is cool again.

A great variety of work can be done on the grinding machines already in market, but for the average small machine shop all over the country the cost of these tools is prohibitive. They are finely fitted up with every appliance for adjustment at certain angles and for plane and parallel work besides; but certain specific classes of work can be done by very simple machines. Take the case of lathe handles, for instance. The whole of the surface on them can be skinned over, so to speak, from the drop-forging by an emery wheel, the machine to which it is attached having formers conveniently fastened to the carriage, so that ordinarily intelligent boys or handy men can run them. Aside from this detail, which is only mentioned as an example, there are quantities of other jobs, particularly in mechanics' and carpenters' tool shops, which can be executed on a simple tool which could be sold at a low price.

Joseph Horner, an English mechanical engineer and tool-maker, has paid much attention to the grinding machine, and gives some points in Engineering which are worth noting. An objection to the method itself has been made by some who urge that the natural wear of an emery wheel would militate against accuracy of dimension, but Mr. Horner says, on this head, that mistaken notions exist as to the amount of wear of wheels. Under certain conditions wheels will show wear during long roughing cuts; this will happen if the work is speeded too high and the wheel is forced too hard. It will also occur if the wheel is too soft, but with proper management these things should not be allowed. A wheel should not show wear even in a long roughing cut and none whatever in a finishing cut. The wear is controllable to such an extent that it should not be noticeable in doing a large number of pieces of the same kind. One surface speed should not be used upon all kinds of work. Neither is one kind of wheel suitable for all classes of jobs at different speeds; this can be done, but it is not wise to undertake to cut iron, steel, and brass on the same wheel, for the time spent in changing wheels is more than made up by the better work done when the whee' is suited to the task in hand. Even on the same material the wheel may need to be hard or soft according to the character of the work to be done, either slow or fast cutting as exigencies may demand, and, in some cases, depending upon whether the machine itself is light or heavy; uniform speeds are not adhered to any more than on lathe work. Specifically the speed of the work should not exceed in revolutions from 10 to 40 feet per minute; 100 feet and over is too fast. The grinding machine is in its unappreciated stage, and has yet to obtain its proper place in machine shops.

It is asserted by a manufacturer of emery wheels that it is possible to remove one cubic inch of steel per minute from cylindrical work with proper wheels, and this is by no means the limit of capacity. The Brown & Sharpe Company illustrate the difference between turning in a lathe and grinding with an emery wheel by the fact that in the latter there are, approximately, 2,500,000 cutting points on a wheel 18 inches diameter by ¾ inch face which pass over from 1 to 4 square feet of surface per minute, while a lathe has but one cutting tool at less speed superficially in a given time.

The practice at present is to rough-turn shafts before grinding them, the allowance for the latter operation being a full sixty-fourth of one inch; sometimes a finishing cut is taken in the lathe, but this is a waste of time and does not give so good results, because the temperature is less likely to rise on a rough surface than upon a smooth one. Rough-turning work for a grinding machine should be done with coarse feed, the coarser the better, within reason, for under these conditions the grinder does its best work. The important point is to rough-turn liberally, and grind lightly, never the reverse of these processes.

THE PROGRESS OF MOSQUITO EXTERMINATION.

It having been demonstrated by many physicians and scientific men that certain species of mosquitoes facilitate the transmission of malaria and fevers from affected communities to those not affected, it follows that the only remedy is to prevent the production of the pest. The method most effective is the drainage of swamps or meadows to avoid standing pools of water; the results obtained in this way have been highly encouraging. Many desirable towns, presenting most attractive locations for residences, have acquired such reputation for having malaria and mosquitos that their development has been greatly retarded. It is to show how easily and with what small comparative expense these depressing conditions can be reversed and improved, that the National Mosquito Extermination Society was organized in this city last winter. The report of the society has recently been published, and contains many useful suggestions as to the best methods to be pursued to prevent the breeding of the mosquito. The society is desirous of enlisting in its membership all persons interested in promoting the general subject, and wishes to secure information from all parts of the country, later to be published in its annual report. As previously remarked, one of the most extensive plans for ridding a locality of mosquitoes is by a thorough drainage of meadows or swamps.

This is now recommended for the great meadows lying east of the city of Newark, N. J., covering a tract about eighteen miles long by four miles wide, or about 27,000 acres. The New Jersey State Geologist and two of his scientific associates have made a report urging the draining and filling of the Newark meadows as the only means of ridding the regions of the mosquito pest.

The report states that the agricultural value of the lands to be redeemed and cultivated would ultimately repay the cost. But the good effect on the surrounding cities and suburban towns in preventing the spread of malaria, thereby promoting the public health, is a greater reason why public aid should be demanded in co-operation with private enterprise or subscription for the prosecution of the work.

Work will have to be begun, no doubt, as that on Long Island was, at the expense of public-spirited citizens who are willing to risk money to prove in a practical way the extermination of the mosquito. It requires co-operation from so many sources that all that private citizens can do by organization and all that the cities can be induced to do in the way of appropriation will need to be combined in order to work on a territory large enough to make the demonstration convincing. It will be an excellent plan for village or town improvement associations in mosquito localities to discuss in public meetings the necessity of eliminating the mosquito pest, urging co-operation with adjoining localities, and show by maps and plans what can be done to secure permanent and lasting improvement. Ultimately, city and State aid can be secured to assist the work, much on the same plan as State aid is now given in road building.

That the importance of the mosquito is truly understood as regards its relation to the public health in the Panama Canal territory is shown by the appointment of Dr. William C. Gorgas, Assistant Surgeon-General, U. S. A., who has instructions to provide drainage for swamps and all mosquito-breeding places in that district. He is now in Panama for that purpose.

The board of health of the village of Lyons, N. Y., has recently adopted a new rule, requiring that all open barrels, casks, or cisterns containing water shall be covered with mosquito netting, to prevent the escape of any mosquitoes breeding on the surface.

Under the right conditions it is astonishing what a large quantity of mosquitoes will develop and breed from a small amount of water.

There are localities under our own observation which have been free from mosquitoes for six years past, which for many years were unbearable to live in in hot weather, all due to the elimination of stagnant pools by simple drainage.

The extermination of the mosquito is a question of growing importance, and we hope will receive general attention among the various States and Territories of this country. The remarkable progress made in Havana, Cuba, in this direction in the prevention of yellow fever by protection from mosquitoes is a notable example of improvement resulting from hygienic scientific investigation.

A VEGETABLE BUTTER.

Our delicious table butter made supposedly from the cream obtained from cow's or goat's milk, besides having a dangerous competitor in oleomargarine, is menaced anew by a substitute no less formidable in character; this is an exotic product—the butter, in fact, extracted from the meat of the cocoanut. This must not be confounded with cacao butter, which, though sounding very similar to cocoa butter, is nevertheless prepared from an entirely different nut and used for quite other purposes.

The cocoanut tree, that most providential growth of the tropics, produces, without cultivation, a nut with which we are all familiar. Contained within its hair-covered and ovoid shell is a most delicious milk, a cooling draft which quenches the thirst of the way-worn and jaded traveler and refreshes the tired laborer. Science has made the important discovery, too, that its meat, of which there is always a generous supply, when dried and pressed furnishes a whitish substance which solidifies at 20 deg. C., but above this temperature runs into a yellow and translucid oil. The annual importations of cocoa-oils coming from India and Africa are considerable. The better grades are drawn from Cochin China, the island of Ceylon, from Australia, and from Karri-Kall, well down near the end of the Kara peninsula. These various commercial grades are obtained by pressing—first cold, then warm—the pulp extracted from the nut which has been previously divested of its shell.

This nut produces 60 per cent of oil, and the cocoanuts collected upon a hectare of land (a fraction over 2 acres) planted to these trees will yield an annual production of 800 kilogrammes of oil which readily oxidizes or becomes rancid, recalling, by its taste, the fruit from which it is derived. Till now this oil has had no other industrial use than furnishing the fats for soap or oil for the lubrication of machinery, the better sorts being employed in the preparation of textiles.

Under the name of "copra" the meat of this cocoanut comes to our shores and is here employed in the manufacture of this industrial oil, the residuum, in the form of a press cake, being fed to cattle to fatten them. According to a French publication, it is in France that this cocoanut oil is subjected to special treatment, from which it emerges to become the formidable rival above indicated of our cherished butter made from cow's milk.

A German chemist of prominence, Dr. Heuner, proposes to buy up all the cocoanut oils and to transform them into a succulent, savory, inodorous product which is soluble in ether and possesses no acid reaction; to this product he announces his intention of giving the name "vegetable butter."

Of all the vegetable oils, that extracted from the cocoanut is the one of which the composition approaches more nearly to the butter made from milk.

Like true butter, it contains 7 per cent of soluble acids, which are not found in such considerable proportion in any other fat. These are butyric acid, capric or decylic acid, which give to our table butter its pleasant aroma and a very pronounced taste of the hazelnut.

Moreover, cocoa butter contains from 25 to 30 times less water than true butter. It will keep 15 or 20 days without showing any acid reaction, and from this fact seems to offer a real superiority over animal butter for use in the preparations of dry pastry, biscuits, and such like.

The process advocated by Dr. Heuner for the treatment of cocoanut oils and from them thereby to obtain a butter in every way adapted for food is that which Dr. Schlink has already put into practice. It consists simply in relieving these oils of their fatty, volatile, and odorous acids, as well as of their other aromatic principles, by means of alcohol and bone-black. After this treatment the product obtained has the appearance of a whitish mass of the consistency of ordinary butter, possessing a sweet savor; it melts at 25 deg. C. and shows the following component parts:

Fatty matter	99.632 per cent
Mineral matter	0.011 per cent
Water	0.357 per cent

The price of cocoa butter, we are informed, is about 1 franc 60 centimes a kilogramme, something over two pounds, and is much lower than that of butter made from cream; moreover, since it contains little or no water, less of it would be required by weight, and, because of its slowness of oxidizing, confectioners and bakers would find it to their advantage to use it for cakes, pies, and other things in their lines, because they would not get stale and unmarketable so quickly.

From the standpoint of hygiene it may be well to remember that butter made from milk occupies the first rank among substances which are most favorable to the culture of microbes and of the worst ferments, while cocoa butter, on the contrary, seems to be an antiseptic medium very improperly qualified for the dissemination and propagation of bacteria. In this respect, comparative experiments made upon both of these substances have given results which do not admit of doubt as to which is the better antiseptic.

Finally, experiments upon the artificial digestion of this form of butter, carried out in the Central Hospital of Vienna, have given equally gratifying results and been confirmed later by other experiments in the different hospitals of Switzerland.

While it has not yet been satisfactorily demonstrated that cocoanut oil can furnish a butter capable of supplanting the delicious products of the dairies of Isigny and Brittany, it is, however, significant that the various boards of health have not raised their veto against the human consumption of this new product; which, let us hope, will not lend itself, like oleomargarine, to the fraudulent adulterations which defy the keen understanding of the chemist.—Translated from Science, Arts, Nature.

HISTORIC FOREST FIRES.

When all the conditions are favorable, forest fires sometimes reach gigantic proportions. A few such fires have attained historic importance. One of these is the Miramichi fire of 1825. It began its greatest destruction about 1 o'clock in the afternoon of October 7 at a place about 60 miles above the town of Newcastle, on the Miramichi River in New Brunswick. Before 10 o'clock at night it was 20 miles below Newcastle. In nine hours it had destroyed a belt of forest 80 miles long and 25 miles wide. Over more than two and a half million acres almost every living thing was killed. Even the fish were afterward found dead in heaps along the river banks. Five hundred and ninety buildings were burned, and a number of towns, including Newcastle, Chatham, and Douglastown, were destroyed. One hundred and sixty persons perished, and nearly a thousand head of stock. The loss from the Miramichi fire is estimated at $300,000, not including the value of the timber.

In the majority of such forest fires as this the destruction of the timber is a more serious loss by far than that of the cattle and buildings, for it carries with it the impoverishment of a whole region for tens or even hundreds of years afterward. The loss of the stumpage value of the timber at the time of the fire is but a small part of the damage to the neighborhood. The wages that would have been earned in lumbering, added to the value of the produce that would have been purchased to supply the lumber camps and the taxes that would have been devoted to roads and other public improvements, furnish a much truer measure of how much, sooner or later, it costs a region when its forests are destroyed by fire.

The Peshtigo fire of October, 1871, was still more severe than the Miramichi. It covered an area of over 2,000 square miles in Wisconsin, and involved a loss in timber and other property of many millions of dollars. Between 1,200 and 1,500 persons perished, including nearly half the population of Peshtigo, at that time a town of 2,000 inhabitants. Other fires of about the same time were most destructive in Michigan. A strip about 40 miles wide and 180 miles long, extending across the central part of the State from Lake Michigan to Lake Huron, was devastated. The estimated loss in timber was about 4,000,000,000 feet board measure, and in money over $10,000,000. Several hundred persons perished.

In the early part of September, 1881, great fires covered more than 1,800 square miles in various parts of Michigan. The estimated loss in property, in addition to many hundred thousand acres of valuable timber, was more than $2,300,000. Over 5,000 persons were made destitute, and the number of lives lost is variously estimated at from 150 to 500.

The most destructive fire of more recent years was that which started near Hinckley, Minn., September 1, 1894. While the area burned over was less than in some other great fires, the loss of life and property was very heavy. Hinckley and six other towns were destroyed, about 500 lives were lost, more than 2,000 persons were left destitute, and the estimated loss in property of various kinds was $25,000,000. Except for the heroic conduct of locomotive engineers and other railroad men, the loss of life would have been far greater.

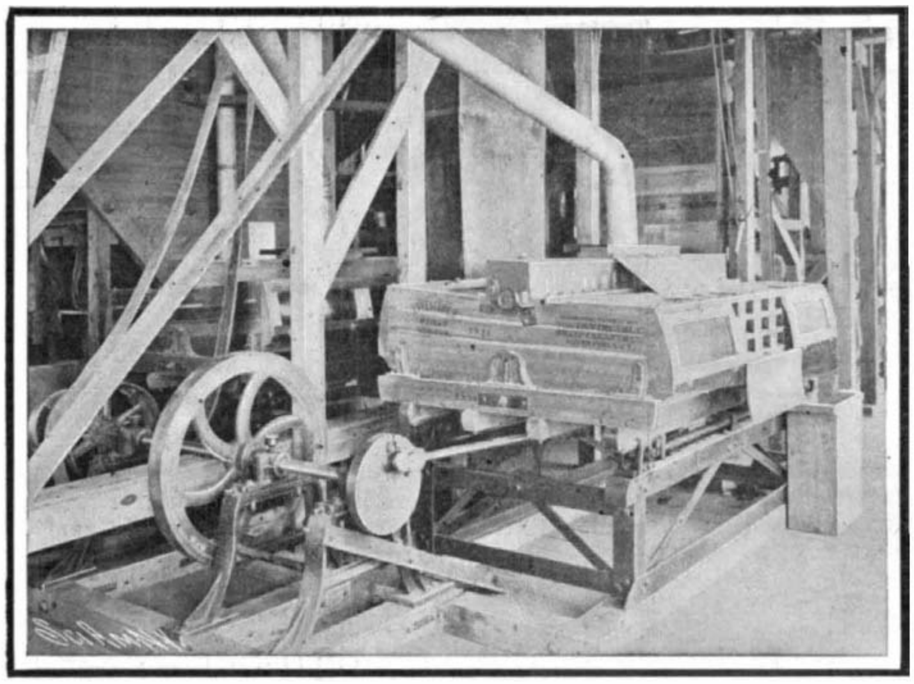
This fire was all the more deplorable because it was wholly unnecessary. For many days before the high wind came and drove it into uncontrollable fury, it was burning slowly close to the town of Hinckley and could have been put out.—Gifford Pinchot in Farmers' Bulletin.

SCIENCE NOTES.

It is not a pleasant thought that the brilliant white note paper which your hand rests upon may have in it the fibers from the filthy garment of some Egyptian fellah after it has passed through all the stages of decay until it is saved by a ragpicker from the gutter of an Egyptian town; and yet it is fact that hundreds of tons of Egyptian rags are exported every year into America to supply our paper mills. At Mannheim on the Rhine the American importers have their ragpicking houses where the rags are collected from all over Europe, the disease-infected Levant not excepted, and where women and children, too poor to earn a better living, work day after day, with wet sponges tied over their mouths, sorting these filthy scraps for shipment to New York. Our best papers are made of these rags and our common ones of wood pulp, which is obtained by grinding and macerating huge blocks from some of our soft-wooded forest trees.—David G. Fairchild in the National Geographic Magazine.

Major James Harrison has just returned to England after a prolonged journey through the dense forests of Central Africa, during the course of which he saw the okapi in its natural habitat. Major Harrison penetrated the Stanley Forest to the region peopled by the pygmies, in search of this animal. His efforts in this country were, however, not successful, so he directed his way to Jabir, and thence into the great forest of De Melley. This forest is particularly dense, the trees being thickly interwoven with dense creepers and tangled undergrowth; in fact, it could only be penetrated by crawling on the hands and knees, a most difficult and arduous operation. On the sixth day after he had entered this forest, his party encountered the spoor of the okapi. This was followed for several hours, when suddenly the party came upon the animal some fifteen feet in front of them. The animal was startled by their approach, and before the major could obtain his rifle from one of the natives accompanying him, the animal had darted into the thick undergrowth. The view that the hunter obtained, however, was sufficiently long to enable him to observe its general characteristics. The animal stood between ten and eleven feet in height, was of a general tawny color about its body, and was striped over the loins. The truth of Major Harrison's story is vouched for by the natives and pygmies who accompanied him on the expedition, and they say he is the first white man who has seen the animal in its native wilds.

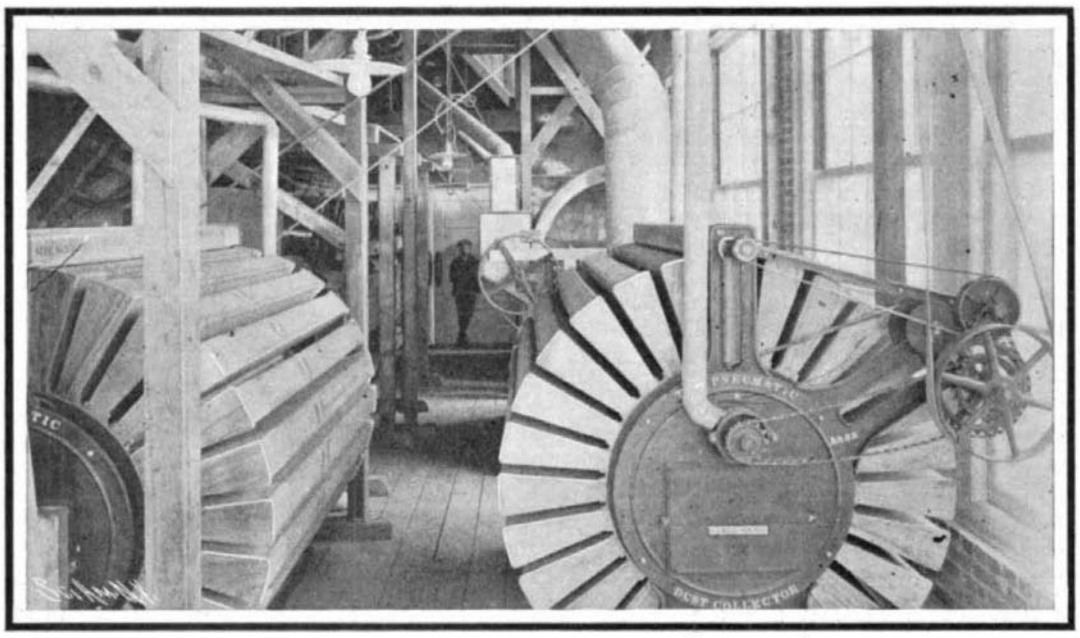
An expedition is being organized in Great Britain for the exploration of those regions of British Northern Nigeria Protectorate situate nearest the western shore of Lake Chad. The object of the expedition is to survey and investigate thoroughly, and to gather some zoological knowledge indigenous to the country traversed. Some three months will be spent at a place called Tonga on the Gongola River, one of the northern tributaries of the Benue, which is conveniently situated for exploring the provinces of Southern Bornu and Bauchi. The expedition is equipped with two steel flat-bottomed shallow-draft boats. These have been built in sections for easy transit to Africa, and will there be reassembled. They have been provided to facilitate navigation of the shallower rivers, and will prove of great assistance in both the survey work and the collection of zoological specimens. After completing all the work that can be accomplished from the Tonga base, the expedition will move northward into the basin of the Koma-Lugu River, where a considerable area of little-known country will be mapped and explored. Proceeding down the river to Lake Chad, Kuka will be reached. Thence it is hoped that the party will be able to proceed to the German and French spheres of influence on the southern shores of the lake, and the return journey will probably be made by way of Shari and Logone Rivers, past Lake Triburi, to the Kebbi, which is a tributary of the Benue.



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

THE PREPARATION OF CEREAL FOODS.

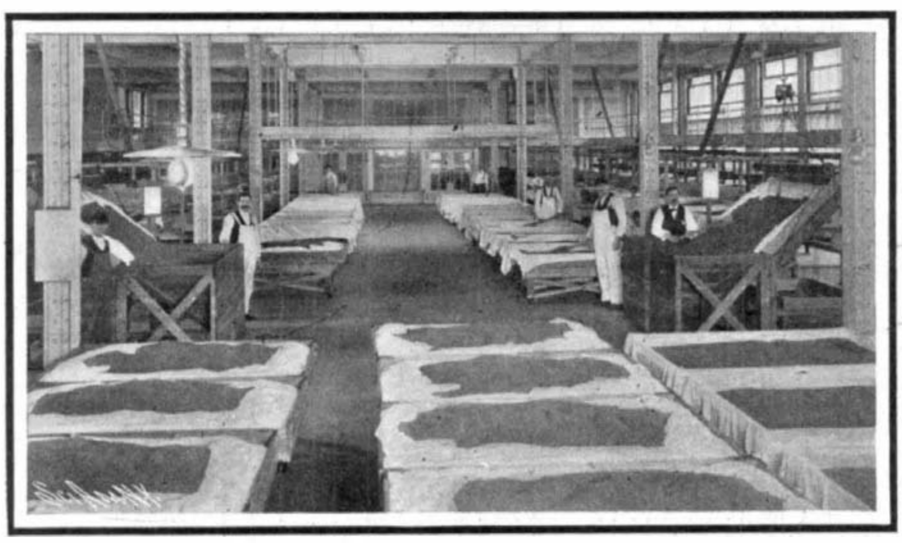
By a cereal food we are to understand a preparation of grain by which its natural properties may be conserved or enhanced by proper treatment to render it more adapted for human needs. The original cereal food was oatmeal, which has been used for centuries by the Scotch, and Sir John Froissart describes 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.



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

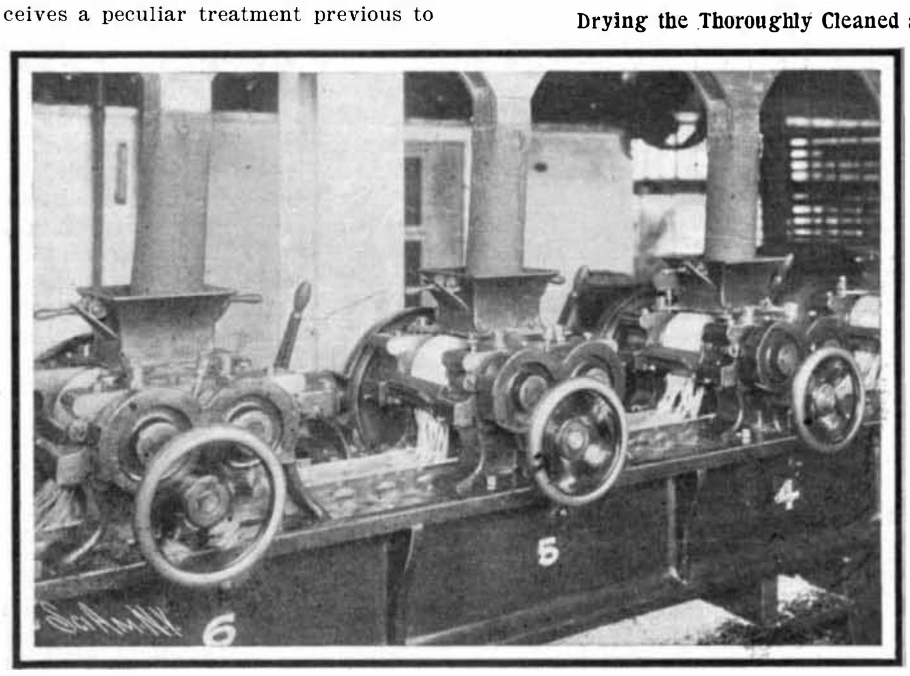
There is located at Niagara Falls, N. Y., a most interesting plant operated entirely by electricity, and, in fact, a large part of the product is baked by electricity generated by water from the adjacent Niagara River. The plant of the Natural Food Company is termed a "conservatory," and the name is 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.

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.



Drying the Thoroughly Cleaned and Cooked Grain Before Shredding.

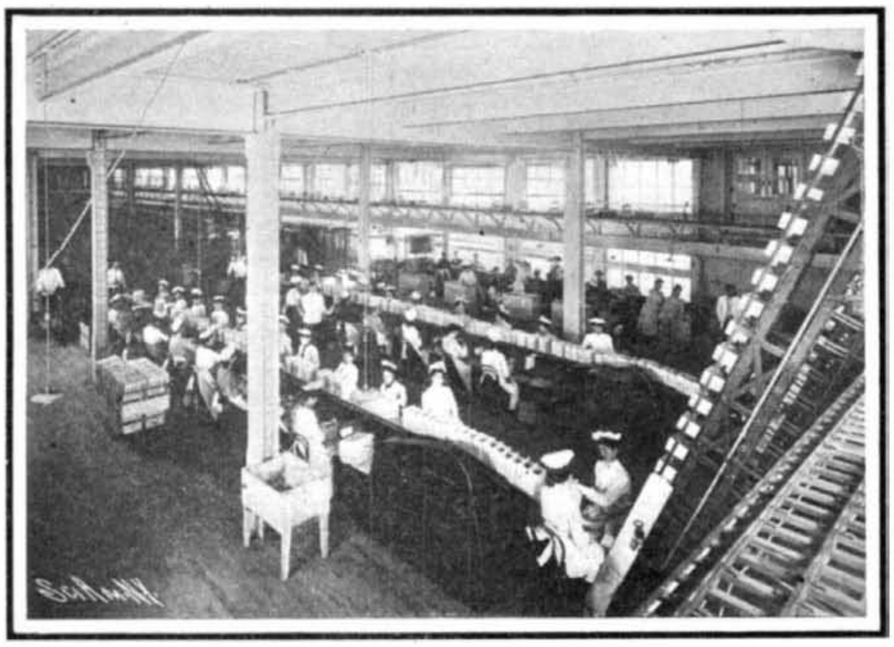
The grain, when it reaches the building, is elevated to the top story and is automatically weighed. It then descends from story to story until as a food it leaves the lower one packed in cartons in boxes. All grain is more or less dirty; there is dust, little bits of binder wire, the "beard" of the kernel, 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



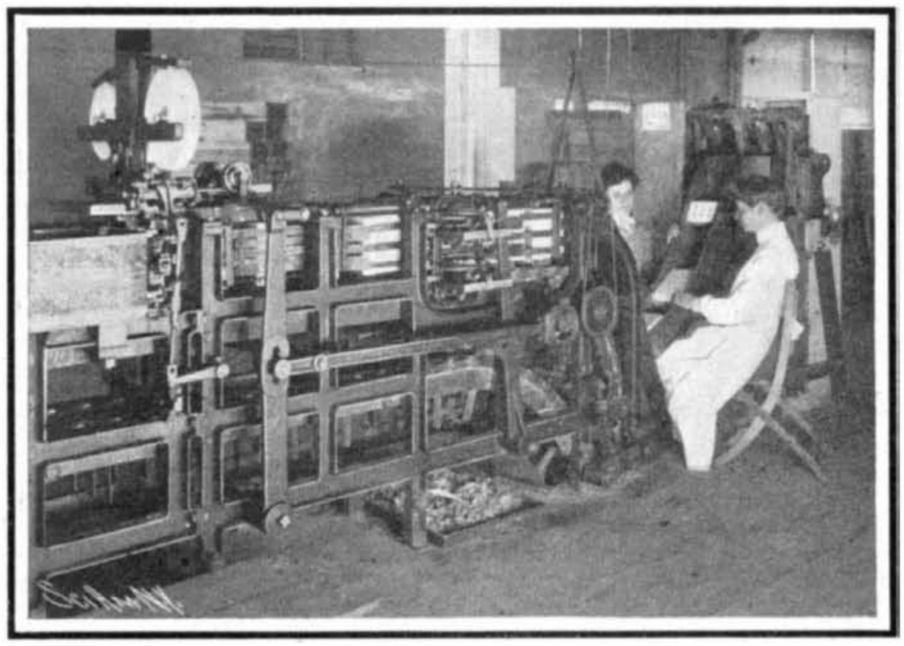
A Battery of Shredding Rolls.

Ovens, Transfer Racks and Ends of Evaporators.

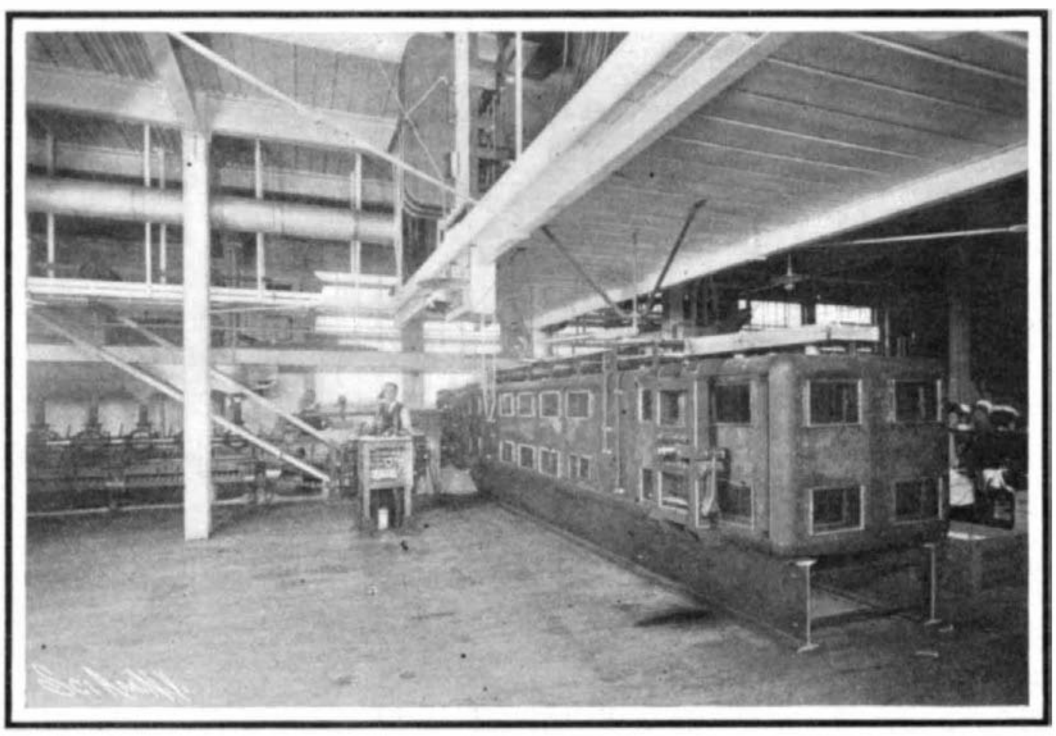
THE MANUFACTURE OF CEREAL FOODS WITH THE AID OF ELECTRICITY.



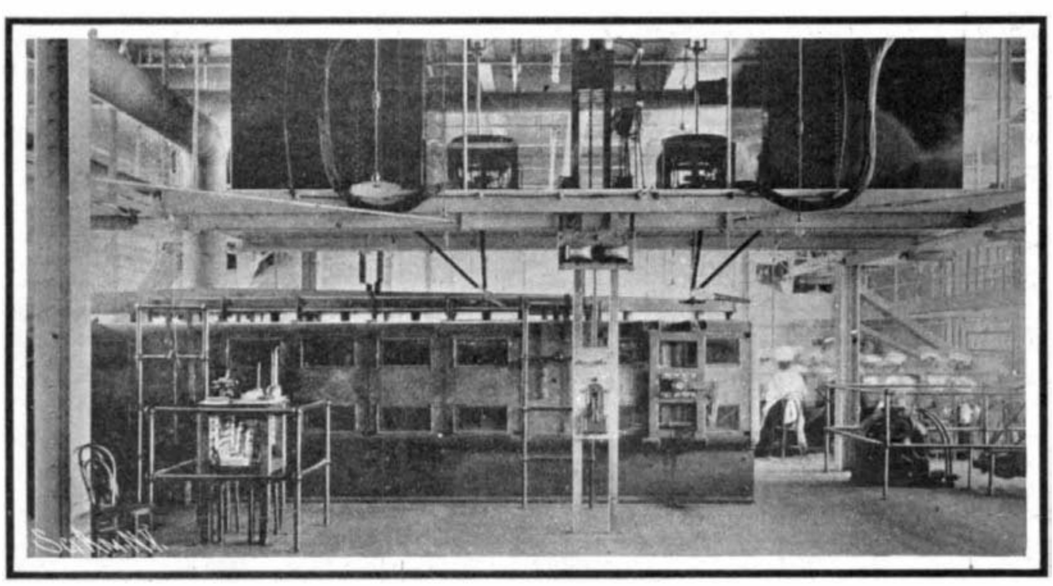
Packing Tables and Endless Carrier.



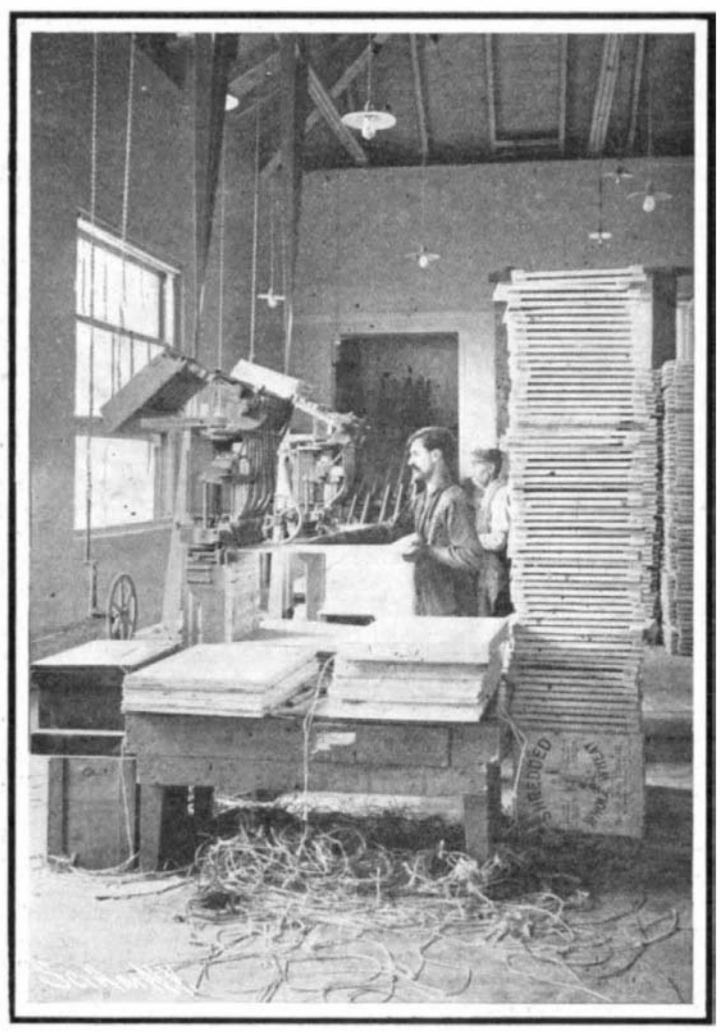
Where the Packages are Automatically Sealed.



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.

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 number 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 $\lambda = 466.2$, 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 $\lambda = 622$ 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.

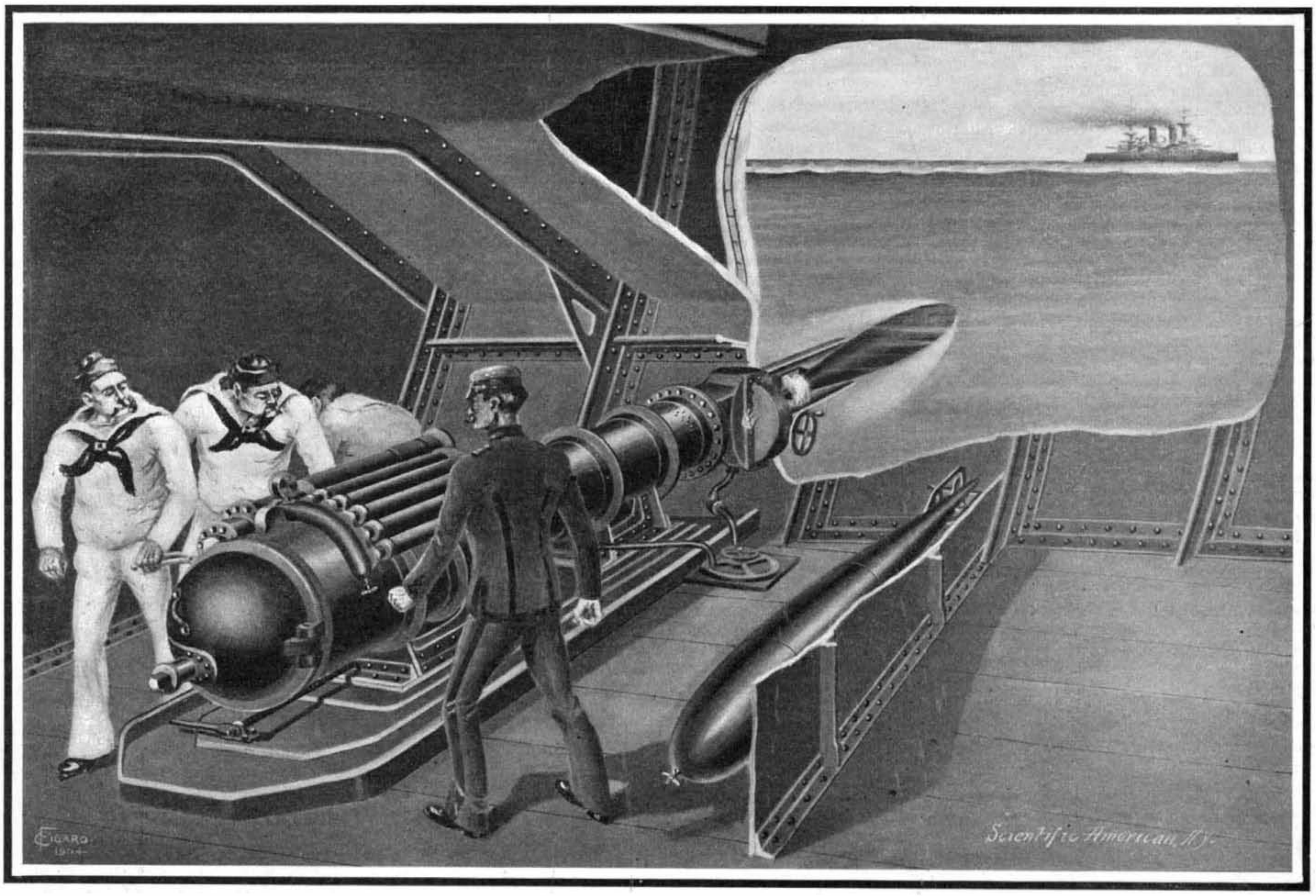
The Current Supplement.

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.

THE SUBMARINE TORPEDO TUBE.

Although there was quite an animated discussion recently in the Board of Construction of the United States navy as to the value of the submerged torpedo tube, in which some eminent naval authorities were strongly opposed to its use in our new battleships and cruisers, the consensus of opinion of the members of the Board was in favor of the tube; and orders were given to install it on many ships now under construction, which were not originally intended to carry the submerged tube. We think that the decision was a wise one, particularly in view of the fact that the other great naval powers are, without a single exception, building such tubes on their later ships. One point urged against the submerged tubes is that their equipment, and the provision of submerged torpedo rooms in which they can be installed and operated, make a serious inroad upon the available space below the protective deck. There is no denying that, as our drawing shows, the torpedo room does monopolize considerable space, extending, as in the present instance, entirely across the width of the ship. On the other hand, the moral and military value of the submerged tube is so great as to quite outweigh any such considered by the torpedo. The center line of the tubes is arranged at right angles to the longitudinal axis of the ship. The tubes themselves are to all intents and purposes smooth-bore guns, of which the torpedoes are the projectiles. They are bolted securely to the floor, and their muzzles are bolted to a massive ring riveted into the plating and framing of the ship's side. The muzzles of the tubes, or the points where they open on the surrounding water, are closed by gates operated by hand-wheels, as shown in our drawing, the gate being normally closed, to prevent the entrance of water within the tube. When the tube is in action, a Whitehead torpedo, with its war-head, containing over 200 pounds of gun-cotton, is picked up from the rack by means of chain slings, suspended from overhead trolleys attached to the deck above, and is brought around on this trolley to the breech of the tube. The breech is provided with a breech-mechanism, consisting of an inner and an outer hinged cover. These are swung open, and the torpedo is thrust home into place and the breech mechanism is locked. The nest of tubes, which will be noticed lying along the breech of the gun tube, are compressed air reservoirs, one end of the nest connecting with the interior of the tube at the is clear of the ship and fully immersed in the water.

The torpedo tube is operated in the torpedo room by three men and an officer. In most cases, the torpedo will be fired from the deck above; for it is manifest that the officer in the torpedo room cannot possibly sight the gun himself. In firing by this method, sights will be arranged on the upper deck in the same vertical plane as the axis of the torpedo, and parallel with the same. Since the torpedo tube is built rigidly into the structure of the ship, it is evident that the tube must be traversed by steering the ship itself, until the tube is brought to bear in the desired direction. When the ship's course has been altered sufficiently to bring the enemy's ship in line, the proper corrections for respective speeds of the ship, etc., having been made, the officer on deck having received word by telephone from the torpedo room that the torpedo is loaded and ready for firing, closes an electrical circuit, and the torpedo is fired. The torpedo is provided with automatic means for preserving it at the desired depth of about 10 feet, at which it is designed to travel; and for steering the little submarine, there is arranged within the torpedo a 3-inch gyroscope wheel, which is attached to a steering engine that acts directly upon



The tube opens through the side of the ship at a depth of about 10 feet below the surface. The torpedo room is situated immediately below the protective deck, the sloping side of which, and the waterline belt armor beyond, are shown broken away.

SUBMERGED TORPEDO ROOM OF A MODERN BATTLESHIP.

siderations of economy and space. Its moral effect will be to keep the enemy at a distance, even when the ship itself may have been so damaged by the enemy's fire as to tempt the enemy to run in and sink it by heavy gun fire at close range or by using the ram, while the ship itself, during the varied maneuvers and favorable opportunitie sea fight, may find itself in a position where it c e its submerged tube with a good probability of hitting the enemy.

The torpedo tube shown in our engraving is of the type that is used on the battleship "Maine." The torpedo room is located in the forward part of the ship, below the protective deck, and its floor is therefore about 10 or 12 feet below the water-line. It is entirely shut off from the rest of the ship by two transverse watertight bulkheads. Two torpedo discharge tubes are mounted within the compartment, the one firing through the port side, and the other, as shown in our engraving, to starboard. The two tubes are not arranged centrally within the compartment, but are staggered, one being near the aft bulkhead, and the other near the forward bulkhead. Carried in racks attached to the aft bulkhead are a half dozen Whitehead torpedoes, three for each tube. In the drawing this bulkhead is broken away to show a torpedo in place; the rack that holds it is not visible, being covbreech, and at the other end with a small firing-chamber containing a charge of gun-powder. The torpedo is discharged as a projectile by firing this charge of powder, and the object of the nest of tubes is to provide a pneumatic cushion between the powder gases and the base or rear half of the torpedo, the purpose being to insure that the acceleration of the torpedo shall be gradual, and that it shall not receive any heavy shock from the explosion of the powder, the powder gases acting to compress the air in the tubes, and the air being driven from the tubes against the torpedo.

Before the torpedo is fired, however, the gate or valve at the muzzle of the tube is, of course, opened, and at the instant of firing, a half-round shield or mouthpiece is automatically carried into the water on the forward side of the axis of the torpedo tube. This serves to stop the rush of water past the mouth of the tube, and enables the torpedo as it is fired to get clear of the side of the ship's hull before it strikes the water. As the torpedo passes out of the tube, a latch on the former is released by engaging a suitable projection on the tube, and this latch opens a connection between the compressed-air chamber and the engines of the torpedo, thereby insuring that the engines are running and ready to assist the flight of the torpedo, by the time it the rudders. By setting the gyroscope on the exact course required, this wonderful little device takes charge of the steering, and will bring the torpedo, even should it be momentarily deflected, back to the true course, and keep it there as long as the torpedo is running.

A Huge Cableway.

A huge cableway, which when completed will be the longest in the world, is to be constructed on the Argentine side of the Andes Mountains by the engineering firm of Adolf Bleichert & Co., of Leipsic (Germany). This cableway is to extend from the Chilecito station of the Argentine Northern Railroad for a total distance of 32 miles. Its termination at this end will be 14,933 feet above sea level, and the engine station that will be erected at this point of the cableway will be the highest in the world. No less than 87 miles of rope will be required for the cableway. The project will necessitate many remarkable engineering difficulties being surmounted, since at one or two points the cableway will have to span gorges 2,800 feet wide by 650 feet deep. The cableway is to have a carrying capacity of 44 tons of ore per hour, and cars each containing 1,100 pounds of ore are to be dispatched at intervals of 45 seconds.

THE GORDON BENNETT CUP RACE.

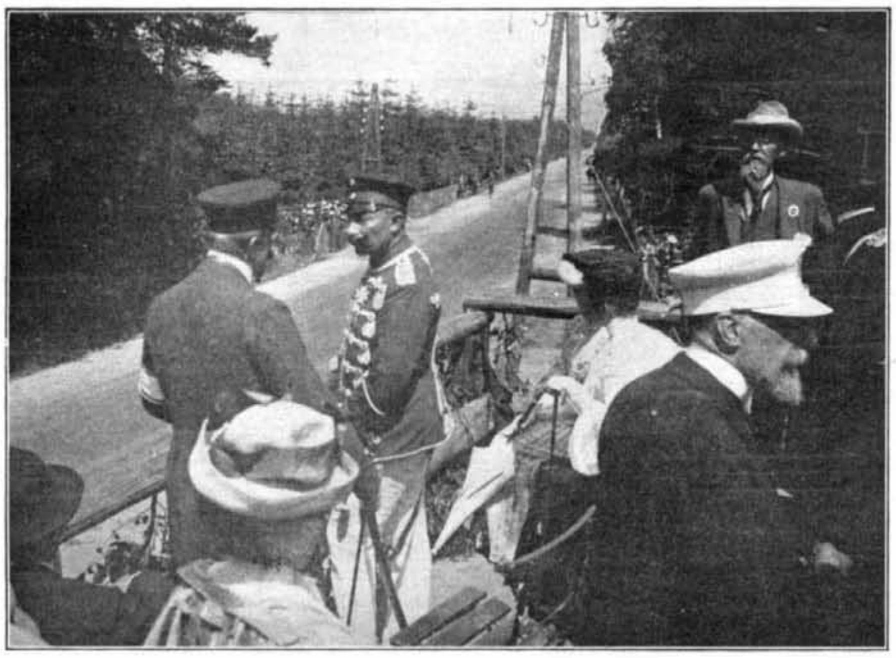
BY SPECIAL CORRESPONDENT OF THE SCIENTIFIC AMERICAN.

No less than six different nations were represented in the cup race this year, and it proved an event of the greatest interest. The race was held in Germany, and the Kaiser took an active hand in carrying out the arrangements.

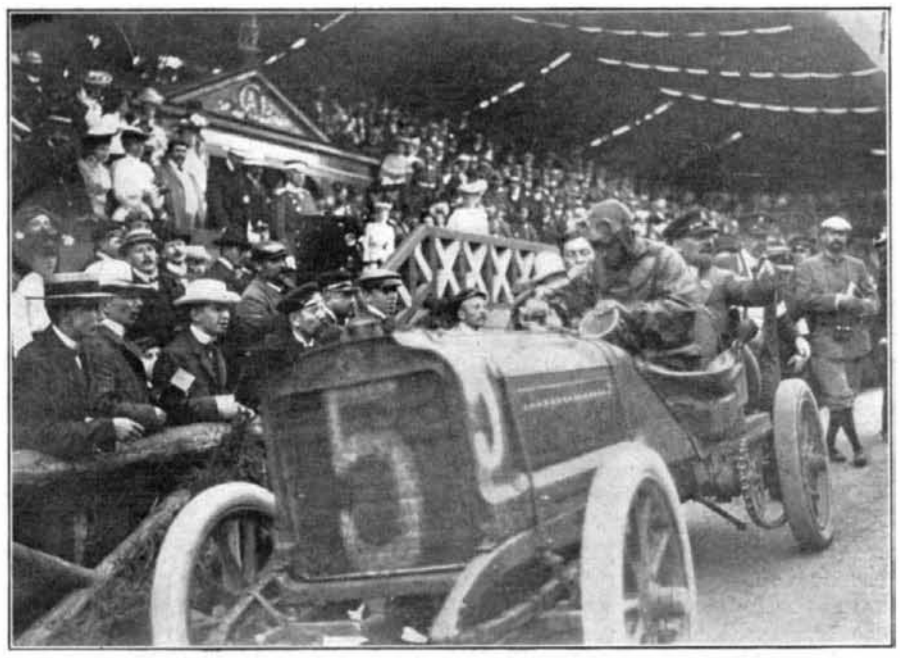
The starters in the race were as follows: Germany had three representatives, Jenatzy and Baron De Caters, each on a Mercedes car, and Fritz Opel on an Opel-Darracq. England was championed by Edge on a Napier car, and Sidney Girling and Jarratt, each on a Wolseley. The three Austrian cars were also of the Mercedes type, but were built at the Vienna works. They were mounted by Werner, Braun, and Warden. The latter is the well-known American chauffeur. Belgium was represented by three racers of the Pipe make, piloted by Baron de Crawhez, Hautvast, and Angieres. The three French racers are of different makes and these cars were the winners in the eliminating trials, which were held before the cup race. The Richard-Brasier car was mounted by Théry, the Mors car by Salleron, and the Turcat-Méry (De Dietrich make) by Rougier. Italy had also three cars, all of the Fiat make, piloted by Cagno, Lancia, and Storero. The Swiss car of the Dufaux make was unable to start at the last minute on account of an accident.

This gave a formidable array of eighteen racing cars, which is by far the largest number which has yet entered the Cup race. This made the race of greater interest this year than ever before, and it thus represented a great industrial battle between the different nations, some of which were already in the front rank, while the others were making their *début*. The cars were all weighed just before the start, and all came very close to the limit weight of 2,200 pounds. The German cars were painted white, the English green, the Austrian black and yellow, the Italian black, the French blue, and the Belgian yellow.

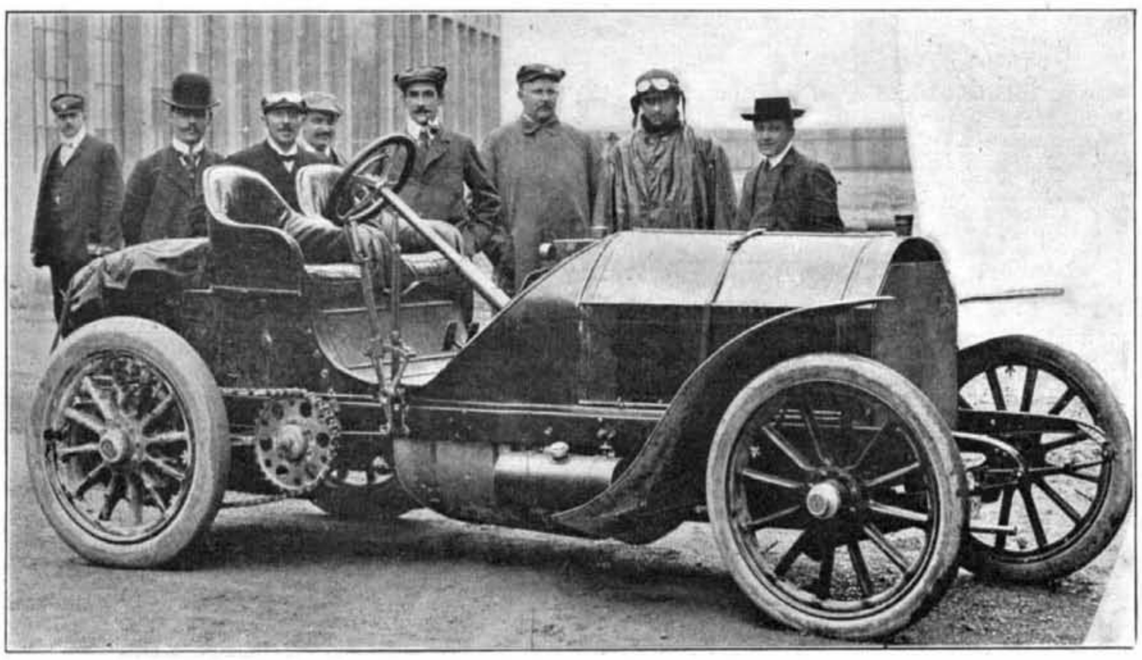
The route which was chosen for the Cup race lies in the Taunus region, to the north of Frankfort and not far from the Rhine. The route makes a somewhat



Kaiser Wilhelm Viewing the Races from the Grand Stand.



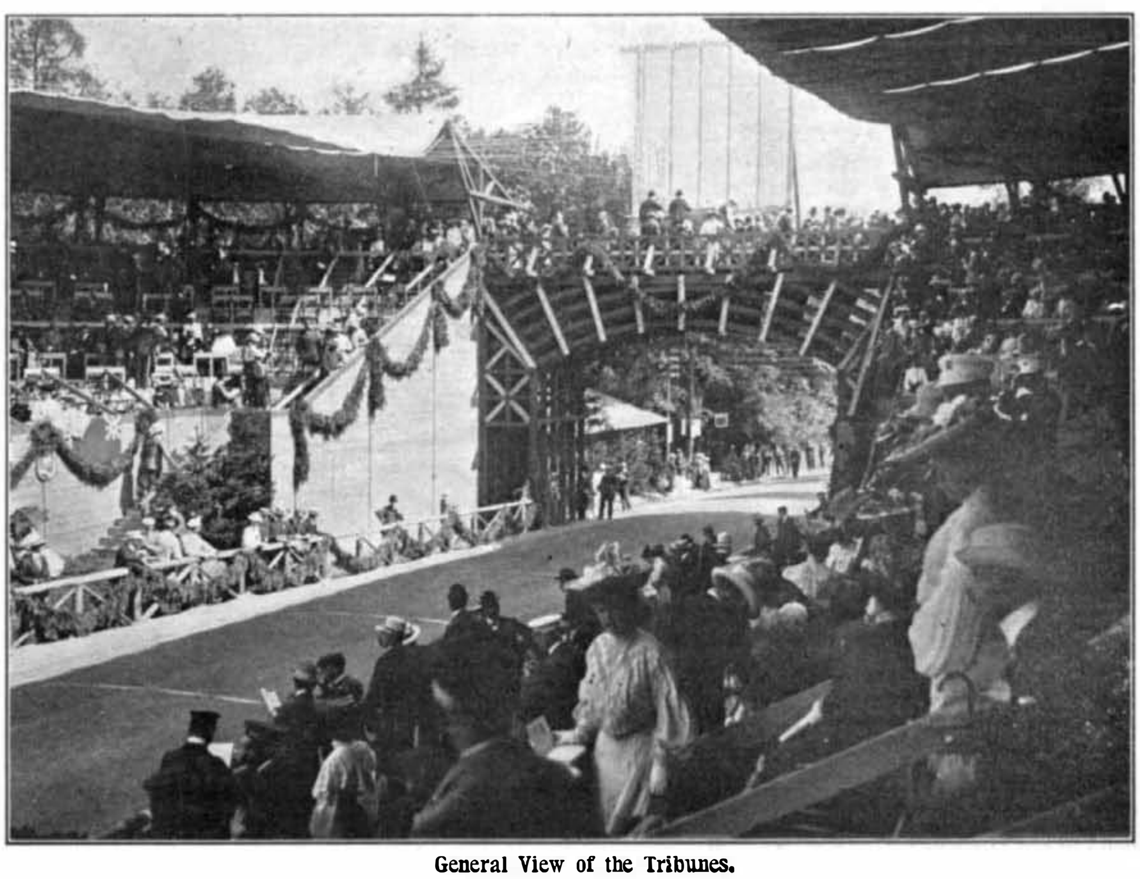
Thery, the Winner, at the Finish, in Front of the Kaiser's Box.



Mercedes Car, with Jenatzy, Who Came in Second.

Baron de Crawhez on a Pipe Car (Belgian).

The Turcat-Mery Car (French), Which Came in Fourth.



General View of the Tribunes.

THE GORDON BENNETT CUP RACES ON THE HOMBURG CIRCUIT.

elliptical circuit, passing through Limburg, Weilburg, Usingen, and Homburg, besides a number of smaller towns. The starting point of the race was chosen at a point near Homburg, known as the Saalburg. The part of the road which lies through the towns was neutralized, and did not count in the racing distance. There were ten control points on the route. The total racing distance for the four rounds which the cars had to make is 528 kilometers (327 miles). The condition of the road in the circuit is reasonably good, but there are some very steep grades and a number of short turns, which gave a severe strain on the cars.

One of the main points to be noticed in this year's event is the large proportion of well-tried racers, representing the leading makes. It was not so in last year's race; although there were as many as twelve competitors, many of them had not made much of a record on the road. In the front rank this year were six Mercedes cars. Three of these had been built in Austria, but on the same lines as the German cars. The French team was represented by three of the leading makes, each of which had already distinguished itself in the different races, and these cars were only chosen after a severe contest in the eliminating trials, where they came out ahead of other competitors, who were also record-winners. It seemed certain from the start that the struggle would be between the French and German teams; then came the English, Belgian, and Italian, which are in the second rank.

The start was to take place from the Saalburg at 7 o'clock in the morning. At daybreak everybody was up, and the starting point was the scene of great animation. The chauffeurs looked after their cars and made the final preparations, while an immense crowd began to assemble, and take their places in the tribunes or along the track. Excellent order was maintained among the crowds by the large number of troops, which had been called out for the occasion. The Kaiser arrived from the neighboring town, where he had spent the night. He appeared on horseback, while the Empress accompanied him in a carriage. With him came the Crown Prince and other members of the royal family. The Kaiser took his place in the imperial tribune amid great cheering, and shook hands with the principal competitors. The tribunes were filled to overflowing with an immense crowd, among which were chauffeurs from all parts of the world. The excitement increased as the time approached for the start. Jenatzy was the first in line, with his Mercedes car. At the signal he made a superb start amid wild cheering, and was soon out of sight.

Edge, on his Napier car, followed at an interval of seven minutes, and after him came Werner, and so on for the eighteen competitors. In general, all the cars made a good start, except that of De Caters, which had some difficulty with the ignition, and was thereby delayed some minutes. Jenatzy was the first to make the turn. He appeared in sight, and passed at lightning speed. Shortly after him came Edge, who appeared to be in good form. He was followed very closely by Théry, who had started fifth in order, but passed two of the other competitors *en route*. His time for the first round was but one-half second behind that of Jenatzy.

The time for each round was posted on an immense bulletin board as each car passed the line. On the first round the English team held a good place, followed by Salleron on his Mors car. However, the interest of the race was centered in the match between Théry and Jenatzy, as it seemed certain that one or the other would win.

On the second round Jenatzy passed first, then Théry, but the latter had started 35 minutes after, and his time was then 1 min. 46 sec. in advance of his rival. On the third round Théry had gained 10 minutes, and his performance showed the greatest regularity. The other competitors followed at short intervals. On the last round every spectator was on his feet; all eyes were turned to watch for the first car. Although Jenatzy arrived first, it was Théry who won the race by 11 minutes, and his time for the four rounds was 5 hours 50 min. 8 sec. Of the other cars, as many as ten had been able to finish, or twelve in all out of a total of eighteen. The Kaiser, accompanied by the Empress and the royal family, received the leading French delegates, and congratulated them upon their success.

The results of the race, as to the time required to make the complete distance of four rounds, or a total of 528 kilometers (327.4 miles) racing distance, are as follows: The time made by Théry was 5 hours 50 min. 3 sec.; Jenatzy, 6:1:28 1-5; De Caters, 6:46:31 2-5; Rougier, 6:47:11 1-5; Braun, 6:59:49 1-5; Hautvast, 7:2:36 2-5; Salleron, 7:15:15 3-5; Lancia, 7:17:54 1-5; Girling, 7:22:54 1-5; Cagno, 7:23:36 3-5; Werner, 7:32:14; Jarrott, 7:36:52. The average time made by Théry was very close to 60 miles an hour.

As to the types of car which made the best time, the order is as follows Richard-Brasier (French); two German Mercedes cars; Turcat-Méry (French); Austrian Mercedes car; Pipe (Belgian); Mors (French).

The greatest interest, of course, centers in the winning car of the Georges Richard-Brasier type. This car is among the leading Paris makes, and was designed by M. Brasier, the engineer of the company. It is expected to furnish a complete technical description of these cars as soon as they return to Paris. In the meantime it may be mentioned that they carry a four-cylinder motor of the vertical pattern, which is rated at 80 horse-power. The ignition is carried out by a magneto, which is driven from the motor. Chain gearing is used for the transmission from the motor to the rear wheels. The front part of the car is of somewhat square form, and is provided with a radiator of the wing type in front. The radiator is cooled by an air-fan placed just behind it and driven from the motor.

The car weighs about 2,140 pounds, and the distance between axles is 8 feet 8 inches. The gage is 50 inches. At full speed of the car the motor is coupled direct to the rear part. The gear-changing box provides for three different speeds. In the racing car all the valves of the motor are mechanically operated. The truck is built of pressed steel, and has front wheels 32 inches in diameter and rear wheels 33 inches.

The Turcat-Méry car, which is among the winners, is another of the leading French makes. It is built by the well-known De Dietrich Company, who adopted this type of car, which was designed by two Marseilles engineers, in preference to the type which they formerly built. Although one of the new cars, it is already a record winner, and came out among the first in this year's eliminating trials.

This car is equipped with a four-cylinder motor, which is rated at 100 horse-power. Contrary to the usual practice, the motor uses automatic inlet valves. There are four such valves per cylinder. The motor is provided with magneto ignition. The car has a pointed or torpedo-shaped front box, with the radiator mounted in the extreme front and beyond the pointed end. A double chain transmission is used from the motor to the rear wheels. The chassis of these cars is built of wood, reinforced with steel plates. The front and rear wheels are 35.2 and 35.6 inches in diameter respectively. The complete car weighs 2,090 pounds. The axles are spaced 9 feet 1 inch apart, and the wheel gage is 4 feet 8 inches.

The Mors racing car has also a 100 horse-power motor of the vertical four-cylinder type. It is built in the boat-shaped or torpedo form, which gave these cars such an attractive appearance last year. The radiator is mounted below the pointed end of the car, and is nearly concealed from view. The motor drives the differential by a direct coupling when at the highest speed. The inlet valves are of the automatic type. This car also uses a chain transmission to the rear wheels. The complete car weighs 2,200 pounds, and the chassis is built of pressed steel. The wheels are spaced 8 feet 8 inches apart, with a 3 foot 1 inch gage, which is comparatively narrow.

The three Belgian cars, one of which took a good place, were built by a leading Brussels firm. The four-cylinder motor of these cars is formed by two castings having two cylinders each. All the valves are operated by a single cam-shaft, and means are provided for relieving the compression of the motor when starting. The admission of gas to the motor is regulated by a throttle-valve, which is placed on the inlet pipe leading from the carbureter. The motor is rated at 100 horse-power.

Accumulators, with spark coil and plug, are used for the ignition. One of the peculiarities of the Pipe automobile is the use of a newly-invented form of magnetic clutch for coupling the motor to the rear shaft. The clutch is formed of a set of disks, one of which has the magnetizing coil imbedded below the surface. When the current is thrown on, the disks come together, and connect the motor to the rear shaft. This clutch has already been described in detail. The gear-changing box provides for four speeds. The chassis is built of wood strengthened with metal.

The Italian cars are built by the Fabrica Italiana, of Turin. The motor is designed for 75 horse-power. It has four vertical cylinders. Magneto ignition, of the Jucisa system, is employed. The inlet valves of the motor are mechanically operated. At starting, the compression of the motor can be relieved. The gasoline reservoir is placed in the rear, and is under pressure. The honeycomb type of radiator is used on these cars, and the flywheel of the motor is placed just behind the radiator, having the form of an air-fan. The distance between axles is 9 feet 3 inches, and the complete car weighs 2,177 pounds.

Briquette fuel is now extensively used in mines, mills, factories, smelting works, chemical works, etc., in all parts of Germany, and the results are said to be eminently satisfactory. For instance, experiments with lignite briquettes in a plain grate furnace resulted in the generation of 5 kilos. of steam per 1 kilo. of fuel, or a relative capacity of two to three compared with ordinary steam coal.

Weeds Used in Medicine.

The United States Department of Agriculture has just issued Farmers' Bulletin No. 188, entitled "Weeds Used in Medicine." The bulletin was prepared by Alice Henkel, Assistant in Drug and Medicinal Plant Investigations, Botanical Investigations and Experiments, Bureau of Plant Industry.

Attention is called to the fact that certain well-known weeds now either generally or locally infesting the country are the sources of crude drugs at the present time obtained wholly or in part by importation from abroad. Roots, leaves, and flowers of several of the species most detrimental in the United States are gathered, prepared, and cured in Europe and not only form useful commodities there, but supply to a considerable extent the demands of foreign lands. Hence it appears probable that while weeds can hardly be made desirable, still in his fight to exterminate them the farmer may be able to turn some of them to account. Some of the plants coming within this class are in many States at present subject to anti-weed laws, and farmers are required to take measures toward their extermination. It seems, therefore, desirable to make these pests sources of profit where possible.

The prices paid for crude drugs from these sources are not great and would rarely tempt anyone to pursue this line of work as a business. Yet, if in ridding the farm of weeds, and thus raising the value of the land, the farmer can at the same time make these pests the source of a small income instead of a dead loss, something is gained.

In order to help the farmers to obtain the best possible results for such products, instructions for collecting and preparing crude drugs from weeds are briefly given.

The plants mentioned in the bulletin are burdock, dandelion, the docks, couch grass, and pokeweed (principally root drugs); foxglove, mullein, lobelia, tansy, gum plant, scaly grindelia, boneset, catnip, hoarhound, yarrow, fleabane, blessed thistle, jimson weed, and poison hemlock (of which either the leaves, flowers, herb, or seeds are used in medicine); and also wormseed, and black and white mustards, of which only the seeds are used.

Descriptions of these plants are given, together with the common names by which they are known in different localities, the habitat (or, in other words, the kinds of places or soils in which they are likely to be found), their geographical range, information as to the parts to be collected, their uses, the extent to which they are imported, and the prices usually paid by dealers.

The principal uses for which these plants are employed in medicine are briefly indicated, but notice is given that none of the drugs mentioned should be taken without the advice of a physician.

Suggestions are also given relative to the manner of disposing of the crude drugs and of packing and shipping them.

The bulletin contains 31 illustrations of the weeds described. It is for free distribution and can be obtained on application to Senators, Representatives, and Delegates in Congress, or to the Secretary of Agriculture, Washington, D. C.

Wireless Telegraphy from Panama to New England.

It is said that a contract has been signed with a New York wireless telegraphic company, providing for five of the longest wireless circuits in the world. The government has been given the full use of the system, and incurs the expense of installing it. The contract is the first step toward the realization of a plan for placing New England and Panama in wireless communication. After the establishment of the service, its extension to the Orient is a matter of no difficulty. The circuits are as follows:

Key West to Panama, 1,000 miles.
Porto Rico to Key West, 1,000 miles.
South Cuban coast to Panama, 720 miles.
Pensacola to Key West, 450 miles.
South Cuba to Porto Rico, 600 miles.

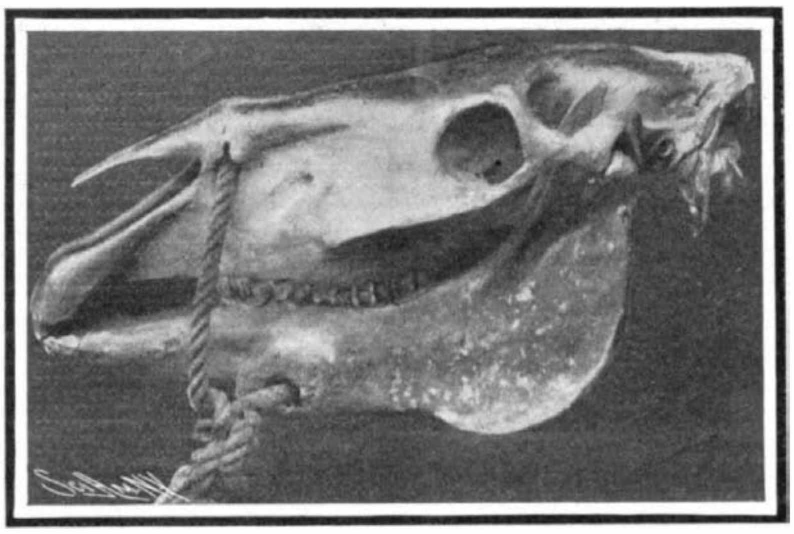
Stations have already been erected by the company on the Atlantic Coast from New England to Florida, and by means of the naval wireless station to be erected at Panama connections will be made with the De Forest stations now in course of construction on the Pacific, and thence to the Aleutian Islands, which station will be the key to the Alaskan business.

The death occurred recently of Col. Hiram M. Carpenter at Bellevue Hospital in New York. Col. Carpenter was the inventor of a number of electrical devices, particularly in the direction of the improvement of batteries, and at one time had accumulated a comfortable fortune, but at the time of his death was poverty-stricken. He was 64 years of age and won his title during the civil war, when he served with the Iron Brigade of Wisconsin, and the Twelfth New York Cavalry.

A CURIOUS FORMATION OF HORSE'S SKULL.

BY ED. J. C. WRAITH.

Near Swan Hill, Victoria, there was found not so very long ago the skull of a horse which tells a pathetic story. When quite young the animal evidently escaped with a piece of manila rope tied tightly around his jaws. In the struggle for existence, the rope became embedded in the bones of the upper and lower jaws. The opening of the lower jaw, through which the rope passes, at first sight would seem to have been drilled; but in reality it was worn away by the friction of the rope on the bone.



HORSE'S SKULL WITH A ROPE EMBEDDED THEREIN.

THE NEW NEMETHY FLYING-MACHINE AND THE PRINCIPLE OF ITS CONSTRUCTION.

BY DR. ALFRED GRADENWITZ.

More than two years ago a flying-machine built by Mr. E. Némethy, of Arad, Hungary, on the well-known kite principle, was discussed in these columns. In this flying-machine an air propeller was rapidly rotated by a gasoline engine. In the course of the experiments made on this machine, as well as by direct observations, the inventor became convinced that on the kite principle a machine could not travel any great distance horizontally, unless an amount of energy quite out of proportion to the effect produced be expended. Birds, on the other hand, do not show any visible effort, and as their wings are placed in a perfectly horizontal plane, their flying resembles much more the flying of paper arrows than of kites. Némethy, accordingly, decided on imitating, in the novel type of flying-machine which he has just designed, that other schoolboy's toy, the paper arrow, the following rules being followed in its construction:

Any flying body, moving horizontally in the air, will undergo a *statical* drift, equivalent to the weight of the air volume which would be statically displaced in the same interval of time in the case of a vertical fall through the air.

Any body falling vertically through the air will, in its fall, displace statically an amount of air equal to the volume of the body, plus the volume of the air cushion formed below the falling body, the existence of which was discovered by Loessl.

If the weight of the flying body be either equal to or smaller than the weight of the amount of air displaced according to the above, the body will float in the air; if this weight be greater, the body will sink, like a body that floats or sinks in water, according as its weight is equal to or else smaller or greater than the amount of water displaced.

For a flying surface moving horizontally through the air at a speed v, the volume V of the air cushion causing the surface to float will be equal to the product of the cross section f of the air cushion by the length L of the same, the latter being equal to the length of the flying surface l plus the speed v.

Accordingly, $V = fL = f\ (l + v)$.

The weight j of the air cushion being equal to the product of its volume by its specific weight,

$$G = Vj = f(l + v)\ j.$$

The total weight of a flying-machine therefore should not be greater than the weight of the air cushion G.

In the case of a broken flying surface, similar to bird wings, the volume of the bearing surface will be greatest if the wings are inclined downward to the horizontal at an angle of 22 deg. 30 min. The angle B, according to Loessl, is 45 deg. If a be the length of each swinging wing, the cross-section of the air cushion f will be:

$$f = 2a \cos \alpha \frac{(a \sin\ \ + a \cos \alpha)}{2}$$

$$f = 2a \cos \alpha \frac{a}{2}$$

$(\sin \alpha + \cos \alpha) = a^2 \cos \alpha\ (\sin \alpha + \cos \alpha)$. In the case of α = 22 deg. 30 min., $\cos \alpha\ (\sin \alpha + \cos \alpha) =$ 1.2071.

This figure (1.2071) thus is a constant for calculating the most favorable magnitude of the bearing surface in the case of the weight and speed of a flying body being given.

When birds move their wings up and down, they swim through the air in accordance with the above laws, the horizontal speed necessary for obtaining the statical drift, as well as the lifting effect in rising, being due to the sliding component of the helicoidal movement of the wings, while the statical drift itself may be varied by altering the horizontal speed. The cross-section of the bearing air cushion is equivalent to the mean value of the cross sections obtaining in the up and down movement of the wings, i. e., to the cross-section corresponding to the horizontal position of the swinging wings.

Birds that float in the air, without moving their wings, may equally be said to swim through the air in accordance with the above laws; the surface of attack offered to the wings by the corresponding position of the body, the wings, and the tail of the bird, being at any time such as to drive the bird in the direction desired. As a sailing ship, by virtue of a corresponding adjustment of the sails and the rudder, may be driven even by a back wind acting at sharp angles, the fact that birds in floating through the air may even move against the wind, is very easily accounted for.

A dynamical flying-machine, designed according to the above laws and able to float in the air at a given speed, requires for horizontal flight as much motive power as necessary to drive the floating machine against its front resistance, with any possible strength of the wind, at a speed such as to secure the length of bearing air cushion necessary for the drift. If the motor be stronger than would be necessary for obtaining the floating motion according to the above, the flying-machine, besides floating horizontally, would rise from the ground, the machine being pushed forward on the ground at a higher speed than would be necessary for horizontal flight, and the flying surface receiving a rising direction by lifting the rudder as soon as this increased speed is obtained.

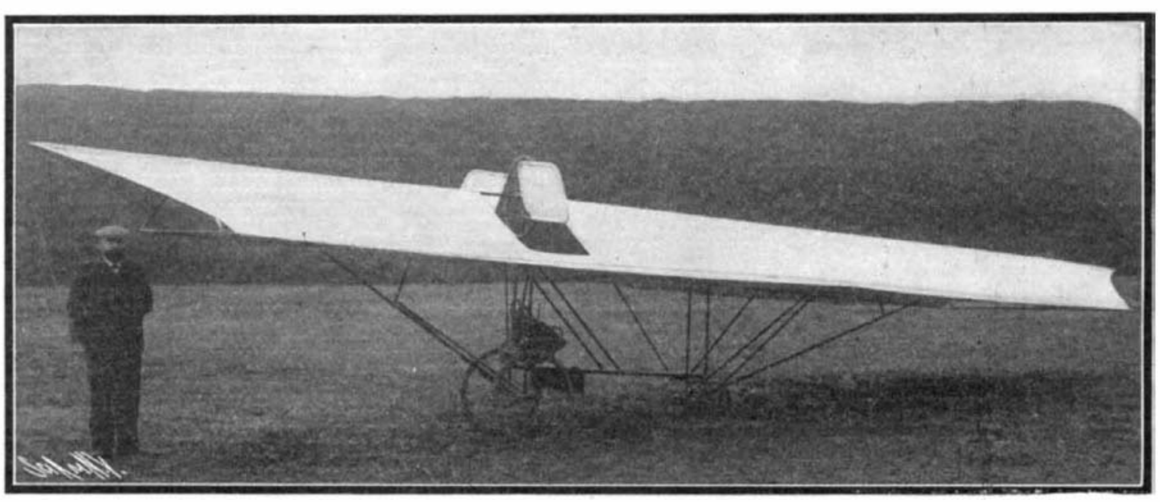
The front surfaces should be as small as possible, and the bearing surfaces so designed as to have the longitudinal axis coincide with the direction of flight. In order to insure a stable floating of flying-machines, constructed according to the above laws, the load should be so distributed on the latter as to have the center of gravity of the whole machine lie below the center of gravity of the supporting air cushion, this position being maintained during the flying movement.

In order to design a suitable dynamical flying-machine according to the laws enunciated, Mr. Némethy uses a bearing surface resembling an arrow, made from linen, silk, aluminium, or the like, the wings of which should best be inclined downward to the horizontal line at an angle of 22 deg. 30 min., so as to obtain the maximum cross section of air cushion, the axis of curvature being parallel to the line of flight.

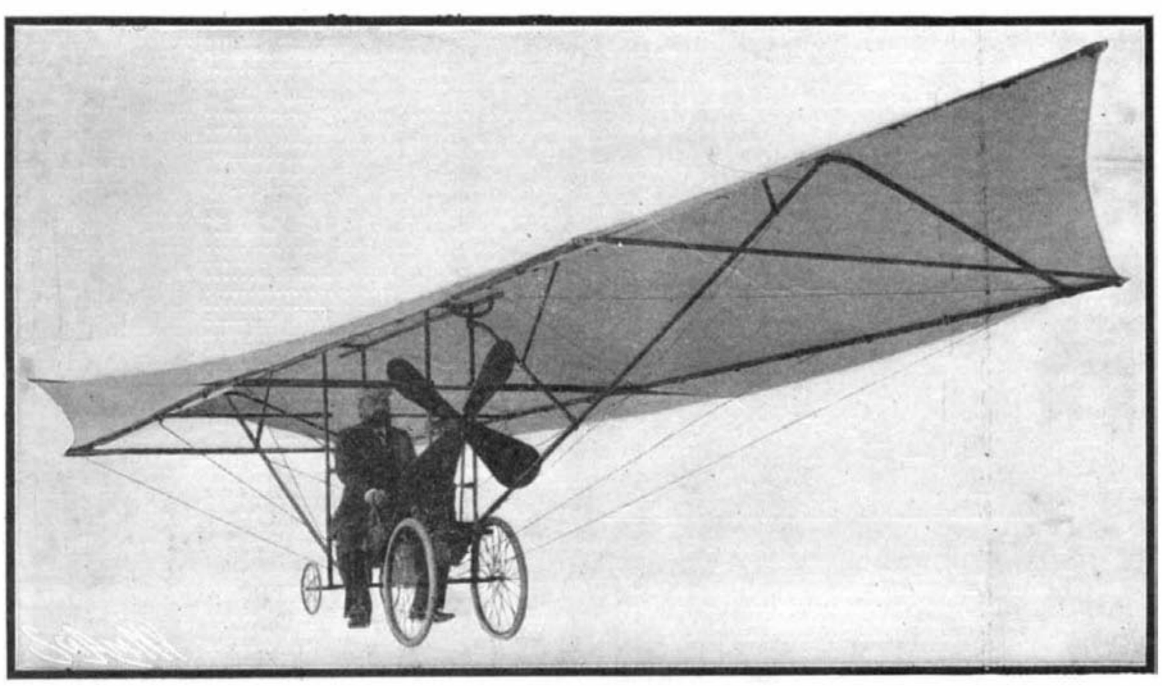
In order to obtain the necessary horizontal speed, parallel wheels or air propellers may be used, the latter being located either in the middle of the bearing surfaces or laterally, or else both in the middle and laterally, being driven by an automobile motor or the like. The weight of the whole flying-machine, including the motor, should according to the above be less than the weight of the supporting air cushion.

The airship may be made dirigible by means of a stern rudder, a vertical rudder, and, if necessary, by two lateral rudders. In order to start the airship from the starting slope or cause the airship to rise from the ground or to alight, the inventor provides a set of wheels on which the whole machine may roll along. By driving these wheels either by means of the propeller motor or a special motor, either in conjunction with or simultaneously with the air propeller, the whole flying-machine may be used on the roads as an automobile, or else the initial speed may be so rapidly increased as to enable the airship to rise even from an ordinary road.

Although the machine has been constructed, no test has yet been made. Until that test is made, we must forbear criticising the construction.



NEMETHY'S NEW FLYING-MACHINE.



NEMETHY'S NEW MACHINE IN FLYING POSITION.

Extent of the Fish-Hatching Industry.

We no longer speak of hatching thousands of fry, but of millions and hundreds of millions. The number of eggs, fry, fingerlings, and adult fish distributed by the Bureau of Fisheries in 1902 aggregated one and one-half billion. It is certain that the shad, whitefish, laketrout, and pike perch fisheries, each of vast importance, have not only been saved from entire depletion, but that they have been maintained, chiefly through artificial propagation, at a high degree of productiveness. That these fisheries are industries to-day, valued at nearly $3,000,000 annually, is due entirely to artificial propagation by the Bureau of Fisheries.—From the National Geographic Magazine.

RECENTLY PATENTED INVENTIONS.

Electrical Devices.

RAIL.—L. STEINBERGER, New York, N. Y. Certain advantageous features are embodied in this invention, among them being provision for allowing the rail to rock slightly during the passing of a train, and insuring a more constant and nearer perfect contact; for providing a bearing-surface for distributing pounding action; for relieving the rail and support of undue strains; for limiting movements thus set up in the rail; for supporting the rail against displacement; for more effectively shedding rain, sleet, snow, etc.; for more thoroughly insulating rail from cross-tie, and for providing a form of rail more readily distinguishable from ordinary rails, thereby preventing accidents.

SUPPORT FOR RAILS.—L. STEINBERGER, New York, N. Y. Mr. Steinberger's invention relates to a means for supporting rails and admits of general use, but is particularly applicable to railway systems employing the so-called "third rail" for the purpose of distributing the electric curent. Among the several objects of the invention, one is to permit a maximum relative movement as between the rail and its support in a plurality of directions. Another, to provide an insulated rail-support presenting the least possible mechanical contact-surfaces to the rail, thereby allowing the rail free movement and avoiding possibility of rail sticking to its support, and thereby bending or breaking it.

ELECTRIC SIGNALING SYSTEM.—J. DIANOVSZKY, Passaic, N. J. The object in this case is to provide a system, more especially designed for preventing collisions of trains and arranged to automatically bring a train to a stop when it passes into a section occupied by the train ahead to allow the engineer of the last train to put himself in telegraphic communication with the engineer of the train ahead, or vice versa, and to allow proper dispatch of the trains from a terminal station without danger of derailing or collision by improperly set switches.

ELECTRIC RAILROAD-CROSSING SIGNAL.—T. C. CLARK, Cambridge, Ohio. This signal for warning teams and pedestrians, comprises two circuit-closing devices arranged in the track, one each side of the crossing and about one hundred and fifty yards from the same, an electric bell which is mounted in a box at the crossing and arranged to be rung upon the approach of a train in either direction, a commutator with electric motor for turning it by which the time during which the bell is to continue in operation is controlled, and electromechanical devices for opening and closing the various circuits and holding them open or closed, as required, and also a circuit-breaking device for the track-circuit.

ELECTRIC SIGNALING SYSTEM.—S. M. YOUNG, New York, N. Y. In this patent the invention consists in a signaling system especially adapted for use on electric railways where the motive power employed is a source of direct-current energy. The object is to provide means whereby the condition of any section of the railway may be visibly, audibly, or otherwise indicated—as for instance, through the operation of semaphore-arms, bells, lights, etc.—or whereby the speed of movement of any car upon the railway may be modified upon entering or leaving any section of such railway—as, for instance, by automatically varying the resistance of the motor-circuit.

Of Interest to Farmers.

PLANTER.—J. H. GROOTERS, Allendorf, Iowa. In this case the purpose is to provide a means for releasing the seed from the seed box or boxes at proper periods, which means are controlled by the guide wire, chain, or cable used in connection with the machine, and further features relate to the construction of the seed-dropping devices, means for regulating the winding of the chain or cable upon the drum, and the construction of the drill shoes which are provided with devices at their lower ends for releasing seed to be dropped into the ground.

DEVICE FOR OPENING OR CLOSING GATES.—H. C. MORGAN, Eugene, Ore. By this improvement the inventor so arranges the ropes and pulleys as to enable the operator to open and close the gate from any point on the ground, in a wagon, or on a load of hay, or the gate may be opened by a cable on the ground or by a man on horseback or without the use of ropes as may be desired.

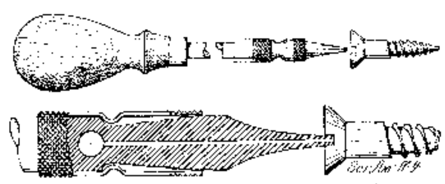
Of General Interest.

ATTACHMENT FOR MARINERS' COMPASSES.—J. ROPER, St. Johns, Newfoundland. This attachment enables bearings of heavenly bodies, landmarks, lights, and distant objects to be taken accurately, enables accurate bearings to be taken at night, the mariner to discover deviation of his compass by taking fixed bearings and comparing with compass indication, accurate bearings to be taken with binnacle without its removal or interference with its hood or top, bearings to be taken off pole-compasses, and to discover by noting bearings of a fixed object from time to time how tide is setting.

NOTE.—Copies of any of these patents will be furnished by Munn & Co. for ten cents each. Please state the name of the patentee, title of the invention, and date of the paper.

IMPROVED SCREWDRIVER.

Electricians and others who are required to drive screws in difficult and inconvenient places, will appreciate the value of the screwdriver here illustrated. The blade of the screwdriver consists of two jaws, over which a sleeve is fitted. This sleeve is so arranged that when moved forward it will crowd the jaws together, permitting them to be inserted



in the screw slot, and when the sleeve is withdrawn, the jaws will spread and hold the screw by pressing against the side walls of the screw slot. The screw can then be driven without the necessity of being held by the hand. Mr. S. E. Condon, 266 Hewes Street, Brooklyn, N. Y., who is the inventor of this screwdriver, desires to dispose of his patent, either outright or on a royalty, to some established manufacturer.

Business and Personal Wants.

READ THIS COLUMN CAREFULLY.—You will find inquiries for certain classes of articles numbered in consecutive order. If you manufacture these goods write us at once and we will send you the name and address of the party desiring the information. **In every case it is necessary to give the number of the inquiry.**

MUNN & CO.

Inquiry No. 5719.—Wanted, a proofing compound for oiled clothing which will dry with a surface free from all stickiness.

Inquiry No. 5720.—For makers of refrigerating plants of one half or one ton capacity.

Inquiry No. 5721.—For information in regard to making wood alcohol, acetate of lime, etc., in connection with charcoal production.

Inquiry No. 5722.—For manufacturers of sad-irons or flat-irons which are heated by gasoline.

Inquiry No. 5723.—For manufacturers of small, complicated springs and clips, of music wire.

Inquiry No. 5724.—For parties to make small special steel chains of 16 gauge (B. & Sharpe) wire.

Inquiry No. 5725.—Wanted, a 3 h. p. marine boiler.

Inquiry No. 5726.—For manufacturers of pile drivers.

Inquiry No. 5727.—For makers of creosote shingles for roofing purposes.

Inquiry No. 5728.—For small fancy tassels made of paper, card, etc.

Inquiry No. 5729.—For parties to make to order stampings of wrought iron or soft steel plate, 3/8 inch thick.

Inquiry No. 5730.—For makers of photo-button frames and photo jewelry.

Inquiry No. 5731.—For makers of rotary fans driven by clockwork.

Inquiry No. 5732.—For makers of brick-making machinery.

Inquiry No. 5733.—For makers of gas balloons.

Inquiry No. 5734.—For the address of the firm in Connecticut making little Egyptian charms.

Inquiry No. 5735.—For makers of electric and motor truck for hose truck for fire department.

Inquiry No. 5736.—Wanted, a patent for a good selling appliance, for sale at a fair figure.

Inquiry No. 5637.—Firms manufacturing machinery for a pencil factory.

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Water heater and garbage crematory, A. Long 763,410
Water tower, J. Curry 763,372
Water wheel governor, D. W. Starrett 763,572
Weighing machine, M. Hofmann 763,560
Well drilling machine, H. Wilburn 763,824
Whirler, G. W. Hinton 763,487
Wind motor, J. H. Ravelli 763,795
Wind or water motor, W. B. Nance 763,623
Windmill pitman and means for its automatic lubrication, W. P. Brett 763,360
Window cleaner or the like, H. A. Hayden 763,888
Window construction, E. H. Lunken 763,496
Window construction, Hausfeld & Lunken 763,484
Window, horizontally pivoted, H. E. Essig 763,471
Window protector, F. O. Carlson 763,853
Wire stretcher, Ferguson & Provost 763,549
Woven fabric formed chiefly of leather fibers, W. H. Drury 763,737
Woven fabric formed of fibrous materials, W. H. Drury 763,864
Wrench, R. J. Berthoud 763,590
Yarn formed of fibrous materials, W. H. Drury 763,377
Yarn from fibrous materials, machinery for manufacturing, W. H. Drury 763,378

DESIGNS.

Bag frame member, C. Flax 37,011
Knife, table, J. J. A. Munro 37,007

Paper weight, Paulson & Heinbockel....... 37,010
Rug, A. W. Bosch 37,013
Rug, J. A. Gillies 37,014
Rug, E. Hill 37,015
Rug, H. A. Miller 37,016
Rug, W. Reinhardt 37,017
Rug, R. D. Stevens 37,018, 37,019
Shade for illuminating devices, F. L. Perkins 37,012
Spoons, forks or similar articles, handle for W. C. Codman 37,006
Tea or coffee pot or similar article, A. Steffin 37,008
Tray, A. Steffin 37,009

TRADE MARKS.

Bitters, Carmeliter Stomach Bitters Co.... 42,890
Bolts, their parts and appliances, expanpansion, Star Expansion Bolt Co., 42,908, 42,909
Boots and shoes, leather, George E. Keith Co. 42,878
Braids, certain named, Sutcliffe & Swift.... 42,874
Bridles and sets of harness, G. Gibson.... 42,880
Canned and bottled fruits and vegetables, Seeman Bros. 42,883
Canned sardines and sprats, "Excelsior" Societe Anonyme Commerciale Industrielle et Maritime 42,917
Cartridges, Austin Cartridge Co......42,911, 42,912
Cider, American Fruit Product Co.......... 42,887
Circuit controller or switches, Albert & J. M. Anderson Mfg. Co.................. 42,926
Cleaning and polishing preparations, certain named, W. B. Tyler 42,924
Cleaning compound for certain named purposes, F. S. Bacon.................... 42,923
Cleansing compounds, certain named, M. M. Hodges 42,885
Coats, vests, pantaloons and overcoats for boys, Greenstein, Simon & Leerburger.. 42,915
Coffee, W. Childs, Jr..................... 42,918
Corsets, J. Siegel & Co................... 42,877
Disinfectant, odorless liquid, Norman C. Hayner Co. 42,902
Electrical apparatus, certain named, H. O. Swoboda 42,906
Fencing, wire, Pacific Steel and Wire Co... 42,930
Floor mats, certain named, Keystone Wire Matting Co. 42,881
Flours, certain named, S. Hamill Company. 42,882
Insect repellent, combustible, Culecide Company 42,905
Malt preparations, legumine, Sussmann & Hoffmann 42,888
Medical preparations for certain named diseases, Pineule Medicine Co.......... 42,893
Medicinal absorbents, certain named plastic, Dr. Van Vleck Co................... 42,900
Medicinal salve, Larkey & Pitt........... 42,901
Medicine for the cure of certain named diseases, liquid, M. P. Blair............ 42,898
Medicine for treatment of the blood and viscera, East India Chemical Co...... 42,892
Medicines, certain named, C. F. Keller, Jr.. 42,891
Meters, certain named, Controller Company of America 42,928
Peanuts, salted, D. Auerbach & Sons....... 42,884
Poisons for animals, K. Weiss............ 42,904
Powder for certain named diseases, effervescent, Gotham Chemical Co............ 42,899
Powder, tooth, McKesson & Robbins....... 42,921
Remedies for asthma, L. di Nola.......... 42,897
Remedies for certain named diseases, American Drug Co......................... 42,895
Remedy for certain named diseases, Pineule Medicine Co. 42,894
Remedy for diseases among live stock and poultry, Nitroline Manufacturing Co... 42,903
Remedy for ear affections, J. W. Evenden... 42,896
Rings, Stone Bros......................... 42,873
Rock drills and hammers, pneumatic, M. Hardsocg 42,907
Roofing felt prepared in asphalt and gravel, Argon Asphalte Co.................... 42,910
Roofing material, certain named, Eastern Granite Roofing Co. 42,929
Rouge, Allison & Lamson.................. 42,920
Rubber shoes and goloshes, India, C[illegible]iatische Handels-Gesellschaft 42,916
Sewing machines, Abraham & Straus........ 42,927
Sheetings, drills and flannels, cotton, [illegible]ican Trading Co..................... 42,875
Slippers, Capital Knitting Co.............. 42,879
Telephone tolls, devices for receiving, Controller Company of America............ 42,925
Toys, A. Schoenhut Co.................... 42,913
Undershirts or undervests, infants', M. Lowenthal & Brother................... 42,914
Vehicles for pleasure use, light road, Premier Manufacturing Co................. 42,931
Washing fluids, L. Bloomer............... 42,886
Washing powder, W. K. Bellis............. 42,922
Waterproof textile fabrics, Hirsch Brothers. 42,876
Whisky, W. A. Gaines & Co................ 42,919
Whisky, rye, J. L. Kennedy 42,889

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"Bu Ko," for tea, A. Lubarsky...11,182 to 11,184
"Bushee Home Cure," for blood medicine, G. H. Bushee........................... 11,197
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"Gold Medal," for paper bags, Union Bag & Paper Co........................... 11,201
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"Whalebone," for paper bags, Union Bag & Paper Co........................... 11,200
"Who-Who," for a game, W. P. Corbin..... 11,202
"Winner Pure Rye Whiskey," for whisky, W. Mulherin & Sons 11,180
"Wyman's Sa-Vo Salve," for salve, W. Wyman 11,193

PRINTS.

"Berlin Shape," for eyeglasses and spectacles, F. J. Rief........................ 1,016
"There's Good Bread Ahead," for flour, Washburn, Crosby Co..................... 1,015

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