Correspondence.

On the Quality of American Files.

To the Editor of the Scientific American:

My attention has been called to remarks made by Mr. A. D. Pentz, in your publication of February 4, practically putting his experience as against my knowledge obtained within the four walls of my manufactory. To correct Mr. Pentz in the supposition that this knowledge has been obtained from one source, I would say that from seventeen to twenty-five years of age, I was every day handling and selling and talking to dealers and consumers the Grobet, Stubs, Reilly Carr, Jowett, Morse & Gambell, John Martin, Greeves, and other makes of English files. I began my experience with a firm who were large and direct importers of the Grobet and Stubs files, and exclusive agents for John Martin's English files, of which they imported some 500 casks. I ended my experience, before going into the manufacture of files direct, as agent for a house who carried in New York a stock of $40,000 in imported files. I know of no better way of getting a correct opinion as to the quality of goods than to deal with the unprejudiced and prejudiced mechanic. One soon has an opportunity to sift the good from the bad, and I claim that the information which I obtained in handling imported files of various makes for ten years, prior to going into the manufacture of the domestic article, was more accurate knowledge and better information as to various qualities of files than Mr. Pentz was able to obtain in his thirty years' experience as a practical machinist. In justice to myself I would not wish the public to form the impression, through what Mr. Pentz has said, that my knowledge was confined exclusively to my own product.

New York, Feb. 7, 1893. J. D. FOOT.

A Pharmacial Columbus.

The celebration of the year 1893 is not exclusively one devoted to the discovery of America, as far as pharmacy is concerned.

Contemporaneous with this great event, just 400 years ago, a man was born of whom it may justly be said he was the "father of pharmacy." On December 17, 1493, in Maria Einsiedeln, Germany, was born an individual who was named Theophrastus Bombastus von Hohenheim. Possibly because of this high-sounding name, but more probably to avoid criticism of being designated as "bombastic," a term applied to his utterances, he assumed the name of Paracelsus; and as such he is known to pharmacy.

Paracelsus is the founder of iatrochemistry, through which the tendency of the middle ages to speculate upon the transmutation of the metals was turned in the direction of the search for the "elixir ad longam vitum," or the elixir of long life. Paracelsus believed that specifics could be found among plants and animals for all the ills that flesh is heir to. The tincture of aloes and myrrh is a survival of the "elixir proprietatis," or "elixir Paracelsi," which originally contained a much greater number and variety of ingredients.

It is more than a coincidence that the eventful year of 1893 should also be the quadri-centennial of the birth of this pioneer in pharmacy. The great convocation of pharmacy on the continent whose discovery simultaneously with his birth lent such great impetus to the world's materia medica, might well honor this polynymous and polypharmaceutical character.—*Western Druggist.*

Henry Sargent Codman.

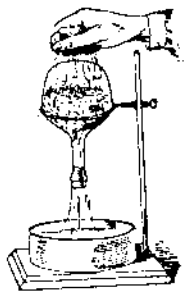
Henry Sargent Codman died suddenly, after an operation for appendicitis, on the 13th of January, at Chicago, where he had charge of the landscape department of the Columbian Exposition. No man at his age had ever accomplished more in his profession, or gave brighter promise of what could confidently be expected from his matured powers.

Mr. Codman was born in Brookline, Mass., on the 19th of June, 1864. He graduated at the Institute of Technology in 1884, and almost immediately entered the office of Mr. Frederick Law Olmsted. In the summer of 1887 he traveled with his uncle, Professor C. S. Sargent, through England, France, Germany, and Italy to study living collections of plants, nurseries, parks, and gardens. Soon after, he went to Paris and pursued his professional studies for more than a year under the direction of Edouard Andre, and on his return he was taken into partnership by Mr. Olmsted. Since then he has been intimately associated with Mr. Olmsted in all the important works that have been carried on by that firm, including the design of the Exposition Grounds in Chicago, in the construction of which he has been practically the executive head from the outset. Mr. Codman was tall, strong, of commanding appearance, and apparently of great constitutional vigor. He had inherited a profound love of natural beauty, and his taste had been disciplined and refined by close observation and wide reading. He was thoroughly acquainted with the literature of his profession. His library in this department was unequaled in this country, and his index of works on the subject, published in this journal, was the most complete that has yet appeared.

He invariably gained the confidence and esteem of all with whom he came in contact professionally, and he was remarkably successful in impressing his opinions upon them and leading them to see things from his point of view. That he won the affection as well as the respect of his associates was remarkably manifested in his Chicago work, where he came into warm comradeship with almost the entire corps of artists, and where he helped, no doubt, materially, to bring about that sympathetic co-operation and unity of purpose which has been so marked among them. This was due partly to the fact that from his position he stood for the one uniting element and represented among the various professions and crafts the general design in its comprehensiveness and consistency. But his professional position was made effective by his personal qualities and accomplishments—by that broad, liberal, and catholic cultivation which brought him into cordial and appreciative relationship with all the artists in all their varied fields. His leadership was, therefore, natural and spontaneous, for, although he was modest almost to diffidence, he never shrank from assuming responsibility. He had the moral qualities which mark the master, in addition to the highest intellectual appreciation of the possibilities of his profession, and in view of what he was and of the relations he had established with so many of the foremost architects of the country, his untimely death must be lamented as a serious loss to rural art in America.—*Garden and Forest.*

ATMOSPHERIC PRESSURE.

Completely fill a tumbler with water, and carefully cover it with a small sheet of thick paper, press the paper firmly upon the surface of the fluid with the palm, then cautiously invert the tumbler, and remove the hand. The paper will be held in place, and the water thus prevented from flowing out, by atmospheric pressure, as shown in the cut. The influence of this surface pressure on the boiling points of liquids is plainly illustrated by an experiment shown below, and described as follows: Half fill a Florence flask with water, boil the water until air is displaced and the dome of the flask is filled with steam, cork tightly, quickly remove the Bunsen burner, and invert the flask. When the flame is removed the temperature of the water will not be more than 100° C. (212° Fah.), and by the time the flask is inverted and boiling ceases it will naturally fall below the boiling point. If cold water be now poured carefully over the top of the inverted flask it will cause the water to boil fervently. The cold water, of course, lowers the temperature of the water in the flask still further, but it also condenses some of the steam, and, by thus forming a partial vacuum, lessens the work necessary to boiling. There being enough heat left in the water to accomplish this lessened amount of work, the water boils again until stopped by accumulation of pressure. The flask may be drenched and the water made to boil a dozen times in succession with a single heating, or the experiment can be made more striking by plunging the whole flask under cool water.



At the sea level water boils at 212° Fah., under ordinary atmospheric pressure, which is stated to be 14·7 (nearly 15) pounds to the square inch. If the atmospheric pressure be reduced or removed, by means of a vacuum apparatus, the boiling point is reduced —to 100° Fah. or less. If the pressure be increased, as it is in a steam boiler, the boiling point of the water is proportionately increased—to 350° Fah. or more. It must also be remembered that as we ascend above the sea level the atmospheric pressure grows gradually less, and the boiling point of water is correspondingly lower. Water boils readily on Mount Washington at 200° Fah., and upon Mont Blanc at 185° Fah.—*Bulletin of Pharmacy.*

City Pavements.

Mr. Thomas Appleton says: It is a common, but I believe erroneous, notion that the joints or seams between the blocks of a pavement are essential for a foothold for horses. I grant that with any hard stone which polishes under wear it is absolutely necessary that there should be a limit to the polished surface in order that the horse can stand up at all, but a horse is less liable to fall upon a macadam or asphalt pavement than upon a stone pavement, and the yielding surface of the cedar block pavement gives a better foothold than brick or stone. In my opinion, sheet asphalt should be transferred to the other end of the list. It has such a perfect surface that a horse's hoof comes immediately into position for work, there is no rocking of the fetlock joint, no slipping down into a crevice, no sliding off from a rounded summit. Besides, no such effort is required to start a heavy load as is necessary in starting on a stone or brick pavement. I should rank the materials under this classification as follows: Sheet asphalt, macadam, cedar block, brick, granite, cobble stone.

I doubt the utility of tables giving the cost of pavement for so long a term as fifty years. There may be several better pavements invented than any we now know of within the next ten years. One generation is about as far ahead as we ought to look.

In the present state of the art, I believe that for Chicago and its immediate vicinity there are but two kinds of pavement to use: First, if the abutting property can stand it, sheet asphalt; second, sapless cedar blocks.

On the Danger of Safety Matches.

BY B. L. PROCTOR.

A few weeks ago one of my staff, when lifting down from a high shelf a few packets of patent special safety matches, let two of the packets (each containing a dozen boxes) fall to the floor. This was followed by a sudden burst of smoke from each of them—a result I had not at all anticipated, but which prompted the inquiry how far the matches could be regarded as safety matches, and whether they were really free from phosphorus, as is generally understood.

One thing evidently in favor of safety was that the fire, which destroyed several boxes in each packet, left as many more uninjured. There was fire, but it was all confined within the thin paper wrapper which contained the dozen boxes.

Chemical examination soon proved that the matches did not contain phosphorus, and experiment further proved that the statement was not true which says that the matches will light only on the box.

As this fact was unknown to me up to the present experience, it will probably be new to many others who deal with these articles and who ought to know how far danger may be increased by the supposition that danger does not exist.

It was soon found that by pressing the tip of one match against the tip of another and then suddenly drawing one across the other, one or both of them were ignited. This was, no doubt, the way in which ignition took place within the boxes, where the match tips were, of course, in contact, and where that particular short, sharp friction would be produced by the concussion of the packet upon the floor.

I find Roscoe and Schorlemmer,* under the head of "Phosphorus," give a formula as follows:

Potassium chlorate	32 parts.
Potassium bichromate	12 "
Red lead	32 "
Sulphide of antimony	24 "

This mixture contains no phosphorus, and, as a rule, it will only ignite on a surface strewed with a mixture of amorphous phosphorus and sulphide of antimony. If, however, these so-called safety matches be quickly rubbed over a surface of glass or a smooth sheet of paper, they can be made to take fire.

I do not know whether I had seen Roscoe's statement previous to this little accident, but if so it had not impressed me. Experience is a more emphatic teacher than a text book.

Previous to my reference to Roscoe I had found it possible to ignite the safety matches upon the pages of the day book, upon the office window, upon a long palette knife, upon porcelain jars (glazed or unglazed), and some other materials, a long, rapid stroke being most effective. Subsequently I repeated the experiments and had failures with the same kind of matches made by the same maker. It may be that the matches vary a little in composition unintentionally, or they may change a little with keeping, or it may be that it depends upon the degree of dryness. The matches with which the accident occurred, and which ignited on various surfaces without much difficulty, had been in a warm dry position for a month or so, while those with which failure to ignite with simple friction was experienced had been kept in what might be considered normal conditions—conditions which did not interfere with their lighting on the box, but which made it very difficult, if not impossible, to strike them effectually upon common materials. After two or three hours' drying before the fire, striking on paper and porcelain again became effective, though not easily so.

The conclusions indicated are:

That the matches do not contain phosphorus.

That it is not true that they will strike only on the box.

That when very dry concussion may ignite the boxful.

That in case of ignition the fire does not spread readily, as it would do if the matches contained common phosphorus or free sulphur.

That a small degree of dampness which may be considered normal under ordinary circumstances does not interfere with their use according to rule, and renders them practically free from danger.—*Chemist and Druggist.*

* "Treatise on Chemistry," 1877, vol i., page 474.

The Glacial Period.

RALPH S. TARR.

(*Continued from page* 86.)

There have been two other explanations advanced to account for the glacial period, one geographical, the other astronomical; but I shall not discuss them further than to state them. The first is that the Gulf Stream was in some way prevented from entering the north temperate regions, which were then rendered much cooler. That this might easily happen is admitted; and that if it should happen it would produce a marked effect upon the climate of the North Atlantic basin is certain. The second theory is that, owing to certain rather complicated astronomical changes, the climate of the north was rendered cooler. That these changes occur, all will admit; but whether they are sufficiently marked in their effect to revolutionize the climate is a matter which even the former advocates of the theory do not press with the vigor which they formerly did. Astronomical combined with the geographical causes above mentioned is the theory now advanced most commonly; but for my own part I am inclined to place more stress upon the latter than the former, though, at the same time, it must be admitted that neither theory can be pressed with confidence.

How long did the glacier remain? Here again we can give no definite answer; indeed, we are even more at loss than in the attempt to explain the glacial period. Some believe that the ice covered the land for a great many thousands of years, even hundreds of thousands, and that it was not a single glacial period, but several, between which were periods of warmth, when the ice melted and the land was again clothed with vegetation. American geologists, in most cases, believe there were two periods of glaciation, while some leading European glacialists believe there were four or five such periods. On the other hand, there are some, both in America and Europe, who believe that there was but one glacial period, and that this was a comparatively short one, perhaps not lasting more than thirty or forty thousand years, which, when compared with geological ages, is but a short time.

Another question which may be asked is, When did it disappear? Here again we are not in a condition to state anything definitely, though we are fortunately possessed of some data upon this point which are of value. It is known that before the oncoming of the last glacial epoch the drainage of the great lake region was quite different from the present. There is near the Niagara River a channel, which crosses the river at the Whirlpool, and is the cause of this whirl, which in preglacial times was formed and occupied by a river, the predecessor of the Niagara. It was filled with drift by the glacier, and so, when the ice left the land, the drainage had to form a new channel, being forced out of its own. This it is now doing, having started at Queenstown and cut its gorge back to the present Falls of Niagara. This work is chiefly, if not entirely, postglacial, and if we could obtain a measure of the rate of erosion we could estimate roughly the length of time required for the work, and hence the date when the ice left the land at this point uncovered.

Seeing the importance of this, the New York State Geologist had a map made of the falls nearly fifty years ago, and a few years since a resurvey was made, so that there was a basis for an estimate of the time required for the construction of the gorge. In forty-eight years the American fall retreated 30 feet and the Horseshoe fall 104 feet. The total length of the gorge is about seven miles. There are many variable factors entering into the problem, for there may have been more rainfall formerly, the amount of sediment may have varied, a part of the channel may have been of drift, and other variations may have occurred. Those who have studied the problem carefully and have given the results of their study in figures have placed the amount of time required at from 7,000 to 20,000 years, while Lyell has estimated 35,000 years.

A study of the Falls of St. Anthony, in Minnesota, which have had a similar history, shows that they have retreated about 900 feet since 1680, when they were discovered, and upon this basis the estimate has been made that the close of the glacial period was from 7,000 to 10,000 years ago. There are other evidences which seem to show that the end of the glacial period was not more than 10,000 years ago. This evidence comes chiefly from a study of the deposits left by the glacier, which, in many cases, are surprisingly unchanged by erosion. This could hardly be the case if they had been exposed to the destructive action of atmospheric agencies for a much longer period than 10,000 years. Still, estimates in years must be considered somewhat untrustworthy.

A word or two about the effects of the glacial period is all that can be given in so short an article. It completely altered all details of scenery and of soil. In and on the ice near its end there were quantities of gravel, clay, and bowlders, while beneath it these materials were dragged along as a ground moraine. While the ice was moving, this drift was used by the ice to plane down the hills, to wear out the valleys, and to crush up the loose material into the finest clay. Like a piece of sandpaper, it moved, over the rocks, polishing and grooving them, as any one can see who will examine a freshly exposed ledge in a glaciated region, or the pebbles themselves which occur in the till or unstratified drift. The ice plucked off bowlders and pried off fragments with which to scour the rocks, and there is a school of glacialists which holds that this scouring action of the ice was in places of great force, even causing the formation of deep rock basins, in which lakes now exist.

The more moderate school, however, is of the opinion that the effects of the glacier were constructive rather than destructive, and these effects are certainly more apparent. The soil of the country was completely removed, and in its place was left a bowlder clay, often, as in New England, far too rocky for the agriculturist. The soil is strong because it contains all the elements of the rock, ground to a flour, and never robbed of its plant-forming elements. Before the ice came the soil of New England was very much like that of the Highlands of New Jersey south of the terminal moraine, and one can see the difference in the soil in that State north and south of this line.

The river courses were changed by the sheet of drift which the ice deposited without regard to the contour of the country. Many rivers, such as Niagara, were forced to carve out new channels, and hence the waterfalls and gorges which abound in the glacial region. Others remained in their valleys, but here and there were partly turned aside from their old channels, and in these cases we have small gorges and rapids, where they have settled down through the drift on some rock spur. Where their channels were crossed by drift barriers, lakes were formed, and in the terminal moraine, as the material is called which was deposited at the margin of the melting ice, many lakes are found in the irregularities of the drift deposit. In Minnesota there are fully ten thousand lakes in one way or another the result of the recent glaciation. In New England there are also thousands of lakes and lakelets and swamps which are in many cases nothing but filled up and partly drained lakes or ponds. The Great Lakes are also partly the result of drift barriers.

The streams flowing from the melting glacier were flooded with water and filled with sediment, and terraces were formed, such as those of the Connecticut and of many other streams in the glaciated regions, and even south of it when they received their supply from the glacier. Many other forms were produced by the ice, the kames, drumlins, moraines, and others, all of which add novelty to the scenery of the region where they are found. We owe much to the glacial period, and it is probable that had it not occurred the history of our country might have been quite different, for perhaps even the present climate is a relic of the ice advance. There certainly has been a time when the life of temperate zones extended far within the Arctic circle, and it is not for us to say that there is not some great cycle of climatic change even now in progress, but which in a few hundred years is inappreciable.

The World's Columbian Exposition.

In ground frozen hard the foundations were recently commenced of the large structure to be known as Festival Hall, near the Horticultural Building. Cold chisels and sledge hammers were necessary to start the work. It is promised the new building, which will be one of the notable architectural features of the Fair grounds, will be completed before April 1. It will be used for a choral hall and dedicated solely to music. In style it is pure Doric, which makes it simple and severe in architectural treatment, but massive and striking in appearance. Added to its other charms is the location. Directly fronting the lagoon, across which will be the wooded island with its treasures of landscape gardening and green shore, no more favorable spot could be chosen for a temple to inspiration. F. M. Whitehouse, of Chicago, is the architect. In form the building will resemble an amphitheater surmounted by a dome. On the four sides will project porticoes, the one facing the lagoon being the principal entrance. The porticoes will be enriched with fluted Doric columns six feet and a half in diameter. From the front portico a spacious flight of steps will lead to the entrance, and at the foot of the steps will be two reproductions of celebrated marble statues of the great composers—Handel and Bach. On either side of the main portico will be panels in relief work representing the progress of music, and in the panels over the doors will be relief portraits of Gluck, Berlioz, Wagner, Schumann, Schubert, Mozart, Mendelssohn, Bach, Handel, and Beethoven. The interior is designed after a typical Greek theater, except that the chorus of 2,500 voices will occupy the space assigned by the Greeks to the stage, which will have the effect of rendering the interior amphitheatrical in form. There will be no galleries to obstruct the vision or deteriorate the acoustic properties of the building, which will seat 6,500 people.

In the selection of works of art to be displayed in the Palace of Fine Arts, the juries appointed to decide upon what works should be admitted have pretty generally concluded their labors. In each of the greater cities of this country there have been submitted hundreds of paintings, and from these have been selected the very best. In New York more than 800 canvases were hung for inspection and 375 were accepted. In Boston the examination was even stricter, and 128 out of 600 were accepted. The Philadelphia jury rejected 400, and will send to Chicago 112 paintings. Of the American canvases owned in Europe, the inspection was equally strict. The Paris jury, composed of the very best art critics of the day, accepted 156 canvases out of a total of 840 submitted. And so it was in London, Rome, Berlin, Venice, and Naples. The work of installation in the art palace will begin about March 1.

The extensive exhibit of the great Krupp Company, of Essen, Germany, is beginning to arrive on the grounds. The first consignment of material arrived by the British steamer Gardafee at Baltimore early in January, and special cars were built for its transportation by the Pennsylvania Railroad Company, the gun trucks being from designs furnished by the Krupp Works, and being the largest ever built. The car that will carry the great 124 ton gun, which has not yet arrived, is a flat truck on thirty-two wheels. The carriage of the big gun, which has first arrived, weighs 38,500 pounds, and the frame weighs 55,000 pounds. Among the other first arrivals are the carriage and frame for a 30·5 centimeter gun, whose combined weight is 80,960 pounds, carriage and frame for a 21 centimeter gun, weighing jointly 19,490 pounds, an 85 ton traversing crane, with its equipments, the whole aggregating 56,650 pounds. One 12 centimeter gun, weighing, with carriage and shield, 18,150 pounds, one 8·7 centimeter gun, weighing, with carriage, 7,854 pounds, and one 7·5 centimeter gun, weighing 4,576 pounds. There are also thirty-two railroad tires, weighing 31,224 pounds, two locomotive driving wheels, thirteen pairs of car wheels on axles, and two car wheels without the axles, besides a number of pressed steel articles, empty projectiles, armor and boiler plates, and miscellaneous forgings and steam pumps.

The display to be made by Germany at the exhibition will be very large. The appropriation of the German government for Fair purposes is larger than that of any other foreign country, and the list of German exhibitors now contains 5,077 names. Represented in it are 230 cities and towns of the empire, and of these 40 cities send more than 10 exhibits each. Berlin leads with 283 exhibitors; Munich follows with 187; Leipsic with 149; Frankfort, 55; Hamburg, 57; and Chemnitz, 41.

Nearly $6,000,000 has been appropriated by foreign governments and about $3,000,000 by the several States of this country for appropriate representation at the Fair, as follows:

FOREIGN APPROPRIATIONS.

Argentine	$100,000	Hawaii	$40,000
Austria	102,300	Honduras	20,000
Belgium	57,000	Hayti	25,000
Bolivia	30,000	India	30,000
Brazil	600,000	Japan	630,000
British Guiana	25,000	Jamaica	24,333
British Honduras	7,500	Leeward Islands	6,000
Barbadoes	5,840	Liberia	7,000
Colombia	100,000	Mexico	50,000
Costa Rica	150,000	Morocco	150,000
Canada	100,000	Netherlands	120,000
Cape Colony	50,000	Nicaragua	31,000
Ceylon	65,600	Norway	56,280
Cuba	25,000	New South Wales	243,325
Denmark	67,000	Orange Free State	7,500
Danish West India	1,200	Paraguay	100,000
Dutch Guiana	10,000	Peru	140,000
Dutch West India	5,000	Russia	46,320
Ecuador	125,000	Salvador	12,500
France	733,400	San Domingo	25,000
Germany	800,000	Spain	214,000
Great Britain	291,000	Sweden	108,000
Greece	60,000	Trinidad	15,000

STATE APPROPRIATIONS.

Arizona	$30,000	Nebraska	$50,000
California	300,000	New Hampshire	25,000
Colorado	100,000	New York	300,000
Delaware	10,000	New Jersey	20,000
Idaho	20,000	New Mexico	25,000
Illinois	800,000	North Carolina	25,000
Indiana	75,000	Ohio	100,000
Iowa	125,000	Pennsylvania	300,000
Kentucky	50,000	Rhode Island	25,000
Maine	40,000	Vermont	15,000
Massachusetts	75,000	Washington	100,000
Michigan	100,000	West Virginia	40,000
Minnesota	50,000	Wisconsin	65,000
Missouri	150,000	Wyoming	30,000
Montana	50,000		

It is proposed in Paris to construct a gigantic reflecting telescope, the mirror of which is to be 10 feet in diameter and the length of the tube 140 feet. It is to be ready for the exhibition which is to be held in Paris in 1900. The mirror is to be silver on glass.

M. Trepied, director of the Observatory of Algiers, discusses the magnifying power of such an instrument. The French papers, in announcing the project, made the statement that this instrument would bring the moon within one meter. M. Trepied shows that with the highest practical power, in the best atmosphere, the moon would be seen as if it were 25,000 meters or 15 miles distant.

Steel Axles.

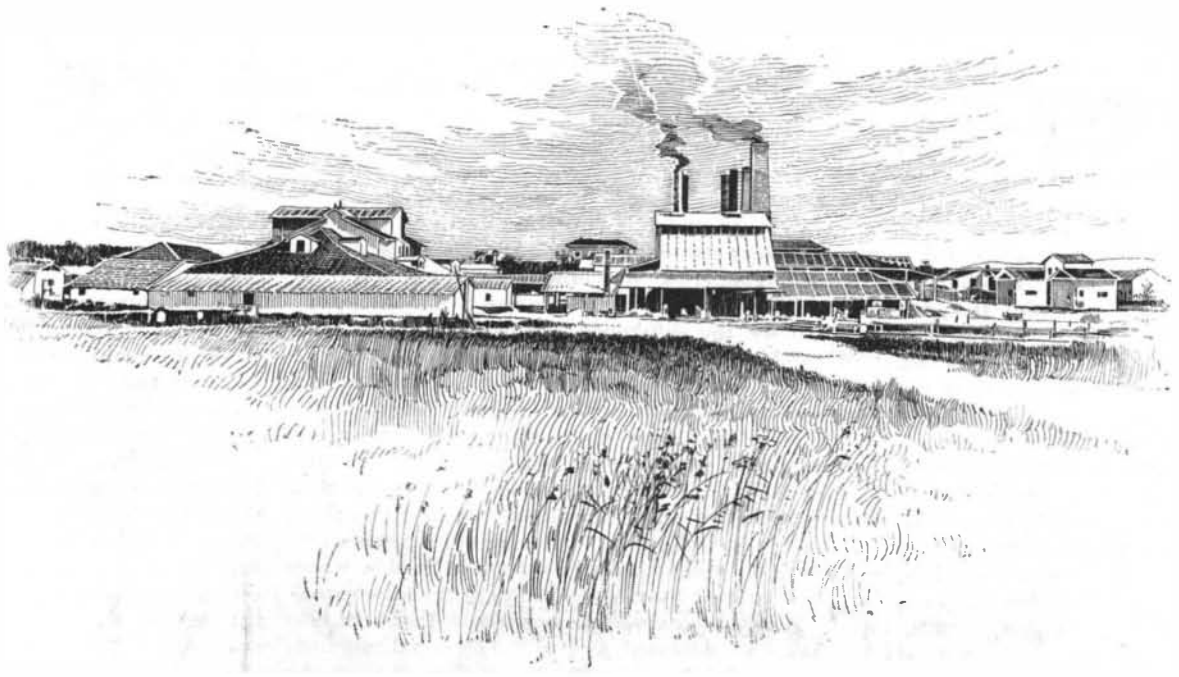
One of the most specious arguments used against steel, the *Railroad Gazette* says, is deduced from the mileage of broken axles, which often show that the average mileage of the broken steel axles is less than that of the iron. This is by no means a conclusive argument; for if the statistics of the axles still running be examined, it will almost invariably be found that steel has proved more durable than iron. The explanation of this seeming anomaly is simple. A new steel axle which has a flaw or is "nicked" in any way is doomed from the start. The crack will gradually but surely spread in the homogeneous material, and the axle will fail or be condemned for a growing flaw after a comparatively short life. The remaining axles, being sound, will continue to run and give a long mileage, and when finally removed will still be sound, though worn below the minimum size. The iron axles, on the other hand, begin the progress of disintegration at once. The more or less imperfectly welded fibers begin to separate, and after a certain time the great majority have been condemned, while the greater number of the steel axles are still running, though possibly none of the iron axles failed as soon as the faulty steel ones.

Steel, however good and suitable in quality, cannot stand unless it is also of suitable form. Some have very incorrectly stated that the section of steel exposed to heavy service should be alike throughout. A car axle, according to this dictum, should be of the same diameter throughout its length. This form, however, was abandoned in the very early days of railroads, owing to the persistency with which fractures occurred just inside the wheel hubs. The true law is manifestly that the section should vary according to the strain, and that the strains should be as nearly uniform as possible throughout the axle, subject to the proviso that there should be no sudden change of form. It will be found that steel fails where this rule is disregarded and stands where it is observed.

One instructive instance is found in the well known case of the bolts by which armor plates are attached to a ship's side. The hard wood backing used between the armor plate and the skin of the hull compresses when the armor is struck by a shot, and its rebound fractured all the bolts tried until Palliser brought out a bolt in which the shank was reduced until its cross section was somewhat smaller than that at the bottom of the threads. When the rebound took place, this bolt stretched a percentage of the whole length of the shank, while with an ordinary bolt the stretch could only take place at the bottom of the threads, and this distance was too short in which to cushion the blow. A large number of failures of steel would never occur if attention were paid to the principle here involved and concentration of the maximum strain carefully avoided.

An Earthquake in Greece.

Early in the morning of January 31, the island of Zante, on the west coast of Greece, was severely shaken by an earthquake, during which many business houses were wrecked and the roof of a prison fell in, wounding many prisoners. Two hours later the city of Zante was shaken by repeated shocks, houses fell in all quarters, and the prison became so unsafe that many prisoners were removed. The people, in a panic, fled from the houses and crowded the streets and market place. Scores of families left the town to camp in the fields on the outskirts, and many dead bodies were taken from the ruins, the government sending out troops with tents and provisions for the homeless. On February 2 and 3 other severe shocks occurred, which are said to have wrecked more than a hundred houses in the city of Zante, and proved very disastrous to several villages on the island. Thousands are said to have left the city to sleep in the fields.



A SUGAR HOUSE IN CUBA—LA SOLEDAD.

The island of Zante is 25 miles long and about 12 miles wide, having an area of 277 square miles and a population of about 48,000. The eastern part of the island is a fruitful plain skirted on the west by a range of limestone hills 1,000 to 1,200 feet high. The town of Zante, and its capital, has a population of 16,000.

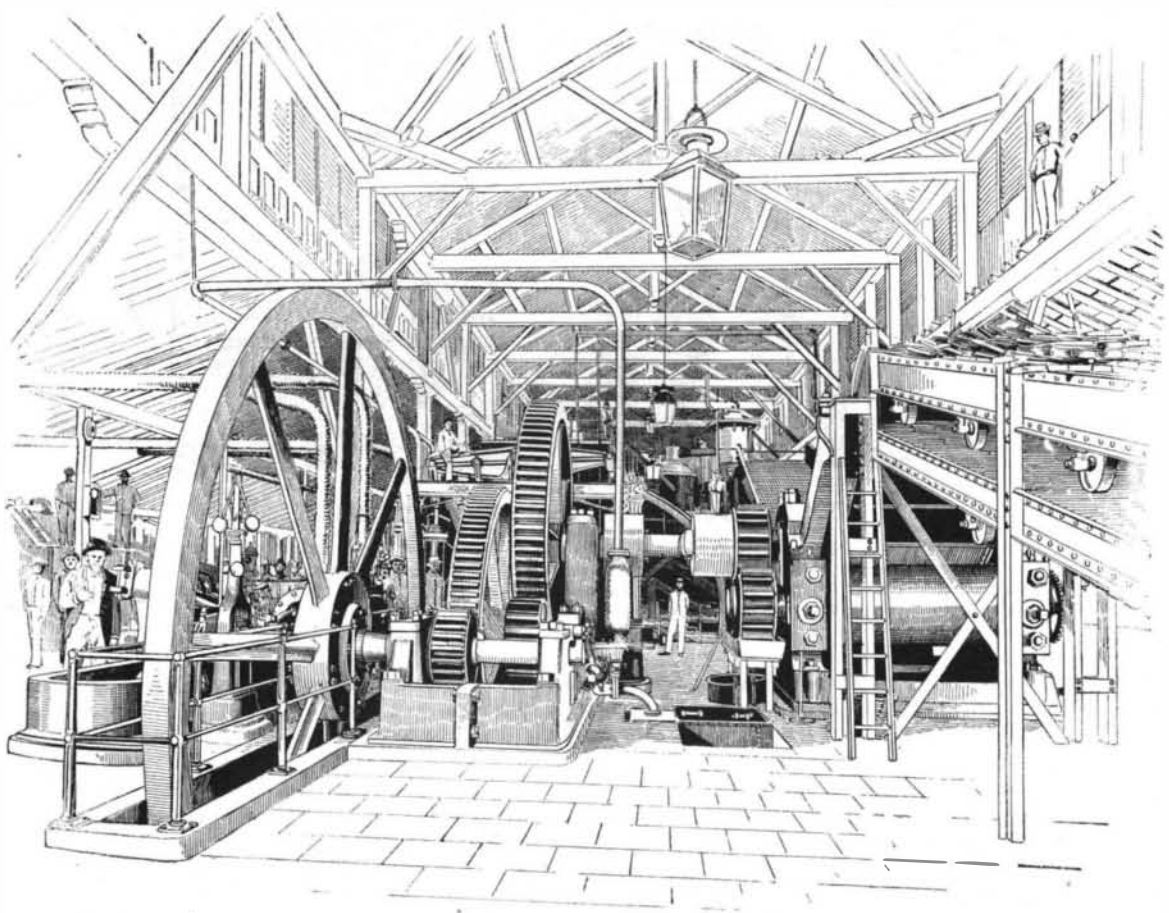
Labor Troubles in England.

It is astounding nowadays what a small matter will result in a big strike. The men engaged in taking the slag from the furnaces at Barrow by means of two locomotives demanded a third, and on Sunday morning four men thus employed struck work because the duet had not been made into a trio. They were followed by the furnace men, and those employed at the steel works had to follow suit. Thus three thousand men have been thrown out of employment all on account of a donkey engine. The difficulty was all pieced up with the exception of the locomotive men, who, having left their work without notice, were not again taken on. The men demanded this, and the general manager promised to deal leniently with them, but refused to take them back into the employ forthwith. Hence the continuance of the strike on so frivolous a pretext. And this at a time when trade is exceptionally bad, when orders are scarce and profits practically *nil*, and when trade prospects are as gloomy as they well can be!—*Ironmonger.*

NOTES ON THE SUGAR INDUSTRY IN CUBA.

BY HUMPHREY J. KIELY.

It is interesting and gratifying to note the rapidly increasing volume of business between the United States and Cuba. The wonderful natural resources of this fertile island, appropriately called "The Pearl of the Antilles," offer many opportunities for the profitable investment of capital and for the consequent introduction of machinery and various mechanical appliances useful and in many cases necessary in the preparation of the products of its fruitful soil. The island is about 600 miles long, 21 miles wide in the narrowest part and 111 in the widest, and is distant 130 miles from Florida. It abounds in forest woods and produces all the fruits of the tropics in great abundance. It is only within recent years that our trade has increased with this country, and the late reciprocal arrangement has done much to extend that trade, especially when it is remembered that the agricultural commodities produced there are as essential to us as our manufactured products are to Cuba. The mineral wealth of the country, consisting of gold, copper, iron, manganese, asphalt and marble, is immense, but the staple product of the island is sugar, and more capital is invested in the cultivation and manufacture of this one article than in all the others combined. The production this year is estimated at 1,000,000 tons, as against 800,000 tons last year, and the limit of producing capacity has not yet been reached, as large tracts of land are still available for cultivation, and the world's demand is constantly increasing. It is the largest sugar-producing country in the world, the climate and soil possessing just the qualities required for the cultivation of sugar cane, and it is not unusual for a visitor to have pointed out a field from which yearly crops have been taken for a score of years without the aid of fertilizer of any kind. Before the emancipation of the slaves, about twenty years ago, when the plantations were numerous and the price of sugar high, the margin of profit was so great that little attention was paid to economy in production or the use of labor-saving machinery. Many of the small plantations with their primitive methods have been abandoned, and it is not an unusual sight travel ng through the country to come upon the ruins of a once prosperous estate looking desolate and gloomy with its crumbling walls and tottering chimney, and to see flowers and shrubbery flourishing amid the wreckage of its dismantled machinery. This has been due in a great measure to the competition of beet sugar, and now large central factories, fewer in number but far greater in capacity, have taken the place of the numerous small estates.



This engraving shows the bagasse carrier arranged on top of the furnaces, through openings in which the bagasse is delivered, and passes to the fires.

A SUGAR MILL, CUBA—THE BAGASSE CARRIER.

It is difficult to conceive, without a personal inspection, the immense size and magnificence of the equipment of these central factories, but some idea may be gained from the fact that they each represent an investment ranging from $200,000 to $1,800,000, and comprise in some cases 10,000 acres each. Central Caracas, probably the finest estate on the island, is valued at $1,800,000.

The central factories are usually an assemblage of very large roomy frame structures, in which work goes on night and day without intermission during the entire grinding season, which commences late in December and ends in May. In some factories work is suspended a few hours Sunday morning for the purpose of oiling and cleaning the apparatus, but this practice is not general. The cane is plentiful and each vies with the other in striv-