SCIENTIFIC AMERICAN

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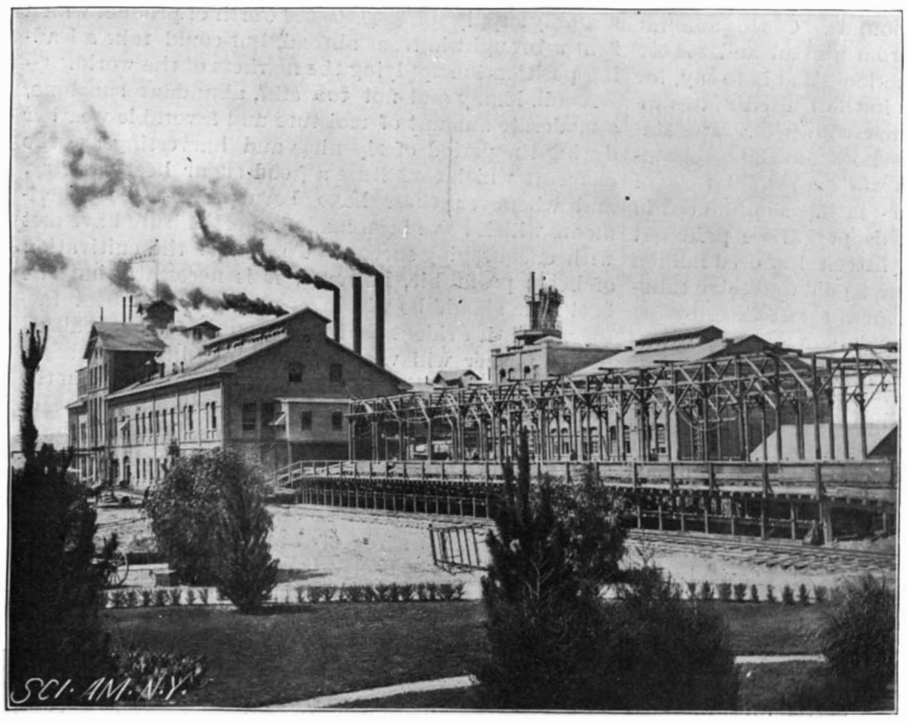

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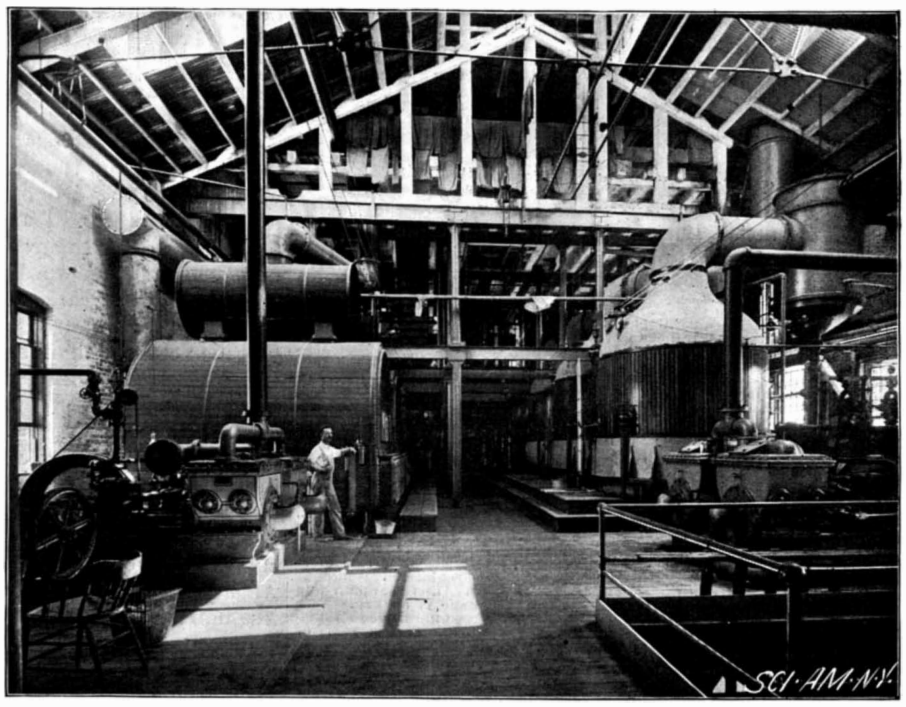

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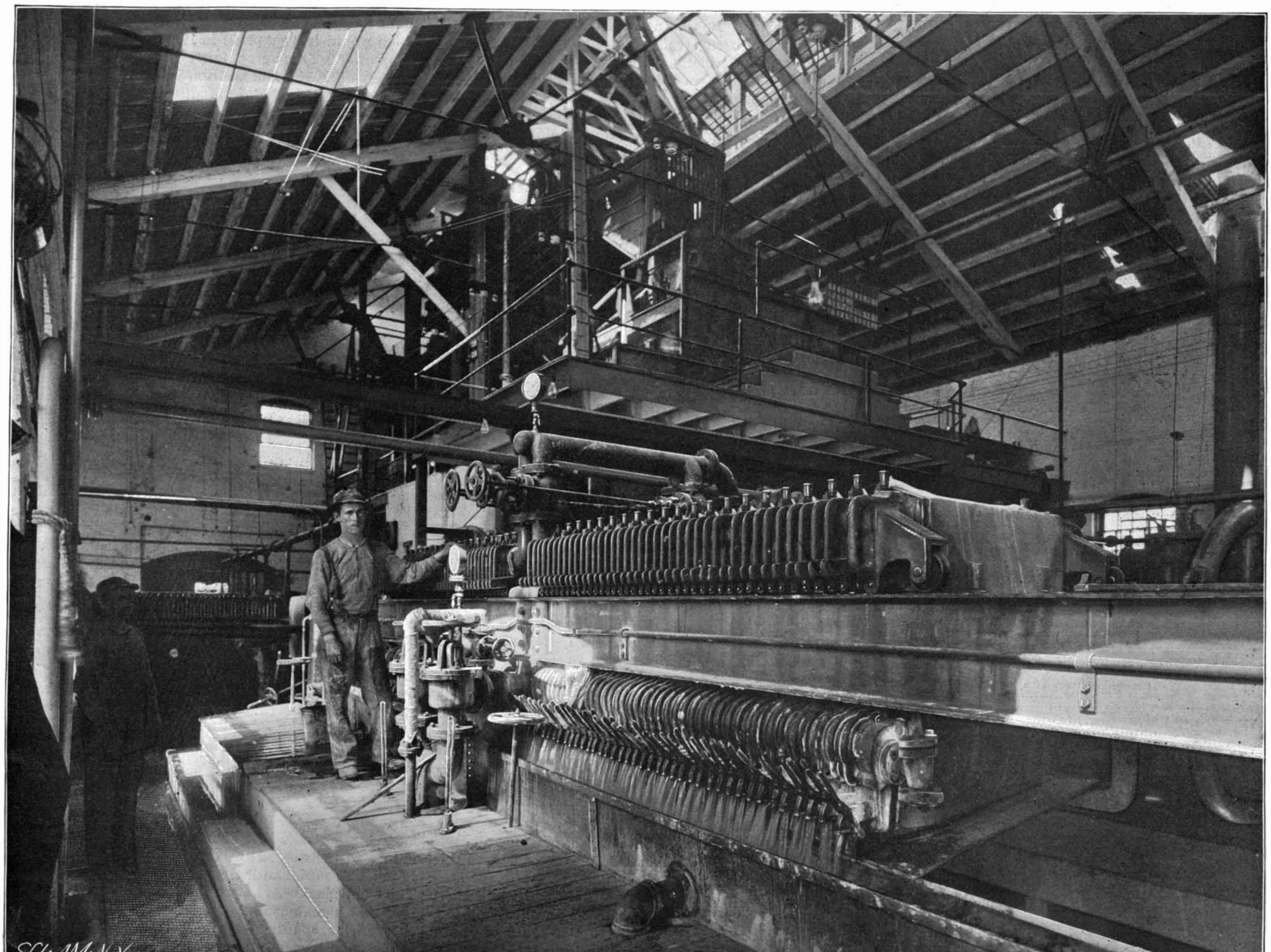

THE FILTER PRESSES—BEET WEIGHING SCALE AT THE REAR.

THE MANUFACTURE OF BEET SUGAR.—[See page 72.]

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THE SUGAR INDUSTRY IN THE UNITED STATES.

There is every indication that during the next few years the beet sugar industry is destined to occupy a very prominent place among the great industrial and commercial questions of this country. The present unsatisfactory condition of agriculture, our present enormous and ever increasing imports of one of the staple products of agriculture, and the legislation by which the present government is seeking to assist the one and reduce the other, render the question of beet farming and beet sugar manufacture a subject of vital concern to every citizen who has the interests of his country deeply at heart.

The statistics of the sugar industry for the year 1896 show that the total consumption of sugar in the United States amounted to 2,093,819 tons, equal to a per capita consumption of 63 pounds. Of this amount 1,739,313 tons were imported from abroad and 354,506 tons represent domestic production—that is to say, for one ton of sugar manufactured in the United States we brought in five tons from other countries. The statistics of the past sixteen years show that the total consumption during that period was 25,182,649 tons, of which 2,673,000 tons, or only one-tenth, was produced in the United States. During this period we paid out for this imported sugar about fifteen hundred million dollars, or in other words we have paid to foreign countries an average yearly tribute for the past sixteen years of about one hundred million dollars. These figures become yet more significant when it is remembered that sugar has declined in value during this period from 7·58 cents to 2·92 cents per pound and that our per capita consumption is from two to three times as much as that of other sugar-producing countries. Of the 1,739,313 tons imported into this country over one-fourth, or 500,000 tons, came here in the shape of brown or raw German beet sugar. This, and indeed all the imported raw sugar, whether from cane or beets, is purchased by the American Sugar Refining Company and other firms of less note, who refine it and put it on the market as standard granulated sugar.

Of the two sources of sugar, sugar cane and sugar beets, the former is the older and better known. It is said that it was the blockade of France during the Napoleonic wars that turned the attention of the French people to the culture of the sugar beet, and that to this emergency Europe owes its present sugar beet industry. Be that as it may, the growth of the industry has been steady, and in recent years truly phenomenal. Germany, which in 1884 produced 1,147,000 tons of beet sugar, in 1894 produced 1,800,000 tons, an increase of 57 per cent. Austria-Hungary in the same decade raised her production from 653,000 tons to 1,050,000 tons, a gain of 61 per cent, and in France the increase has been from 303,000 tons to 814,000 tons, a gain of 163 per cent—the increase for the whole of Europe during the same period being 78 per cent, and the production reaching the great total of 4,792,000 tons.

The question naturally arises: Is there any difficulty of soil or climate which at once renders us dependent upon these countries for our own supply and prevents us from taking part in this vast and profitable industry? To which it must be answered that no such difficulties exist, inasmuch as there is a broad belt of country reaching in a continuous line from the Atlantic to the Pacific, several hundred miles wide and over three thousand miles long, which is admirably suited to the growth and harvesting of the sugar-producing root. It has been found that beets grow best in a temperate climate, and the richest and most reliable crops are obtained in regions where the average temperature during the months of June, July and August is about 70 degrees Fahrenheit. Very valuable information on this subject has lately been given in pamphlet form by Prof. H. W. Wiley, Chief of the Division of Chemistry in the United States Department of Agriculture. It is shown that the sugar beet belt, following the isothermal line of 70 degrees Fahrenheit, commences near the city of New York, passes up the Hudson River to Albany and then turns to the left, following the southern shore line of Lake Erie. It then swings up into Michigan, passing to the south of Lansing; and curving to the south through Chicago, it passes up through northeastern Illinois and southwestern Wisconsin into Minnesota. Here it turns due west and runs into central South Dakota, where it takes a sudden turn to the south, passing in a general southerly direction through western Nebraska and eastern Colorado and New Mexico to near the southern boundary of the latter State. Here it curves broadly to the west, passing through Arizona to its western boundary, where it runs north again in a long and narrow loop through Utah and Idaho, the northern turn of which is near Boise City, Idaho. It returns thence through Utah and southeastern Nevada to southern California, where it runs north in another long loop whose northern extremity is to the south of Mount Shasta, the line finally terminating at the Mexican border. Now, while the sugar beet belt is theoretically supposed to extend for one hundred miles on each side of this line, experimental work has shown that sugar beets can be raised successfully in many localities which lie well outside of this limit. Mr. Herbert Myrick, who should speak with authority, draws the northern boundary of the belt from Troy, N. Y., through Lake Ontario, central Michigan, central Wisconsin and Minnesota, northern North Dakota and Montana, terminating it at the western end of the border line between the latter State and Canada, thus including the whole of Washington and Oregon. The same authority draws the southern boundary of the belt through Virginia, Tennessee, western Kentucky, southern Illinois, central Missouri, southwestern Kansas, and western Texas to the Mexican line. If the mean between the two hundred mile strip and the broader belt above indicated be taken as representing the area over which the sugar beet crop can be successfully raised, it is evident that the United States could not only supply the $100,000,000 worth of product which is now brought in from abroad, but could take a leading position in supplying the markets of the world.

A soil, loamy and not too stiff, abundant sunshine, a moderate amount of moisture and favorable weather during the period of ripening and harvesting are the elements which constitute a good sugar beet country, and whenever these have been present the experiments which have been made in beet culture have met with encouraging success. To render the cultivation of beets profitable, however, it is necessary that the beet farm should be within easy reach of a beet factory, for it is evident that the amount of profit realized by the farmer will vary, other things being equal, as the distance which his crop has to be hauled. In the present issue we give a detailed description of one of the large and successful establishments which have served to demonstrate that our soil, climate and methods are adapted to the production of beet sugar on a large scale. This factory began operations in 1891, when 1,800 acres of beets were grown, which yielded 7·26 tons of beets to the acre, the farmers being paid $3.90 per ton for the crop and the average return per acre being $28.37. In 1895, the acreage under cultivation had increased to 7,528, and the yield had increased from 7·26 tons to 11·03 tons to the acre, the farmers receiving on an average $4.35 per ton for their crop, the average return being $47.98 per acre. During this period, moreover, the average percentage of sugar in the beets had increased from 13 to 15 per cent. The cost of raising the beets in the Chino Valley is about $30 per acre, most of this being due to labor, which would leave a profit in 1895 of $18 per acre to the planter. This agrees fairly well with Prof. Wiley's estimate of a net profit of from $8 to $15 per acre as an average, the California district being peculiarly favorable to a large and reliable crop.

Altogether it must be admitted that the possibilities of this new industry, both for the farmer and the capitalist, are great and not easily overestimated. If the cultivation of the sugar beet and the manufacture of beet sugar can be once widely and firmly established, our farmers will be largely delivered from the anxiety and risks which attach to a "one crop" country, and the country itself will be keeping at home a sum of money equal to the value of our whole export of wheat and flour.

JEOPARDIZING TRADE MARK PROPERTY.

It is strange that a very considerable number of business men should, through carelessness or ignorance, seriously jeopardize this species of property. One of the greatest dangers is unwittingly to give an otherwise valid trade mark a descriptive significance. This occurs when the trade mark is a word which, though it be fanciful in itself, takes on a descriptive value so as directly to convey a meaning descriptive of the goods, their quality, grade, nature or character. This is most likely to occur when the owner has different trade marks for different grades of goods. If such marks do, in fact, designate different grades of goods, they have lost their office as trade marks and may become public property. But this danger may be present with respect to a sole trade mark, as for example: The name "Excelsior" is an ideal trade mark, yet there is the fibered material, akin to shavings, which, as a stuffing for mattresses and upholstery, is much sought after, and this material being properly described as excelsior, the name is free to the public. This because the originator failed to assert his trade mark rights, and, indeed, gave the descriptive quality to the name. He should have registered the trade mark in the Patent Office, marked the name "Trade mark," and should not have described his goods merely as excelsior.

Another result of not registering, but relying merely on common law protection: We have in mind one or two notable trade marks lost to the originator by failure to register. It will answer to call one the Lion brand. The originator thought a red lion very proper. The trade mark was not registered, and so it came to pass that ingenious imitations in different parts of our enterprising country eventually became as numerous as the great Barnacle family and more discriminating, until, like old country inns, we had the blue lion and the white lion and lions piebald; lions rampant and lions courant; lions passant and lions couchant and their kindred. To the complaint of the originator, it was asserted that his trade mark was distinctly a red lion, and that he was trying to broaden it to take in other men's property. Testimony pro and con was as plentiful as at a modern trial for heresy and equally as determinate. The originator could have cleared the air had he registered before others adopted resembling marks, and had defined the one essential feature of the lion, with or without improvements on nature and with or without reference to posture.

Therefore, register all your trade marks, register each distinct feature of each mark separately, and do not make a trade mark describe the goods to which it is applied, or the object is defeated.

THE LATEST PERFORMANCE OF THE TURBINIA.

It was only a few years ago that we were looking forward to the day when some naval architect and engineer would give us a vessel capable of steaming at a speed of twenty miles an hour. So swift has been the development of marine engineering that to-day there exists a bona fide steam vessel that has been run at just double that speed, or, to be exact, at the rate of 40⅓ miles per hour. At the time of our last notice of this phenomenal little craft, we were informed by Mr. Parsons, the designer of her engines, that the turbines had never demonstrated their actual power, for the reason that the main steam pipe had proved to be too small to supply steam as fast as the turbines could take it.

Judging from reports in the English technical press, this defect has evidently been made good and the motive power tuned up to working pitch; for it seems from the statement of Sir George Baden Powell, who was on board the Turbinia as she steamed down the ines of the fleet at Spithead, that she reached a speed of 34 knots. In a letter to Engineering, Mr. Parsons states that during a recent trial the turbines indicated 2,400 horse power and gave the boat a speed of 35 knots an hour. This is equivalent to 40⅓ miles an hour, or well up to the speed of the average passenger train. As a mere question of speed, this is a phenomenal performance, and it is not likely that it will ever be reached by a boat driven with an engine of the reciprocating type; but the wonder of it is increased when Mr. Parsons goes on to say that it was done on an expenditure of 14 pounds of steam per indicated horse power. When we bear in mind that the best type of Corliss compound engine working under favorable conditions will consume not less than 18 pounds of steam per indicated horse power, the high economy of the compound turbine will be appreciated.

At the same time it must be admitted that one could wish for more exact details of these runs. The speed is given in round numbers that suggest rather careless or crude timing. Sir William White, chief constructor of the British navy, has suggested that some builder of torpedo boats, like Yarrow or Thornycroft, should first run a boat with a set of his own engines and then substitute a set of Parsons turbines, with a view to determining their relative efficiency. Such an experiment, if carried out at considerable length, would settle the question as to the economy and practicability of the turbine for this class of service.

PNEUMATIC TUBE MAIL SERVICE FOR NEW YORK CITY.

Some thirty years ago the late Alfred E. Beach, of the SCIENTIFIC AMERICAN, exhibited in this city a working plant for the carriage of mail matter rapidly from branch stations to a central office by means of pneumatic tubes. He also experimented successfully on the idea of conveying loose letters in a smooth tube by a strong current of air, regarding it as an improvement over the old plan of having separate cars. The idea is in practical use to-day in the many mail chutes found in tall buildings, where gravity supplants air as a propelling force. Now, a generation after, a similar system is to be carried out in this city, permission having been granted by the Legislature to the United States postal authorities to lay pneumatic tubes in our streets connecting the General Post Office with a branch post office in the Produce Exchange building, in lower Broadway, and by a route west from the Post Office, through Mail Street and Park Place, thence south through Church Street, Greenwich and Whitehall Streets.

Another line, the longest and most extensive, is to connect the large branch Post Office H, Forty-third Street and Lexington Avenue, with the General Post Office, having loops entering the intermediate Branch Stations, D, F, and Madison Square.

Another projected line is from the General Post Office via the Brooklyn Bridge to the Brooklyn Central Post Office.

The distribution of local mails will thus be rapidly effected and much time saved by these proposed facilities, creating a service that will be appreciated by the public. Contracts have been awarded for the construction and equipment of the tubes, and the work of laying them is to be begun early the coming fall.

A. B. Fry, Chief Engineer of the Treasury Department, has prepared and finished the plans for the new system. It is similar to the pneumatic tube service used by the Western Union Telegraph Company in dispatching messages from its branch offices to the main office. Two tubes eight inches interior diameter will be laid parallel with each other, one for sending, the other for returning to the General Post Office. They will be perfectly smooth inside. A pressure of air will be maintained at the end of the line by a suitable air compressor sufficient to cause the carrier to travel through the tube at the rate of thirty miles an hour. On long lines reinforcing air compressing stations are arranged to keep up the pressure, much on the same plan as is used in caissons, etc. The carrier, after being loaded with letters, is put into the tube much in the same way as a bullet is loaded into a gun. The air pressure then propels it forward at a good speed. It is surrounded with rings of packing saturated with vaseline and fits the tube tightly, to prevent the air from passing by.

Each carrier can sustain a weight of thirty pounds, though in practice not more than a third of that is required. The carrier itself is an ingenious contrivance, almost three feet long, with an unusually large cylinder. It opens from one end by a curiously constructed lock, riveted to the inside of the door. When fastened, its compartment becomes thoroughly airtight, having no projections beyond the packing rings, which run out about an inch from the cylinder. The carriers will hold about five hundred letters, or considerably more than are now transported in a single vehicle by this method.

In operation the carrier, on reaching the end of the route, is gradually arrested by compression, and, striking a trigger, the door at the end of the tube is opened and the carrier is discharged, or lightly falls upon a flat receiving table. The carrier is then opened, and the packages of mail matter which it contains are assorted, stamped and delivered. Carriers can be dispatched rapidly one after the other, on a headway of but a few seconds.

So much progress has been made in the use of compressed air that it is surprising its application to the propulsion of mail matter is now only about to be accomplished. We shall watch with interest the development of this new agency for the rapid transmission of mails, and are sanguine of its ultimate benefit and success.

THE HEAVENS FOR AUGUST.

BY WILLIAM R. BROOKS, M.A., F.R.A.S.

THE SUN.

The right ascension of the sun on the first of the month is 8 h. 48 m. 20 s.; and its declination north 17 deg. 50 m. 55 s. The right ascension of the sun on the last of the month is 10 h. 40 m. 33 s.; and its declination north 8 deg. 23 m. 4 s.

MERCURY.

Mercury is evening star, reaching its greatest elongation east of the sun on August 26, which will be the best time to look for Mercury. Its elongation amounts to 27 deg. 18 m., and it occurs only four days after the planet is in aphelion.

Mercury is at its descending node on August 12, at 9 hours.

On August 13, at 1 hour, Mercury is in conjunction with Jupiter, when Mercury will be 1 deg. 14 m. south of Jupiter. On August 30, at 1 h. 35 m., Mercury will be in conjunction with the moon, when the planet will be 1 deg. 50 m. north of the moon.

The right ascension of Mercury on the fifteenth of the month is 11 h. 15 m. 23 s.; and its declination north 4 deg. 17 m. 5 s.

VENUS.

Venus is morning star. Having reached its greatest elongation from the sun in July, it is now slowly moving toward the sun, but will remain a conspicuous object in the morning sky for some time.

On August 24, at 1 h. 24 m., Venus is in conjunction with the moon, when the planet will be 2 deg. 31 m. south of the moon.

On the first of the month Venus rises at 1 h. 42 m., and crosses the meridian at 9 o'clock A. M. On the last of the month it rises at 2 h. 13 m., and crosses the meridian at 9 h. 25 A. M.

The right ascension of Venus, on the fifteenth of the month, is 6 h. 51 m. 22 s.; and its declination north 21 deg. 16 m. 10 s.

MARS.

Mars is evening star. On August 1, at 11 h. 15 m., Mars is in conjunction with the moon, when the planet will be 4 deg. 41 m. north of the moon. Also, on August 30, at 2 h. 18 m., Mars will again be in conjunction with the moon, and 5 deg. 32 m. north thereof.

On the first of the month Mars crosses the meridian at 2 h. 23 m., and sets at 8 h. 47 m. P. M. On the last day of the month Mars crosses the meridian at 1 h. 35 m., and sets at 7 h. 35 m. P. M.

The right ascension of Mars on the fifteenth of the month is 11 h. 37 m. 18 s.; and its declination north 3 deg. 16 m. 19 s.

JUPITER.

Jupiter is also evening star, and on account of its rapidly approaching conjunction with the sun, should be looked for soon after sunset.

On August 1, at 5 h. 40 m., Jupiter is in conjunction with the moon, when the planet will be 4 deg. 36 m. north of the moon. Jupiter will be again in conjunction with the moon on August 28 at 11 h. 21 m., with the planet 5 deg. 2 m. north of the moon.

The conjunction of Mercury and Jupiter on August 13 has already been noted in the section on Mercury.

On the first of the month Jupiter crosses the meridian at 2 h. 12 m., and sets at 8 h. 40 m. P. M. On the last of the month Jupiter crosses the meridian at 37 m. past noon, and sets at 6 h. 58 m. P. M.

The right ascension of Jupiter on the fifteenth of the month is 11 h. 4 m. 42 s.; and its declination north 7 deg. 3 m. 1 s.

SATURN.

Saturn is in the southern evening sky, and, except for its rather low altitude, is in favorable position for telescopic observation. Work, however, should be begun as soon as it is dusk. On August 16 Saturn is in quadrature with the sun, or ninety degrees east thereof.

On August 25, at 7 h., there will be an interesting conjunction of Saturn and Uranus, when Saturn will be 1 deg. 48 m. north of Uranus.

On August 6, at 10 h. 12 m., Saturn is in conjunction with the moon, when the planet will be 7 deg. 13 m. north of the moon.

Saturn crosses the meridian on the first of the month at 6 h. 46 m. P. M., and sets at 11 h. 47 m. P. M. On the last of the month Saturn crosses the meridian at 4 h. 52 m. and sets at 9 h. 50 m. P. M.

The right ascension of Saturn on the fifteenth of the month is 15 h. 30 m. 10 s.; and its declination south 16 deg. 56 m. 59 s.

URANUS.

Uranus is evening star, and, as indicated by its conjunction with Saturn on August 25, will be found in the vicinity of that familiar planet throughout the month.

Should it happen to be cloudy on the evening of conjunction, Uranus may be readily found for several nights, before and after the conjunction, just below Saturn, say about one and three-quarters of a degree, with the aid of a good moderate size telescope. With a power of one hundred diameters and upward, Uranus may be distinguished from a star by its disk. Even with a much lower magnifying power the planet may with certainty be identified by the painstaking observer, if he will make a careful map of the field the first night and compare it on subsequent nights with the telescopic field of stars. A slight motion of one of these objects, among the stars, would prove it to be Uranus. This would certainly prove a most interesting and helpful piece of telescopic work.

On August 17, at 2 h., Uranus is in quadrature with the sun.

The right ascension of Uranus on the fifteenth of the month is 15 h. 31 m. 1 s.; and its declination south 18 deg. 50 m. 28 s.

NEPTUNE

Neptune is in the morning sky. Its right ascension on the first of the month is 5 h. 24 m. 28 s.; and its declination north 21 h. 51 m. 37 s.

Smith Observatory, Geneva, N. Y., July 19, 1897.

OBESITY.

There is certainly no class of disorders, says Dr. J. H. Kellogg, in Modern Medicine, in which the application of pure medicinal agencies is more clearly futile than in the treatment of obesity. In this disease, as has been clearly shown by Oertel and other European investigators, diet, regimen, and the application of physiological remedies are the only means which can be relied upon for tangible and permanent results. In treating this class of patients, I first restrict the diet, both in quantity and in kind. In some instances I allow the patient to eat almost anything he chooses, provided he eats but one thing. I have secured excellent results by placing the patient upon an exclusive diet of grapes, apples, or some other fruit. A diet of kumyzoon, buttermilk, granose, zwieback, gluten biscuits, but one article being taken at a time, has also proved efficient. When a patient takes but one article he soon tires of it, so he is quite certain not to take too much. If bread is permitted, it must be eaten dry only. It is best taken in the form of zwieback or gluten biscuit. The patient is not allowed to take fluids at meal time, but he may drink at other times as much as he likes.

Next to diet, exercise is the most important matter. The patient should exercise to the extent of decided weariness two or three times a day. Before breakfast, or rather before eating, is the best time for exercise. Walking is, as a rule, not sufficiently vigorous work to reduce the flesh appreciably unless the patient has an opportunity to climb hills. Cold baths, electric light baths, Turkish baths, and other eliminative measures used in moderation are useful, but care must be taken in the use of hot baths, or injury will be done. Hot baths should always be followed by a cool spray or shower, and for many persons the cold shower or spray is to be preferred. It is an excellent tonic, and stimulates the oxidation processes.

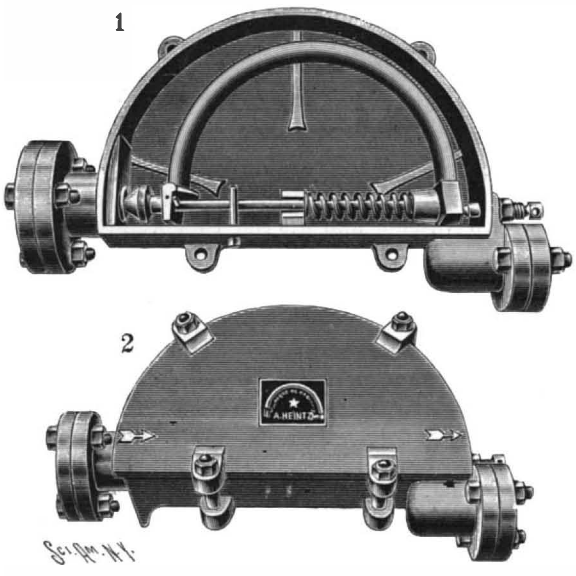
AN EFFICIENT STEAM SAVER.

The illustration represents a steam trap that works the same at all pressures, without regulating, which has no air valves or pet cocks, screws, rotating parts, etc., and which thoroughly and quickly blows out steam pipes when steam is first turned on. The Heintz steam trap has been well known for many years in Europe, where it has been used almost everywhere and has become very popular, but it is comparatively new to steam users in this country, to whom it is being introduced by William S. Haines, sole manufacturer, No. 136-S. South Fourth Street, Philadelphia, Pa. It is entirely automatic in its action, and is applicable to steam pipes, heating pipes, etc., and generally to all industrial appliances in which steam is used as a source of heat or power, being made small, light and compact, without any sacrifice of strength or efficiency. The trap is wide open when cold, and, as will be seen in Fig. 1, the valve is controlled by a curved tube spring which is partly filled with a liquid that, heated by the condensed water passing through when the trap is first put in use, completely fills the tube spring at the moment the temperature reaches 197° F. As the temperature of the water increases, the tube spring rapidly extends its extremities, and by the time a temperature of 212° is reached the valve has been forced tightly into its seat, remaining so until enough condensation has accumulated to lower the temperature 1°, when the valve opens enough to pass this condensed steam off, closing again so quickly, however, that no steam escapes. This operation is so rapid and continuous that a constant flow of water is passing off from the outlet of the trap, but no sign of steam is ever apparent. There is no pressure in the trap when at work, and the trap is blown through and cleared of deposit each time it is worked, all air and water being blown out before the trap closes. If the boiler pressure is much above 100 pounds, it may be necessary to adjust the regulating screw, but the strength of the tube spring is sufficient to close the valve and keep it tight against the pressure of 200 pounds. There is no possibility of freezing of the trap, and when the radiator size is used in steam heating systems there is no pounding or noise. No air valves are necessary, and the control of the steam in each room lies wholly with the occupant, as heat can be turned on in only one room of the entire building without its going into the radiators in other rooms, though all the radiators may be fed by the same supply pipe and drained by the same exhaust, for no steam in any radiator can get beyond the trap attached to it. The manufacturer is in the possession of many records showing material savings in establishments equipped with the Heintz traps, and a recent communication from the Massachusetts Institute of Technology testifies to its perfect working under pressures varying from 100 to 150 pounds.

WATER FILTRATION.

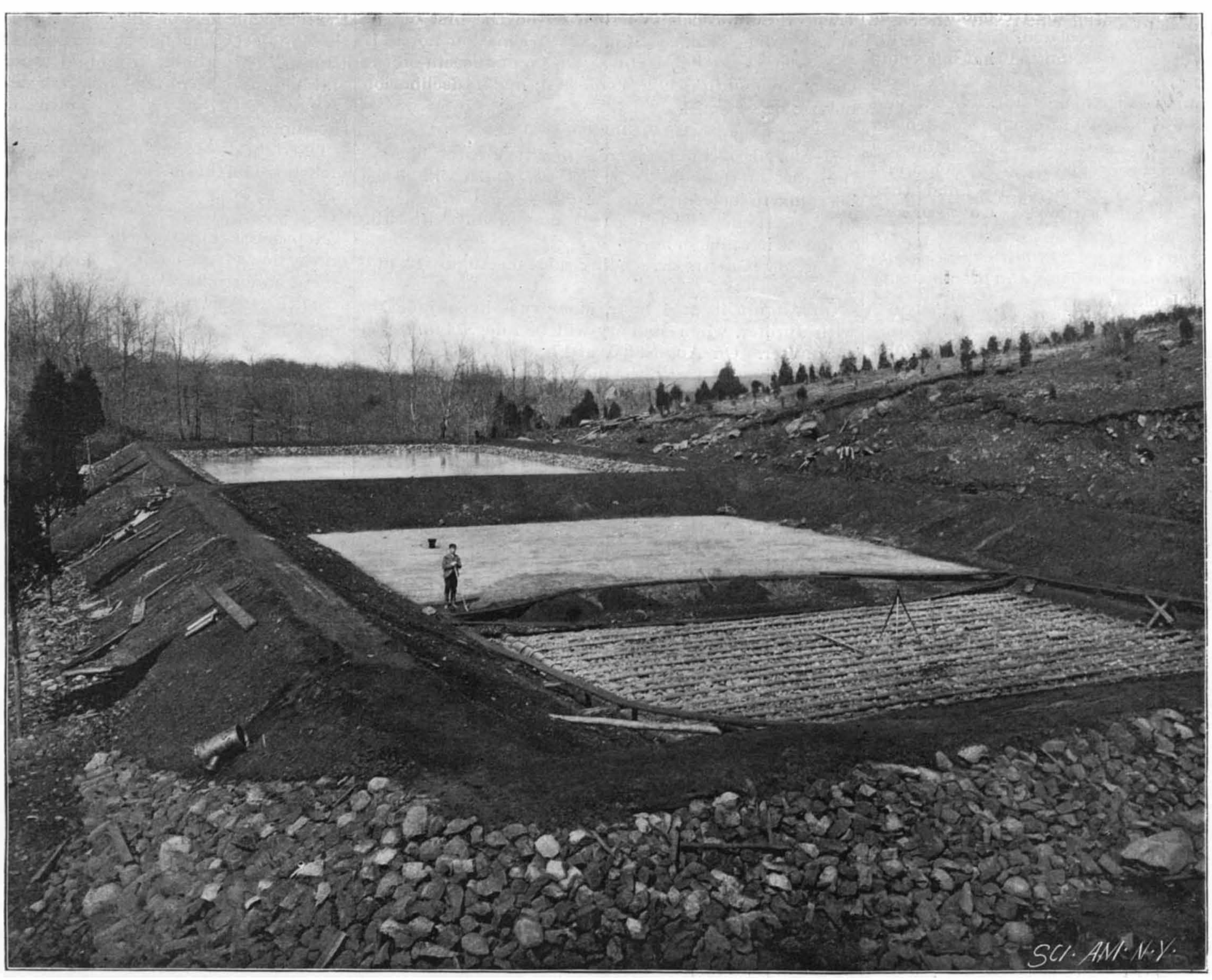
BY CHURCHILL HUNGERFORD, C.E.

The purification of the contaminated water supplies of many European towns and villages has long been effected by passing the water slowly through large beds



THE HEINTZ STEAM TRAP—INTERIOR AND EXTERIOR.

of sand; and though the results attained were extremely satisfactory, both from a hygienic and an æsthetic standpoint, the manner in which the impurities were removed was but slightly understood until the comparatively recent investigations of Koch, Pasteur, and others finally demonstrated that the high efficiency of some of these filters was due mainly to at least three vegetable organisms which infested them. Two of these were found to be very similar to the nitrifying organism that exists in the soil and so ably converts the fertilizers to a form in which the plants can assimilate them. The third surrounds each grain of sand in the surface of the filter bed with a coating of a gelatinous nature, which so effectually fills the spaces between the grains of sand that the most minute particles are able to enter the filter but a slight distance indeed.



METHOD OF CONSTRUCTING FILTER BED AT LAMBERTVILLE, N. J.

While the mechanical or straining office of the filter is greatly promoted by this last mentioned growth, the destruction of the dissolved organic matter, or food of the disease-producing germs, is an equally important feature and a far more complex process. Dead organic matter, whether animal or vegetable, goes through the successive stages of decay (in itself a bacterial process, the deadly ptomaines being sometimes formed) until it has reached the stages known as "albuminoid" and "free" ammonia, the first representing the organic matter on which the bacteria of decay are still working and the second the completed process. The dissolved organic matter in the water of uncovered reservoirs usually exists in both these forms, and its reduction to harmless inorganic salts is the duty of the filter.

The nitrifying organism that infests the filter bed extracts the ammonia from the water in its passage through the sand and converts it into nitrous acid. This product combines with the lime that exists in all natural waters, forming nitrites. These nitrites are again attacked by another similar organism and nitric acid is the result, which, again combining with the base, forms nitrates or the inorganic salts of nitrogen. It frequently happens that even this last product undergoes some obscure change and is entirely eliminated from the water. This, however, is not sought after, as it requires a reversal of the conditions necessary for the support of the nitrifying organism, and as the nitrates have no hygienic significance, the process is considered as having progressed sufficiently far.

In practice, the unfiltered water is maintained on the surface of the sand at a depth of from two and one-half to six feet. The bacteria that exist in the water together with the suspended impurities being unable to enter the sand, on account of gelatinous growth, form a film or slime on the surface of the filter that materially aids in the straining process, by retaining over ninety per cent of the suspended matter in the water that subsequently follows. After entering the sand, the water comes in contact with the nitrifying organism, which converts the dissolved organic matter into harmless inorganic salts and destroys any bacteria that may have penetrated the surface. The water is drawn from the bottom of the filter clear, bright, and sparkling, and practically free from bacteria.

In time the film of impurities on the surface of the sand becomes so thick that not enough water can pass through it to meet the demand, and the filters then require cleaning. This is effected by scraping the film or "blanket," as it is called, from the surface of the filter bed, care being taken to remove as little of the sand as possible; for, thanks to the gelatinous organism, the suspended impurities have been unable to penetrate the surface. The filter is then in condition to run for another period of time, ranging, under the varying conditions, from two weeks to four months. Cleaning costs from fifty cents to one dollar per thousand square feet of filtering surface. The average cost of filtering one million gallons of water in six American filter beds is about one dollar. In waters containing from ten thousand to fifty thousand bacteria per cubic centimeter (about fifteen drops), these filters commonly remove all but fifty or seventy-five and frequently all of the bacteria. Mr. George W. Fuller, biologist of the Massachusetts State Board of Health, says of the Lawrence filters: "Out of one hundred and two analyses, fifty-eight indicated that the filtered water was absolutely sterile." An experience of the writer at the Lambertville, N. J., filter beds, showed the influence of the gelatinous growth in removing the suspended matter. When the filters were first put in operation the turbid water showed only a very slight change after passing through them. As soon, however, as this growth had taken place, the water ran from the filters clear and odorless.

All properly constructed filter beds improve with age, instead of deteriorating, but it is essential that they be so constructed that all the conditions necessary for the inception and growth of the nitrifying organism are rigidly adhered to, as otherwise undesirable bacteria will infest the beds and make the water far worse after than before filtration. The bacteria grow through the bed after the manner of mildew through a bolt of linen. A properly constructed filter bed can be compared to a well cultivated garden, in which the weeds are destroyed and the plants flourish, and a poorly constructed filter to a neglected garden, in which the weeds outgrow and dwarf all other vegetation.

The popular idea regards all bacteria as disease producing microbes. The bacteria are really a microscopic growth of the lowest order of vegetable life, and many of them are essential to our existence. Some, however, are deadly, as the typhoid, cholera and bubonic plague germ; some produce diarrhea, and others impart a very objectionable taste to water or fill the pipes with their growth. Any or all of these that may exist in the water are efficiently removed by the filter, and the immediate reduction of waterborne diseases is testified to by all communities where this method has been adopted.

Government Distribution of Seed.

In the time of Cæsar, largesses of grain were frequently distributed to the populace of Rome, in times of discontent, to smooth the course of ambitious politicians. The fact is brought to mind by the great dimensions which the business of distributing seeds by our Department of Agriculture has attained. Over 20,000,000 packages of field seed and vegetable and flower seed were thus distributed by the government the past spring. In the entire distribution nearly every variety of vegetable known to the agriculturist was distributed. There were 32 varieties of beans, 10 varieties of beets, 23 varieties of cabbage, 11 varieties of carrots, 19 varieties of sweet corn, 18 kinds of cucumbers, 30 kinds of lettuce, 19 varieties of muskmelons, 17 kinds of watermelons, and 15 varieties of onions. The entire amount of seeds distributed was sufficient to plant an area of 355 square miles, or about six times the size of the District of Columbia. The distribution of seed in 1893 amounted to 8,800 packages for each member of Congress, at a total cost of $66,548; in 1894 each Congressman got 16,000 packages, the entire cost to the government being $57,000; in 1895 the number of packages of seeds distributed was the same as in the previous year, but the total cost was reduced to $47,000. In 1896 Congressmen got 15,000 packages each, and the government paid $80,500 for the whole lot. During the past spring each member of Congress has received 40,000 packages of seeds, for which the government has paid $130,000.

THE CURVE AND CROSSINGS AT FIFTY-NINTH STREET AND EIGHTH AVENUE.

EXTENSION OF THE UNDERGROUND TROLLEY SYSTEM IN NEW YORK.

Our readers will see from the accompanying illustrations that the Metropolitan Traction Company has already commenced work on the important improvements which it is contemplating on a large portion of its lines. The work which is being done at the Circle, at the intersection of Fifty-ninth Street and Eighth Avenue, marks the commencement of a costly undertaking which involves the complete rebuilding of over forty miles of the company's lines, the horse cars and light rails being removed and replaced by electric cars and the latest type of underground trolley or conduit road. The lines which are to be immediately reconstructed on the west side of the city are the Eighth Avenue line, from the Harlem River to Fifty-ninth Street, and the Sixth Avenue line, from Fifty-ninth Street to the Battery; and on the east side the Madison Avenue and Fourth Avenue lines, between the Harlem River and the Post Office. In the present overburdened condition of street railroad travel, and particularly of that on the Broadway line, the electrical equipment of two continuous lines on each side of Broadway and Central Park will go far to relieve the congestion in north and south bound travel during the busiest hours of the day.

An important feature will be the crosstown connection at Fifty-ninth Street, on which the new system will be laid down between First and Tenth Avenues, by means of which passengers may travel from upper Madison Avenue to lower Sixth Avenue, and from Eighth Avenue to Fourth Avenue, and vice versa, without change of car. We present two illustrations of the Circle, taken during the building of the conduits and the laying down of the crossings and the connecting curves, which will give a good impression of this important meeting point, at which so many leading thoroughfares of the city intersect. In the view showing the Columbus statue the thoroughfare to the right is Eighth Avenue and that to the left is the commencement of the Boulevard. In the other view we are looking south, and the broad thoroughfare to the left is Eighth Avenue. Although the continuation of the line down Eighth Avenue is not to be undertaken immediately, the crossings are being put in at once. As soon as the work is all completed at this point the whole of the Circle will be asphalted. It should be added that the

THE CIRCLE, FIFTY-NINTH STREET AND EIGHTH AVENUE, LOOKING NORTH.

CONSTRUCTION OF UNDERGROUND TROLLEY LINES IN NEW YORK CITY.

curve that swings around to the left will form the connection between the Eighth Avenue and Fifty-ninth Street lines, and will be used by the cars which will run to the lower city from this point by way of the new Fourth Avenue line.

Our readers will remember that the Metropolitan Traction Company has been operating for many months several miles of underground trolley road on a branch of its system known as the Lenox Avenue line. This was built as an experimental line from which data might be gathered for the construction of the present extensive system, and in order to be prepared for contingencies the conduit was made large enough to admit of the line being changed to a cable road, if the electric system should not give satisfaction. Since the line was first put in operation, in June, 1895, the company has always expressed itself as fully satisfied with its performance, and hence the decision to use the underground system on the new lines was not unexpected.

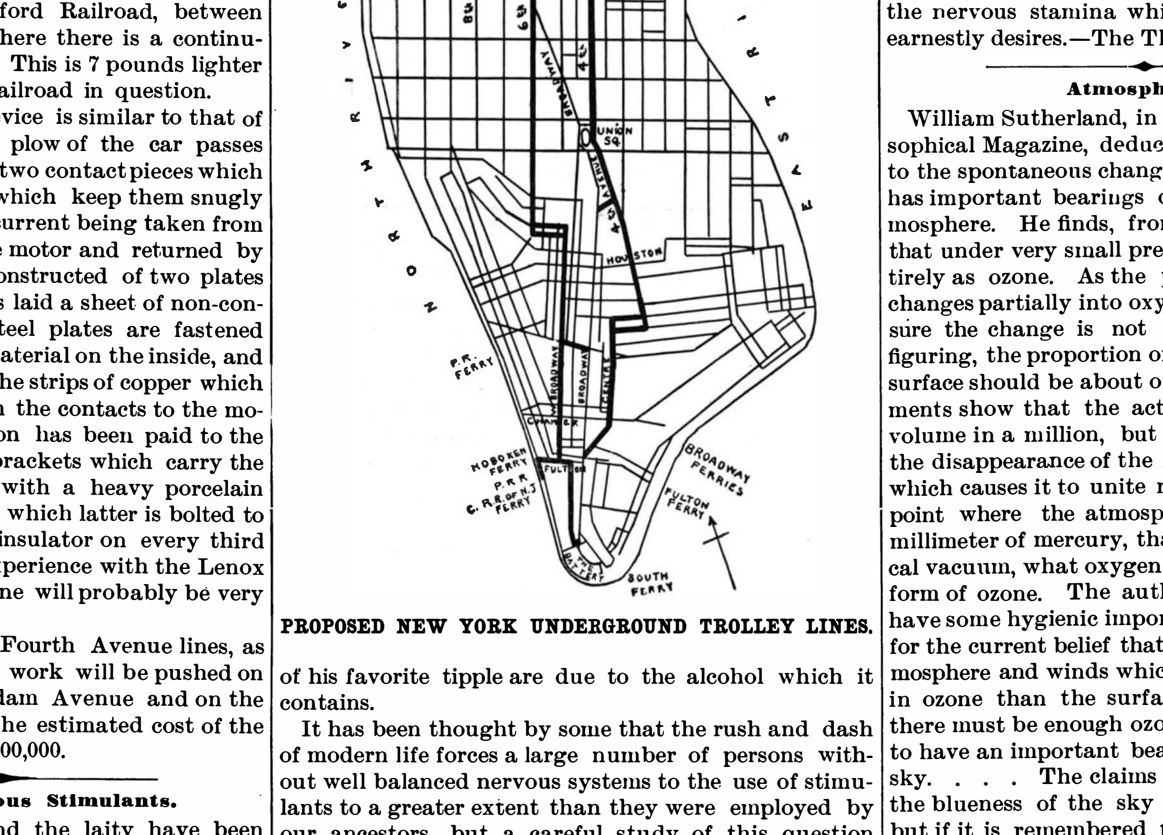
The new conduit, track and equipment will not differ materially from those of the Lenox Avenue line, for a full description and illustration of which the reader is referred to the SCIENTIFIC AMERICAN for February 22, 1896. The conduit, for the reason given above, will be smaller, as will be seen from the accompanying drawing. The yokes, and, indeed, all the metal work, are lighter, and contain many minor improvements in the details. The feed wires are carried in the terra cotta ducts shown adjoining the yokes on the inside of the tracks, and connection is made between them and the conductor rail on the inside of the conduit. The conductors are T-shaped and weigh 21 pounds to the yard, one of these being used for the supply current and the other for the return. The slot rails weigh 57 pounds to the yard and the track rails will be 9 inches deep and will weigh 107 pounds to the yard. This is the first time that a 9 inch rail has been used in New York City, and the rails are probably the heaviest to be found in the track of any regular street or steam railroad. The heaviest rail in extensive use on the trunk railroads of this or any country is to be found on the main line of the New York, New Haven and Hartford Railroad, between New York and New Haven, where there is a continuous stretch of 100 pound rail. This is 7 pounds lighter than the rails on the street railroad in question.

The underground contact device is similar to that of the experimental line. The plow of the car passes through the slot and supports two contact pieces which are carried on spring leaves which keep them snugly against the contact rails, the current being taken from one rail, carried up through the motor and returned by the other rail. The plow is constructed of two plates of steel, upon each of which is laid a sheet of non-conducting material. The two steel plates are fastened together with the insulating material on the inside, and between the latter are placed the strips of copper which serve to carry the current from the contacts to the motor cables. Particular attention has been paid to the question of insulation. The brackets which carry the conductor rails are provided with a heavy porcelain cap cemented into an iron cap, which latter is bolted to the yoke. There will be an insulator on every third yoke, and, judging from the experience with the Lenox Avenue line, the loss on the line will probably be very light.

As soon as the Eighth and Fourth Avenue lines, as outlined above, are completed work will be pushed on an extension through Amsterdam Avenue and on the lower Eighth Avenue line. The estimated cost of the completed system is about $6,500,000.

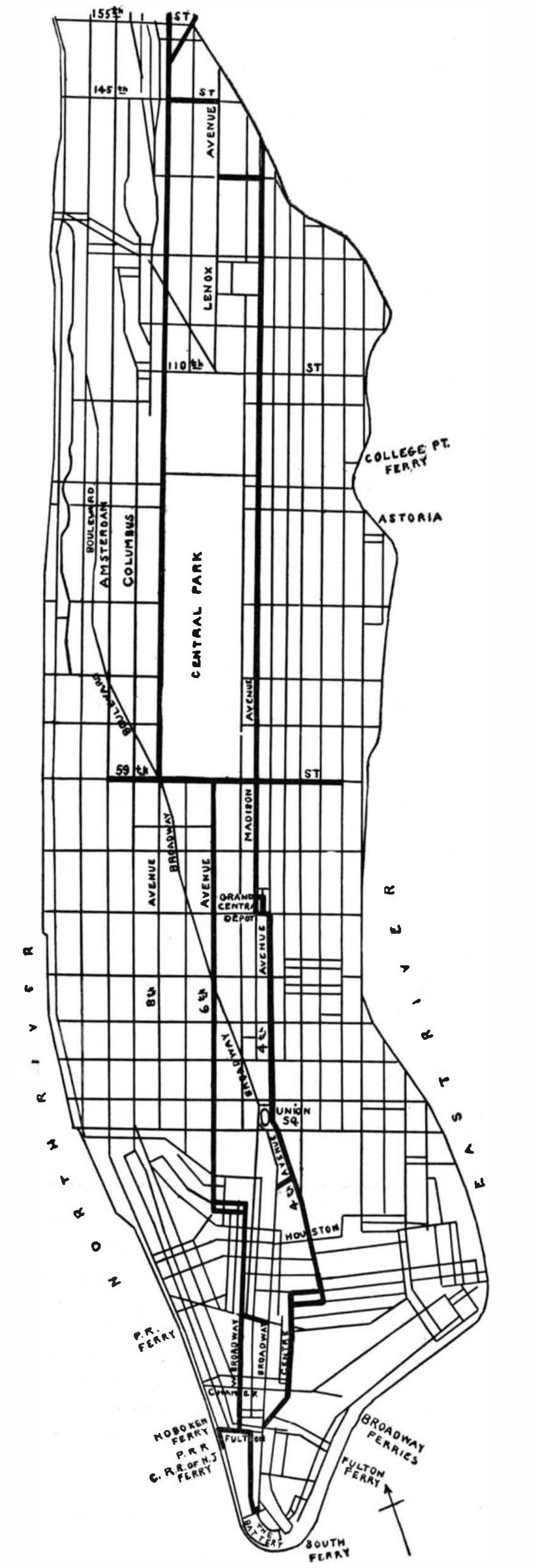
The Abuse of Nervous Stimulants.

The medical profession and the laity have been accustomed for so many years to the abuse of alcohol as a nervous stimulant that some persons have become hardened to the miseries which it induces, while others have been stimulated to its excessive condemnation. As a result of this and of the general desire for stimulating foods or drugs, a very large number of persons have been led to place before the public other powerful nervous stimulants, of which both the medical profession and the laity know less than they know of alcohol, until at the present time there are almost as many consumers of nervous stimulants other than alcohol as there are of those who use alcohol to excess.



CROSS SECTION OF CONDUIT—UNDERGROUND TROLLEY ROAD, NEW YORK CITY.

Further than this, the number of these substitutes is daily increasing, and in many instances unprincipled venders are fortifying comparatively innocent and mild nervous stimulants, dispensed for common use, with so large a quantity of alcohol added that the patient really becomes addicted to the alcohol habit while thinking he is simply using an innocuous drug; he thinks he is taking coca, kola, or some similar stimulant, when in reality most of the temporary changes for the better which he notices after a dose



PROPOSED NEW YORK UNDERGROUND TROLLEY LINES.

of his favorite tipple are due to the alcohol which it contains.

It has been thought by some that the rush and dash of modern life forces a large number of persons without well balanced nervous systems to the use of stimulants to a greater extent than they were employed by our ancestors, but a careful study of this question would seem to indicate that this is untrue, and that for many hundred years the human race, in some of its parts at least, has been accustomed to use and abuse nervous stimulants, for the same purpose as we use and abuse them to-day.

Unfortunately, many physicians, in their endeavor to relieve symptoms temporarily, and ignoring the underlying causes of the affections from which their patients suffer, are too ready to employ many of the preparations we have named, not only giving them to their patients, but using them themselves. The object of this note is not, however, to direct attention to these preparations or to the evil effects which they produce, but rather to make clear the fact that all of them are but temporary makeshifts which in the end, in the vast majority of cases, materially increase the discomfort and the ill health of the person who takes them.

The abuse of these remedies by the profession is not so much the result of ignorance as of carelessness. There is no drug yet discovered, so far as we know, unless it be alcohol, which distinctly adds force to the body when it is taken. All of the so-called "strengthening remedies," which enable a man to accomplish more work when he is under their influence, do this not by adding units of force to his body, but by utilizing those units of force which he has already obtained and stored away as reserve force by the digestion of his food. Kola, coca, excessive quantities of coffee and tea, and similar substances, while they temporarily cause nervous work to seem lighter, only do so by adding to the units of force which a man ought to spend in his daily life those units which he should most sacredly preserve as his reserve fund. The condition of the individual who uses these remedies when tired and exhausted, with the object of accomplishing more work than his fatigued system could otherwise endure, is similar to that of a banker who, under the pressure of financial difficulties, draws upon his capital and reserve funds to supplement the use of those moneys which he can properly employ in carrying on his business. The result in both instances is the same. In a greater or less time the banker or the patient, as the case may be, finds that his reserve fund has disappeared and that he is a pecuniary or nervous bankrupt.

Even the advertising boards and the fences of the cities, towns and country now contain advertisements which mislead the ignorant into the idea that, by using the drugs named thereon, they will actually increase the development of their muscular power, when in reality the final result of such a course must be to decrease the nervous stamina which the would-be athlete so earnestly desires.—The Therapeutic Gazette.

Atmospheric Ozone.

William Sutherland, in a recent paper in the Philosophical Magazine, deduces an important law relating to the spontaneous change of oxygen into ozone, which has important bearings on the constitution of our atmosphere. He finds, from theoretical considerations, that under very small pressure oxygen should exist entirely as ozone. As the pressure increases, the ozone changes partially into oxygen, but even at a high pressure the change is not complete. According to his figuring, the proportion of ozone in the air at the earth's surface should be about one volume in 7,000. Measurements show that the actual proportion is about one volume in a million, but Mr. Sutherland accounts for the disappearance of the rest by its chemical activity, which causes it to unite readily with metals. Above a point where the atmospheric pressure is about 0·715 millimeter of mercury, that is, where there is a practical vacuum, what oxygen there is, is completely in the form of ozone. The author says: "These deductions have some hygienic importance, and explain the reason for the current belief that the higher regions of the atmosphere and winds which come from them are richer in ozone than the surface air; they also show that there must be enough ozone in the whole atmosphere to have an important bearing on the blue color of the sky. . . . The claims of ozone to a serious share in the blueness of the sky have been rather neglected; but if it is remembered that the blueness of ozone is enormously stronger than that of oxygen under the same conditions, it becomes apparent that the quantity of ozone which has been theoretically shown to have a probable existence in the atmosphere must exercise a considerable influence on the color of the sky and the color of distant objects."

The New Register of Copyrights.

The Hon. John Russell Young, Librarian of the Congressional Library, at Washington, has appointed Thorwald Solberg, of Boston, Register of Copyrights. This, next to the Chief Assistant Librarian, is the most important place on the staff of the new library. Mr. Solberg is a native of Wisconsin and was born in 1852. Mr. Solberg has served in the Library of Congress for thirteen years, and eight years ago he was selected by the Boston Book Company to take charge of one of its important departments.

Bursting of a Fly Wheel in the Tacoma Railway Company's Power House.

BY A. M'L. HAWKS, C.E.

At 1 P. M. on Sunday, July 11, an accident occurred to an engine in the power house of the Tacoma Railway Company, resulting in the bursting of the big fly wheel and the practically total destruction of the engine of which it was a part.

The initial source of the trouble was the breaking of one of the small brass arms on the governor which holds up the sliding collar. This disabled the governor, and thus the regulation of steam to the engine was destroyed, which immediately set the engine to racing. The engineer in charge of the power house ran at once to cut off the valve and attempted to shut off the steam by means of the hand wheel. When he had closed this valve about half way, finding that he had not only not reduced the speed of the engine, but that it was constantly gaining, and also being terrified by the whipping of the belt (which connected the fly wheel with the driving pulley on the line of shafting, and beneath which he had to stand to manipulate the hand wheel), which had become considerably frayed, owing to the extreme tension put upon it by the racing engine, he abandoned this task and sought safety in flight. The manager of the company and the secretary were in the office adjoining the engine room. Hearing the noise, they hastened to the engine room to attempt to aid the engineer in his task of controlling the engine. But, seeing the peril of their position, so near the wild engine, they also fled from the building. As they emerged, a report like the sound of a cannon came from the engine room. The walls immediately in front of the engine were burst outward; the roof, together with some cross arms, wires, etc., was thrown into the air, and steam, brick, iron and lime dust covered the immediate region of the engine.

The fly wheel of the engine, which was a segmental pulley, weighing 40 tons, 25 feet in diameter, 4 feet 8 inches across the face, the rim having a thickness of 2½ inches, reinforced with two ribs, 1 inch by 6, was found to have exploded into over twenty pieces. One piece, weighing about 100 pounds, was thrown a distance of over 400 feet. Several pieces, weighing from 150 to 500 pounds, were thrown more than 250 feet. Several pieces of 500 pounds weight or over were thrown directly upward through the joists and double flooring of the ceiling overhead, and the rafters and double thickness of roofing, and, returning through the same coverings, landed in the power house within 10 feet of the original fly wheel. The lower portion of the wheel seems to have flown tangentially forward, striking against the masonry surface of the wheel pit, and considerably battering the same. A few stray pieces flying through the power house destroyed the driving pulley on the line of driven shafting, and injured the dynamos to a small extent. On the hub of the fly wheel there was not left a piece of any arm longer than a foot in length; the engine shaft was torn from its bearings; one of the teeth on the clutch on the engine shaft, engaging with a smaller engine in an adjoining room, was torn out; the piston rod of the racing engine was bent near the crank pin to an angle of 30 degrees; the connecting rods to the valves were bent and twisted beyond recognition; and, practically, nothing but the steam chest remains in place.

Fortunately for the smaller engine, which was engaged on the main shaft with the one destroyed, and which for a time acted as a balance, keeping down the speed of the racing engine, one of the bolts holding down the pillow block bearing near the clutch gave way, which, in turn, brought a strain on the clutch, breaking out the tooth, and in this way it became disengaged, and no further harm was done.

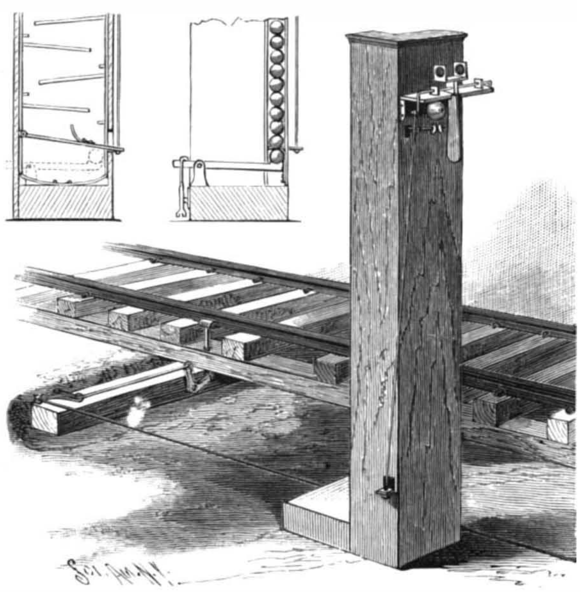
One of the curious phenomena of this explosion was the way in which the pieces traveled. Some pieces came directly through the front of the building, rising at an angle of thirty to forty-five degrees; another part rose vertically through the roof, and a third portion flew almost horizontally forward in the wheel pit. Probably not more than ninety degrees were covered by the flying missiles. The strain upon the rim of this wheel must have been very great, as, in one instance, a piece of about 2 feet of the circumference of the wheel by 4 feet 8 inches wide, coming from between the arms, not pierced by bolt holes and showing no signs of flaw, was torn out and thrown aside by itself. This piece, with its reinforcements, shows on its two faces of fracture over 300 square inches of good, clear grained cast iron. Taking the tensile strength of cast iron at 30,000 pounds per square inch, it will be seen that it must have required an energy of several million pounds to effect this destruction.

The exploded engine was one built by the Frick Engine Company, of Pennsylvania, and was rated by the builders at 750 horse power with 80 pounds of steam, but had been run at times under a load of 850 to 900 horse power. At the time of the accident it was running under a little more than normal load, due to the Sunday excursion business of suburban lines.

This accident will point out the necessity of a means of regulating such machinery, not only by the governor and the hand wheel cut-off valve, but also by some means whereby, from a safe distance from the danger of flying pieces of the engine or fraying belts, the supply of steam can be easily regulated.

AN IMPROVED RAILROAD CROSSING SIGNAL.

A device designed to signal the approach of a train by ringing a bell and exhibiting visual signals is represented in the accompanying illustration, and has been patented by William S. Woods, of Sulphur Springs, Ind. The signal box has a vertical ballway so arranged that the descent of a ball therein, as the ball strikes transversely inclined or cross partitions, as shown in one of the small views, will cause a rod at the side to be depressed to sound a bell, the length of time the bell is sounded being governed by the number of cross partitions or baffle plates. An adjacent chamber holds a column of balls resting at their lower ends on a lever, as also shown in one of the small views, the chamber discharging at its upper end into the upper end of the ballway, so that the balls are used in a circuit, each operation of the lever lifting the column of balls one step, and discharging a ball into the ballway. A detent holds up the column of balls from moving back with the lever, and a detent device at the upper end of the ball-holding chamber prevents the balls from passing out too freely. A visual signal is arranged adjacent to a shelf on which a lamp or lantern may be placed, and comprises a shaft on which are secured a semaphore or signal arm and light frames carrying panes of colored glass, the signal arm swinging horizontally and the frames turning inward on opposite sides of the lantern as the signal is operated. The shaft carrying the signal arm is weighted to normally hold the arm horizontally, a position it assumes when released by a detent actuated by a descending ball, the visual signal being then exposed until the ball depresses a tilting bar at the bottom, causing the readjustment of the shaft. The lever by which the signal is actuated



WOODS' RAILROAD CROSSING SIGNAL.

may be operated in any suitable manner by an approaching train. A portion of the track may be arranged to be depressed by a moving train, and such movement of the track may be made to tilt a bell crank lever, connected through other levers and a slide rod with the lever by which the column of balls is elevated.

Photographing Rail Deflections.

In an article about the techical applications of photography by Herr Wilhelm Müller, in the Zeitschr. des Oesterr. Ing. u. Arch. Vereines for February 5, an arrangement is shown for enabling the deflections of rails, bridges, etc., under moving loads, to be photographically recorded. Briefly, says the Engineering Magazine, the apparatus consists of a camera, of which the plate holder is fitted to slide across the back by clockwork, so that a series of successive images may be taken upon one and the same plate at uniform intervals of time. The rail or beam to be observed has attached to it a brilliantly polished bead, which is photographed as a point of light, and the successive images of this point show the deflections. A second lens causes the images of a similar stationary point to be photographed upon the same plate in a line just below, thus furnishing a base line for comparison. The images are so close together that they practically form a continuous line, the deflection images giving an irregular curve showing the movements of the rail, while the spacing of the points upon the base line are clearly enough defined to enable the intervals of time to be noted.

It is, of course, essential that such an apparatus should be mounted upon a very solid foundation, as the least vibration of the camera would be fatal to the accuracy of the record; and the objective used must have great light gathering power, owing to the feebleness of the illumination. The apparatus, as installed in the Nordbahnhofe, in Vienna, is fixed upon a masonry pier, is fitted with a Zeiss anastigmat objective, and has given excellent results in practice.

Science Notes.

Some time ago Prof. Von Holst, of Chicago University, gave an account of the alleged great discovery by Prof. Von Schroen that crystals were organic substances. A letter has just been received in San Francisco from a gentleman who interviewed Prof. Von Schroen in Naples, which throws a different light on the subject. It seems that the professor is studying the process of crystallization, and has taken 2,800 photographs to show the transfer of organic into inorganic matter. It is said that his investigations will probably be of great importance in bacteriology, physics, chemistry and mineralogy.

According to Dr. A. Tschirch, resin, oil, and other secretions are never formed within the cell membrane, but in a special layer known as the resinogenous layer. The septa which occur in the vittæ of Umbelliferæ are the remains of this layer. To the substance of which this layer is composed the author applies the term "vittin." It is of a pectinaceous character, and appears to be identical with the substance of mucilage. In schizolysigenous passages, like those of the Rutaceæ, there is first a caplike formation of the resinogenous layer, followed by a dissolution of the cells and a resorption of the protoplasm.—Sitzber. 68 Versammlung Deutscher Naturforscher u. Aerzte, 1896.

The death is announced of the eminent chemist, Prof. Schutzenberger, who was born in Strasburg and studied medicine there. He began his chemical studies while working for his degree, After having been attached to the chemical laboratory at the Conservatoire des Arts et Métiers, he became assistant director at the Sorbonne Laboratory, head of the chemical department at the College du France, then in 1876 professor in chemistry at that college. In 1884 he was elected a member of the Academy of Medicine. In 1888 he succeeded Depray at the Academy of Sciences. He was the author of works on chemistry applied to animal physiology, on diagnosis and on coloring matters and fermentation.

In an interesting paper in the Transactions of the Botanical Society of Edinburgh (vol. xx, p. 534), Miss M. J. Newbigin gives a detailed account of the various coloring matters of leaves and flowers, which she divides into lipochromes and anthocyans, the former being insoluble, the latter soluble, in water. The authoress states that there is no evidence that lipochromes are in any way derivatives of chlorophyl. She groups them into two classes, eucarotins and carotinins. Anthocyans are probably derivatives of tannins. The theory that their chief purpose is to protect chlorophyl against decomposition in a strong light is scarcely in harmony with some of the conditions under which they are commonly formed, as, for example, in young shoots in spring and in autumn leaves. Etiolin is probably nearly allied to chlorophyl, these two being nearly the only pigments in the vegetable kingdom which contain nitrogen.

The Emperor of Japan has just conferred upon Prof. David P. Todd, of Amherst College, one of the highest honors within his power to bestow. The honor comes in the form of "an imperial saké cup." It is an article of small intrinsic value, but of the greatest importance when its significance is considered. It is of ordinary red lacquer and has no ornamentation, except a gilt imperial crest. In Japan, no article bearing the imperial crest can be purchased. A year ago Prof. Todd was in Japan conducting an eclipse expedition. A new school house had been built at Esashi, and the government tendered to Prof. Todd the use of the school house as a station. Prof. Todd assisted at the opening of the school on the day after the eclipse, and founded a library for the little town. It was in recognition of Prof. Todd's interest in Japanese educational affairs that the Emperor conferred the cup upon him. It is an honor which is very seldom bestowed on foreigners.

The effect of alcohol on mountain climbers is discussed by Dr. Otto Snell in No. 3 of the Mittheilungen des Deutschen und Oesterreichischen Alpenvereins. Last autumn he had a card in the same publication requesting climbers to forward their personal experiences and views to him. He received sixty communications, thirty-seven of which, or sixty-two per cent, condemn the use of liquors, wine, or beer as an impediment rather than an aid. Twelve are for a moderate use of wine, but pronounce against brandy and beer. Three believe in taking along brandy, to be used, however, not as a stimulant, but in case of need as a medicine, or to mix with glacier water. Only five of the sixty expressed their belief that alcoholic drinks are beneficial or harmless to climbers. The general conclusion drawn by Dr. Snell from these answers is that while in exceptional cases alcohol may be harmless, or possibly useful, as a rule great moderation is desirable, while the majority of experts are for total abstinence until after the climb is over, and some even strongly urge abstinence, or great moderation, on the day before the expedition. One of the correspondents expressed his conviction that the bottled drinks taken along by climbers benefit no one but the tavern keepers from whom they buy them.

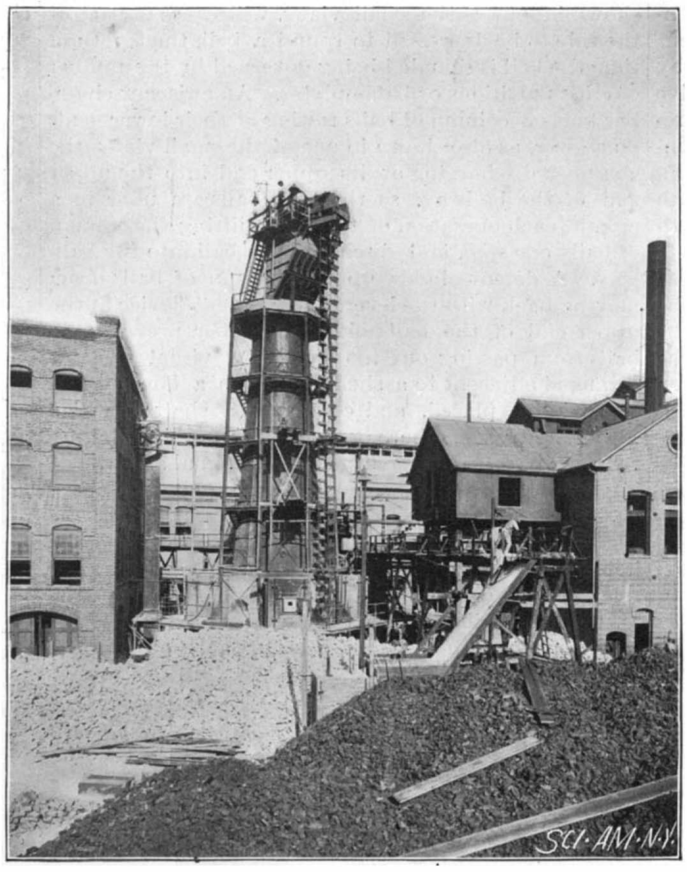
THE MANUFACTURE OF BEET SUGAR.

About midway between Los Angeles and San Bernardino, and well in the center of the famous orange and lemon belt of Southern California, is to be found one of the most promising industrial establishments in this country. It was but a few years ago that the site now occupied by the Chino Valley Beet Sugar Factory and the surrounding beet fields formed part of an extensive stock ranch, but as the result of the decline in the demand for live stock the owner was led some years ago to investigate the quality of the soils for various crops, and discovered that he could raise beets having a high percentage of sugar, and that he could secure a heavy yield of this crop to the acre. This very important discovery led to negotiations which resulted in the erection by the Oxnard Company of the Chino Valley beet sugar factory, which commenced active operations in 1891 and has increased its output steadily ever since. The land in the vicinity is divided up into beet farms of from five to twenty-five acres in extent. These have been purchased from the company on easy terms, and the factory is now the central point in a prosperous community, which has the certain prospect of good crops, convenient market and a steady income.

Before entering into a detailed description of the process of manufacturing sugar from beets, it will be well to draw attention to the fact that contrary to the popular notion that the sugar cane is the source of nearly the whole of the world's sugar supply, it really affords much less than half this amount, more than half or fully sixty per cent of the total being manufactured from the sugar beet. So exclusively has sugar become associated in the public mind with the sugar cane that it is popularly supposed that no other source, such as sorghum, maple trees or beet, can produce the genuine article of the first quality. As a matter of fact the only difference between refined sugar from beets and refined sugar from any other source is in name.

The beet which is used for the manufacture of sugar must not be confused with the common beet with which we are familiar on the dining table, although they have a common ancestry. The sugar beet with its high percentage of saccharine matter is the outcome of long years of careful culture. It is stated that some of the present varieties, which, under favorable circumstances, will produce from fifteen to eighteen per cent of sugar, are instances of what careful culture will do, the same varieties producing a century and a half ago only six per cent of saccharine matter. The improvement of the beet has been carried out on what are known as beet seed farms, of which there are several in Germany and France; and the selection and improvement of the best beets are carried out with a wonderful amount of care and patience. The varieties best known in this country are the Vilmorin Improved and the Kleinwanzleben. The percentage of sugar in the former is about 16, and it will yield from 12 to 16 tons to the acre. The latter is not so rich in sugar, but produces a heavier crop.

From the time the seed is put in the ground to the time when the beets are ready to harvest is from four to four and a half months, the crop which is planted at Chino early in February being ready for harvesting in June. The beets are hauled in wagons from the surrounding farms and are stored in four huge bins or sheds, which have a capacity of 1,500 tons. Between the bins are three elevated driveways for the wagons, and the whole load is dumped into the bins at one operation by lifting one end of a rope net which covers the bottom and is permanently fastened to one side of the wagon. Along the bottom of each flume extends a cement trough, through which a stream of water flows and discharges into the factory. The bins are provided with a sliding bottom, which can be drawn out to allow the beets to fall into the trough, in which they will be floated into the building. A similar flume is arranged alongside the railroad track for handling the beets which are brought in by rail.



THE LIME KILNS.

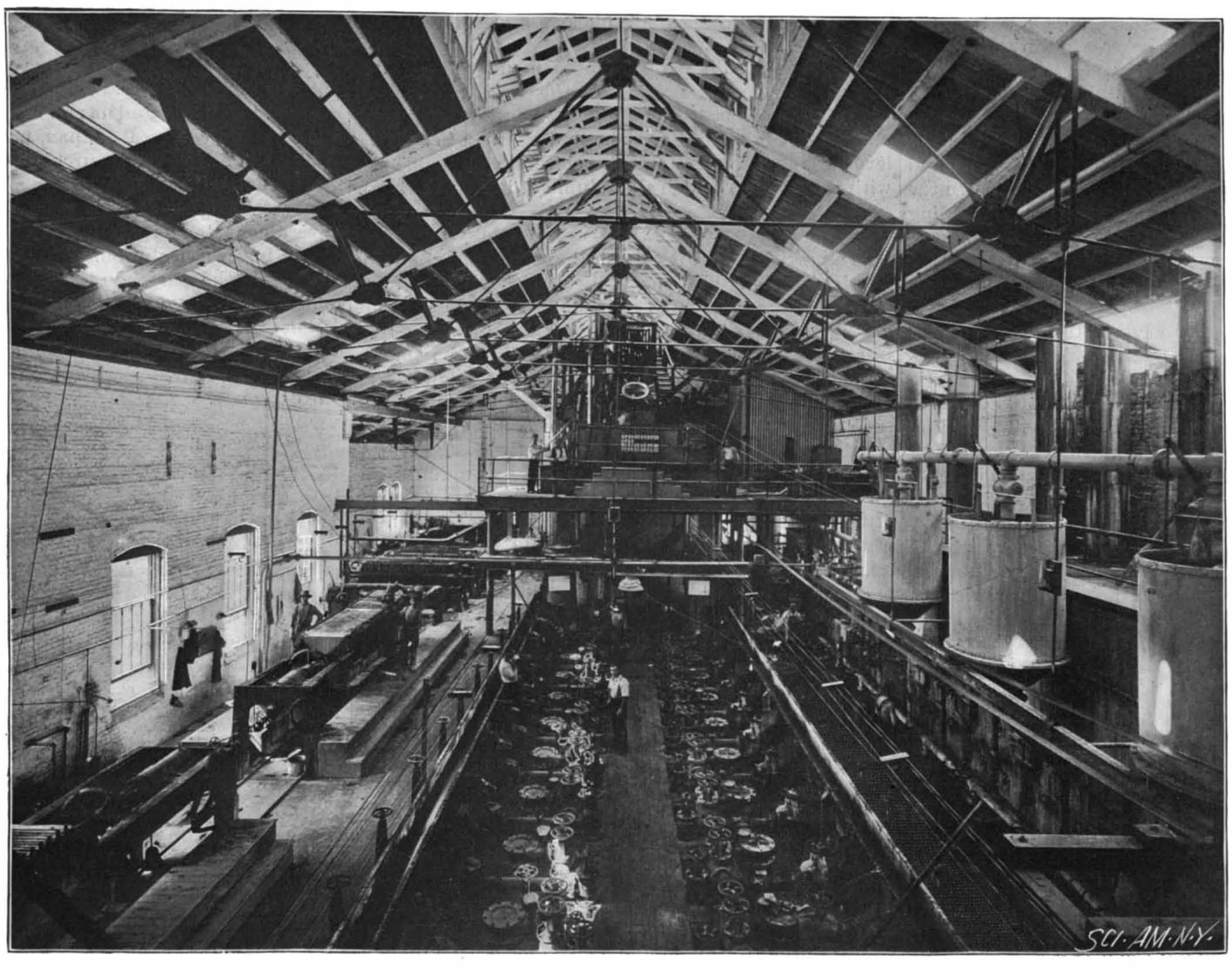
These bins are so constructed that the beets receive full ventilation on the sides and from below; but it is always the aim of the company to use up each day's delivery as it comes, much better results being obtained when the beets are worked up fresh and crisp than when they are run into the factory in a "wilted" or heated condition. The beets are ordered in for daily delivery by the head agriculturist and his assistant in such a systematic manner that the amount brought in is usually a few tons in excess of or below the 800 tons that are worked up in the factory in each twenty-four hours. On floating into the factory the beets are passed into a large trough, where they are freed from the coarser dirt, and then they are carried to the washer, a huge perforated cylinder in which they are spun around and further cleansed.

They are now carried by an elevator to the roof of the building containing the diffusion batteries, etc., and unloaded into the hopper of a large automatic weighing machine, which as soon as it has received a ton of the beets drops them into a slicing machine, in which a number of swiftly revolving, serrated knives cut up the beets into thin and narrow slices which are known as "cosettes." In slicing the beets an effort is made to cut as many as possible of the minute cells in which the saccharine matter is stored. The "cosettes" are now fed into the diffusion battery, which will be noticed ranged down the center of the room below the level of the slicing machine. The battery consists of a series of large vessels in which the juice is extracted from the "cosettes" by passing a stream of water through them. The water passes in at the head of No. 1, is forced down through the mass and passes out through a pipe at the bottom. It is then led to the top of the next vessel, and together with the juices washed out of No. 1, it circulates through the "cosettes" in No. 2. The water with the juices from Nos. 1 and 2 is then drawn off from No. 2 and passes down through No. 3, the process being carried on throughout the whole battery. The solid residue from the battery is then placed in a press, and after it has been relieved of its moisture it is used as feed for cattle.

The juice is now pumped into carbonation tanks, where it is treated with trisaccharate of lime, the lime being precipitated by means of carbonic acid gas. From the carbonation tanks the juice is taken to the filter presses, which are ranged on the opposite sides of the room. These consist of a series of iron frames upon which are hung jute filter cloths. The frames travel upon a pair of steel I beams, and are pressed together by means of a powerful screw. The purified juice passes through the cloths and flows into a side trough, the carbonate of lime and other impurities remaining between the cloths in the form of soft doughlike cakes. A part of this residue is set aside for use as a fertilizer for the next season's crop of beets, and a part of it is placed in transporting scrolls, which deliver it into a drier, from which it is cast into a rotary kiln. Here it is reburned to oxide of lime, and in this form is available for use over again in the carbonating tanks. By this means about two-thirds of the original lime is re-used in the process, a saving of sixty-six per cent of the lime rock.

It should be noted here that the Chino factory is not turning out any molasses; all molasses produced in one day is put through a separate process in which the sugar of the molasses is precipitated by means of powdered lime in the form of a trisaccharate. This trisaccharate is used in place of ordinary lime as a clarifier of the juices of the next day's operations. In this way all sugar of the molasses is returned to the juices, and all the sugar contained in the juices is turned out of the factory as standard sugar ready for the world's markets.

After it has passed through the filter presses, the juice is given a second treatment with lime and carbonic acid gas, and after being treated with sulphur fumes, it is filtered through bags and concentrated in what is known as the "quadruple effect," which is nothing more or less than a set of huge boilers where the surplus water in the juice is boiled off, the "thin juice," of

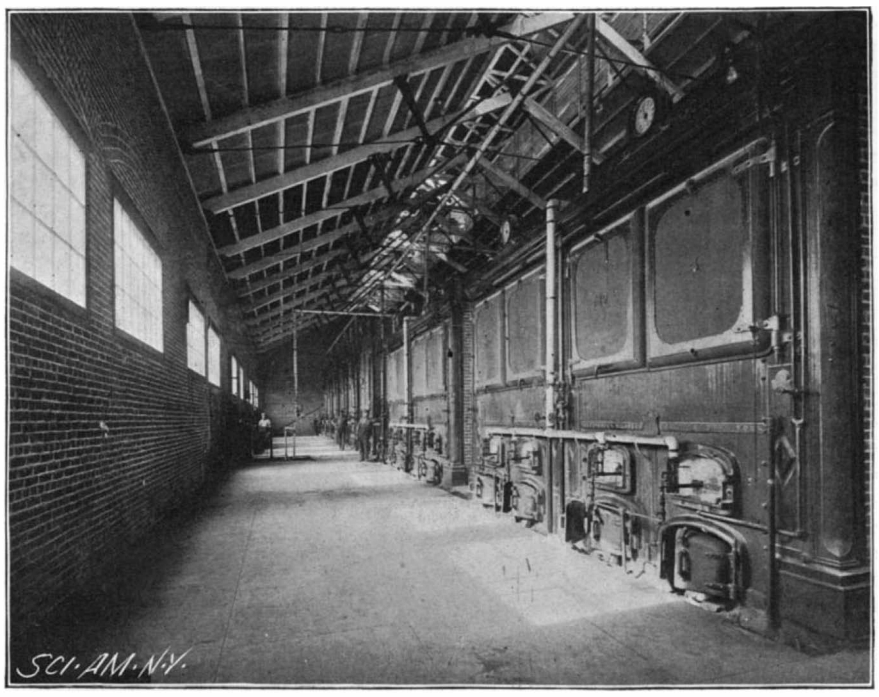


THE FILTER PRESSES, DIFFUSION BATTERIES AND CARBONATION TANKS.

about 12° Brix, being converted into "thick juice" of about 55° Brix. The thick juice is subjected to a further treatment of sulphur fumes and bag filtration, and the sirup is then ready for crystallization in the vacuum pan. This is a large vessel heated by a coil of copper steam pipe in which the sugar is crystallized, these crystals, together with the uncrystallized sugar, forming a pasty mass known as "masse cuite." From the vacuum pan the "masse cuite" is run into the crystallizers, closed cylindrical vessels provided with a cooling jacket and stirring arms and scrolls. Here it is cooled under constant agitation and allowed to remain a certain length of time in order to permit of a further crystallization. It is then dropped into the centrifugal mixer and from this into the centrifugals, which are quickly revolving baskets with perforated walls in which the "masse cuite" is freed by centrifugal force from the adhering sirup, the sugar crystals remaining in the basket. The crystals are then subjected to a series of washings until they acquire a perfect whiteness, after which they are sent through a revolving drum, heated by steam, and "granulated." From the drum the snowy product is passed through sieves and sacked ready for the market.

Before leaving this very interesting subject, it should be noted that the Chino Valley factory and also that at Norfolk, Neb., are at present the only two factories in existence which are able to turn out all the sugar contained in the beet as standard granulated sugar, and to do this without turning out any other sugars, not even molasses.

For the data contained in the present article our thanks are due to Mr. Henry T. Oxnard, the president of the Chino Valley Beet Sugar Company, to Mr. N. R. Cottman, the manager of the factory, and to Mr. W. Baur, of the Oxnard Construction Company.



BOILER HOUSE—OIL FUEL BROUGHT IN BY GRAVITY FROM DISTANT WELLS.

Salvage Appliances.*

Whenever a large vessel was unfortunately sunk, as in the case of the Grosser Korfuerst and the Victoria, all kinds of wild schemes were propounded for the easy salvage of the vessels, no matter what the weight of the vessel might be or what depth of water it was lying in. In the case of the Victoria, sunk in 70 fathoms of water, it had been seriously suggested to freeze, by chemical means, the water inside her; and in the case of the Vanguard it had also been proposed to lift her by enveloping her in a huge canvas sheet and pumping air inside the vessel, thereby expelling the water and raising her to the surface.

Wreck raising might be classed under two heads, namely, theoretical and practical. Among the former was, first, the plan of lifting with air bags placed inside the sunken vessel, which had been successful with a few small vessels, the Prince Consort, paddle steamer of 607 tons gross, sunk at Aberdeen, being the largest. The remainder of the vessels lifted in this way had not exceeded 200 tons, and many attempts had resulted in complete failure. The air bag system would be an excellent one practically, if all vessels were empty or in ballast, which foundered in divable water, and the decks were built to withstand the strain necessary, and there were no projections such as bolts, beams, etc., or frictional movements, such as were set up by tides or currents, causing fatal injury to the air bags, to say nothing of the rapid deterioration of plant of this description.

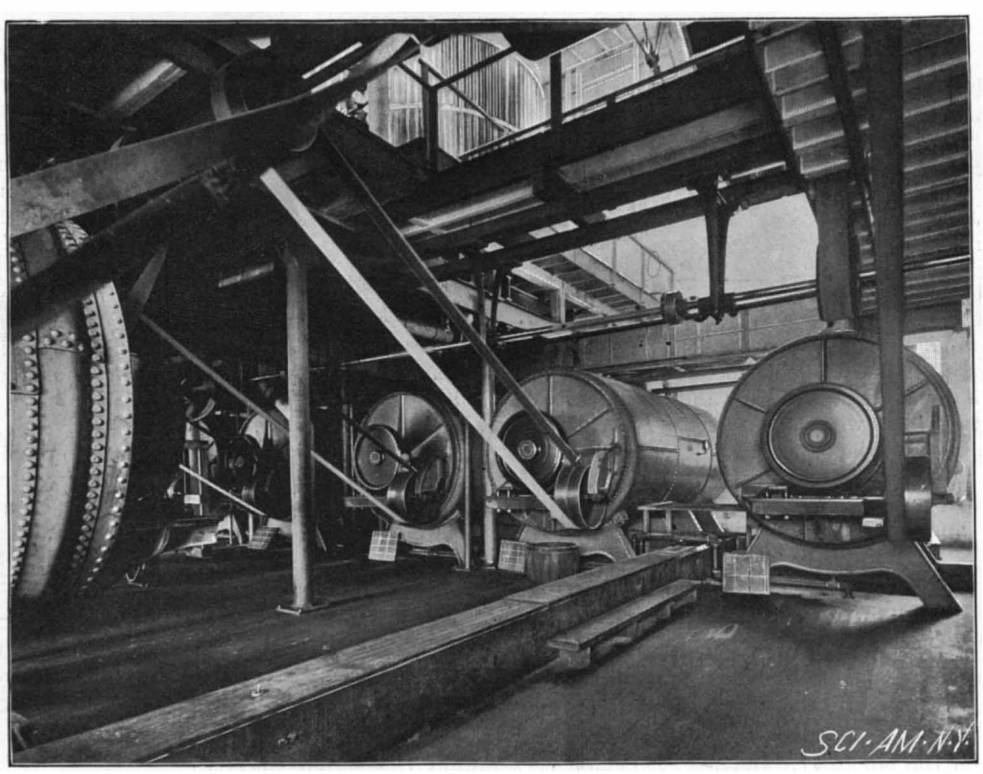
Another plan which has been attempted was that of using cylindrical pontoons constructed for the purpose, sinking them to the bottom to lie alongside of the sunken vessel, and having attached the pontoons by chains or wires passing round the hull, the water was pumped out, thus giving buoyancy to the pontoons. This plan would be simple and perfect but for the fact that it was impossible for the divers to do a tithe of the work which this plan imposed upon them.

There were only two methods which had been found practicable, he said, namely, first pumping, and stanking and pumping, which might really be called one plan, as pumps were the main factors; the second, lifting by means of wire ropes and camels. The first of these plans could be, and had been, very successfully applied; and, excepting on the Thames, might be said to be the only way in which attempts were made to salve vessels of any size. The practice was, in the case of a sunken vessel with no great depth of water on her decks, for divers to carefully shore up her decks with stout timber, so that they would withstand the pressure of water from above when the water was pumped out from under them; all hatches and deck openings had to be carefully covered with strong canvas and planking, and holes were cut in the covers just large enough to allow suction pipes to pass into the ship, smaller pipes to admit air, and when all was ready with the pumps on vessels moored above the wreck, the water was pumped out. If everything held good, the vessel came up; but great care was required to prevent her capsizing when she began to lift. If the depth of water should be too great for the above method, the ship had to be stanked—that is to say, balks of timber had to be bolted or secured to her waterways, thick planks had to be fastened to the balks so that they came above water, then a platform or deck constructed across, and the whole made watertight with canvas or oakum—the water pumped out, and the vessel, as she lifted, pulled into shallower water. In this way the Austral and Utopia had been salved, and it might be said to be the only practicable way in which very large steamers could be salved. Of course, it was a costly, risky, and tedious method, and though it was necessary for very large vessels, there was no necessity for applying it to smaller vessels, that is to say, for the vast majority of steamers or of sailing vessels, as vessels up to three or four thousand tons could more expeditiously and cheaply be raised by means of wire ropes and camels than by any other method, and that without the removal of cargoes. In the case of most other methods the cargoes had to be removed.

As regards the method of raising vessels by means of camels and wire ropes, he said that the method carried little or no element of chance with it, and the only difficulty was in getting the ropes under the vessel. He thought, if this method was more generally employed, most of the sunken ships might be recovered, which would result in a saving to the owners, and in many cases would serve to remove obstructions and dangers to shipping. He considered the system of removing dangerous sunken wrecks by means of explosives as barbarous. On the Thames this method was not, however, employed, pontoons being used instead. These pontoons were secured by wire hawsers to the sunken vessel at low water, and as the tide flowed the hawser took the weight off the vessel, the pontoons sank to their displacement, and the cortege was towed to the most suitable place for beaching.

Something better than this plan has been a long-felt want, says the Marine Record, especially in places where the tidal range was small, or nearly absent, and in endeavoring to fulfill this requirement the author's appliances (the models of which were exhibited) had been devised.

* Abstract of a paper by Capt. James Bell, Assoc. I. N. A., read before Section G of the British Association for the Advancement of Science.



A SET OF CRYSTALLIZERS.

Occupations of Americans.

Much interesting data about the occupations of the American people is given in the bulletin of the Eleventh Census recently made public. It shows that the total number of people engaged in occupations of all kinds in 1890 was 22,735,661. Of the whole number of working people the females form 17·22 per cent. Divided by classes the working people of the country are as follows: Agriculture, fisheries, and mining, 9,013,336; professional, 944,333; domestic and personal service, 4,360,577; trade and transportation, 3,326,122; manufacturing and mechanical industries, 5,091,293. Considerably more than four-fifths of the illiterate male population of the country and over one-fourth of the illiterate female population are working. Over 59 per cent of the workingmen are married, over 37 per cent single, over 3 per cent widowed, and one-quarter of 1 per cent divorced. In manufactures and mechanics the carpenters and joiners, numbering 611,482, make up the greatest element, with dressmakers and milliners following, with 499,690. There are a little over 1,000,000 bookkeepers, clerks, and salesmen, 690,658 merchants and dealers, 5,281,557 farmers, planters, and overseers, and 3,004,061 agricultural laborers, 349,592 miners, and only a little over 60,000 fishermen and oystermen. Professors and teachers, aggregating 347,344, form the most numerous of the professional classes. Physicians and surgeons, 104,805, come next; then lawyers, 89,630; clergymen, 88,203; government officials, 79,664; musicians, etc., 62,155; engineers and surveyors, 43,239; artists and art teachers, 22,496; journalists, 21,849; and actors, 9,728.

Sunstrokes in New Orleans.

During the last two weeks of June, New Orleans suffered from an epidemic of sunstrokes different from anything of the kind that has occurred there before. The peculiar feature of the epidemic was the exceedingly large proportion of the deaths to the prostrations, half or more than half the persons affected having died, and a considerable number of them having been found dead in bed in the morning. The total direct mortality from the heat for the week ending June 26, when the temperature was at the highest, was thirty-one from sunstroke and congestion of the brain, and for the entire hot wave, forty-three. This mortality is phenomenal in New Orleans, which is but seldom a sufferer from sunstroke. Not more than once in three or four years do any deaths whatever occur from the malady, and then only two or three.

Dr. Koch on the Bubonic Plague.

Prof. Koch, the bacteriologist, has just made his report giving the result of his investigations into the bubonic plague which has been ravishing India. He says that the bacilli possess but little vitality outside of the bodies of men and animals, and adds that Prof. Haffkines' serum possesses undoubted protective qualities. Prof. Koch states that his report is founded on the results of experiments on fourteen hundred cases.

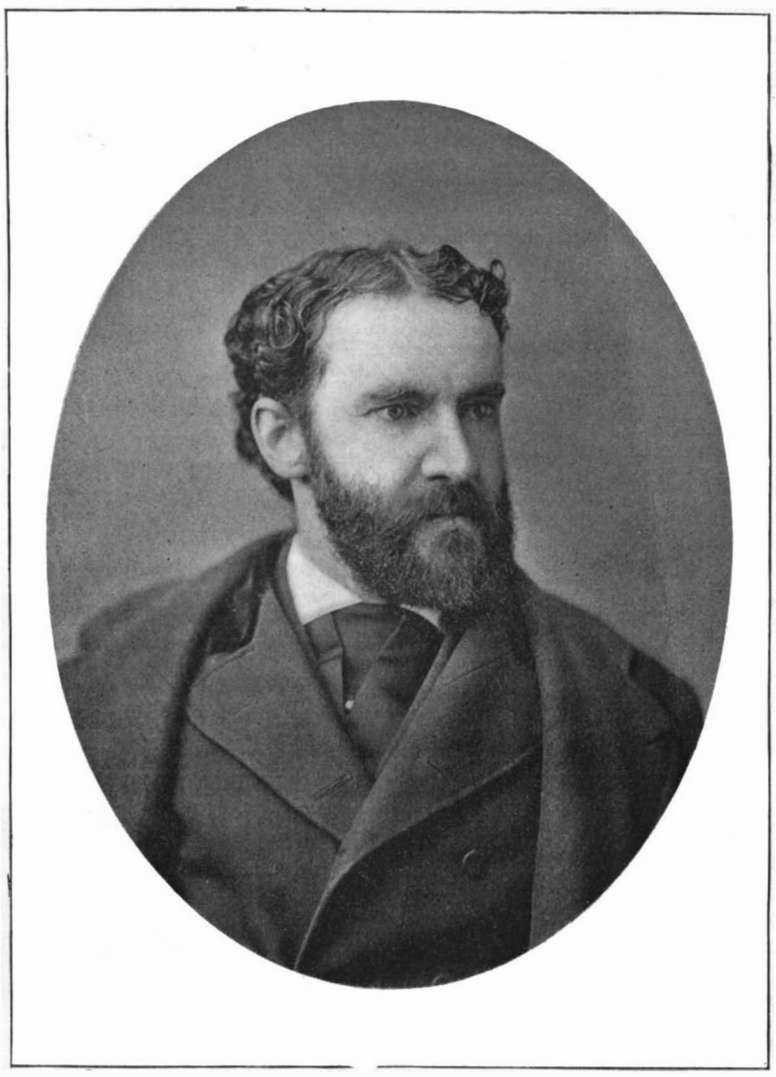
ALFRED MARSHALL MAYER.

In our last issue we gave a biographical notice of the physicist, Dr. Alfred Marshall Mayer, and now through the courtesy of Mr. Joseph Wetzler we are enabled to present a portrait of him. The principal facts connected with his life were mentioned last week, so we will now only refer to some of his important discoveries. Early in his career, Prof. Mayer determined to devote himself to the problems of acoustics, and his researches led him to the solution of many of the questions in acoustics that have baffled other investigators. He discovered the auditory apparatus in the mosquito, and also many physical characteristics and peculiarities of the human ear for the reception of sound. His scientific researches since 1872 have been principally published in the American Journal of Science, under the title of "Researches in Acoustics." These include a method of detecting the phases of vibration in the air surrounding a sounding body; mode of measuring the wave lengths and velocity of sound in gases, resulting in the invention of an acoustic pyrometer; the determination of relative intensities of sound; five new methods of sonorous analysis for the decomposition of a compound sound into its elementary tones, and several other important discoveries in the field of acoustics. He was one of the associated editors of the American Journal of Science. One of Prof. Mayer's most important contributions to physics was a paper on "The Determination of the Law Connecting the Pitch of a Sound with the Duration of its Residual Sensation." Other treatises were: "On the Effects of Magnetization in Changing the Dimensions of Iron and Steel Bars," "Experiments with Floating Magnets," and "On Measures of Absolute Radiation." Prof. Mayer was of a strong mechanical turn of mind, and invented a number of machines and apparatus used in the laboratory of the physicist.

He was a many-sided man, and one subject in which he took the utmost interest was archæology, and in his studies of this particular topic he showed unusual acumen.

In a chapter entitled "The Prehistoric Hunter," written by Prof. Mayer for the handsome volume entitled "Sport with the Rod and Gun," which he edited, he shows how thoroughly he had mastered the subject and how his comprehension of the hunting of to-day helped him in the better understanding of the chase of the past.

When Prof. Mayer was in France some years ago, in Dordogne and Abbeville he made some remarkable finds of prehistoric handiwork, almost in the identical places where Boucher de Perthes carried on his earliest researches, some sixty-odd years ago. It is more, however, as a physicist than as an archæologist that Prof. Mayer will be missed.



PROF. MAYER.

How and Why We Should Watch the Clouds Drift.

One of the most important elements in weather prediction is the direction of the wind, and by this is meant not the local currents near the surface, but the great and more steady ones high in the air. The surest way to get the trend of these is to watch the clouds that drift along with them. It would seem an easy matter to tell in what direction the clouds are moving, but M. J. R. Plumadon, the French meteorologist of the Puy-de-Dome observatory, tells us that it is by no means what it seems. The Literary Digest translates what he says on the subject in an article in Les Science Populaires, Paris. "The direction followed by the clouds in their passage across the sky constitutes, with the height of the barometer and the temperature of the air, the three principal elements by whose aid we foretell the weather by purely local observations. The clouds do not move haphazard; they obey the general atmospheric movements, and their motion is regulated [by the law of Buys-Ballot; that is, they so move that atmospheric pressure is always less on the right than on the left of the cloudy current. This is a consequence of the earth's rotation and of the solar action in displacing the air from the equator toward the poles. When the clouds come from the south they indicate that a minimum of pressure exists in the west; when they move from the north, that proves that there is a center of low pressure toward the east, and so on. The observation of the clouds thus enables us to know: 1, the approach of centers of disturbance; 2, the relative position that we occupy in the region where these centers may cause atmospheric perturbations.

"By combining these data with the indications of the barometer and taking account of the season of the year, we may, after judicious experimentation, be able to foretell the morrow's weather with great probability of exactness. . . .

"It is, then, a matter of great interest to determine the movement of clouds exactly. The determination is effected easily and quickly when one is accustomed to it. But for persons who are not used to the process, it is troublesome and almost always somewhat inexact because of certain illusions that one must know how to avoid.

"The first condition to fulfill is to know the orientation of the place of observation. That presents no difficulty for localities where we live or with which we are familiar; for others it is necessary to use a small compass, taking care to remember that the geographical north does not coincide exactly with the magnetic north. . . .

"To know exactly the direction of motion of the clouds, it is indispensable that the observer's head should remain immovable; it is a good thing to furnish it with something to lean against. We must also have a fixed point of view situated in the direction of the visual ray, that is, directed toward the cloud to be observed; the corner of a house, the branches of a tree, the sash of a window can serve for this purpose.

"The observatories commonly employ for current observation of the clouds a special apparatus known as the 'nephoscope;' it is a mirror of black glass on which have been traced with a diamond concentric circles and also diameters 45° apart. The mirror can be turned in its own plane about its center by the aid of a proper mounting. A vertical strip divided into millimeters is fixed on the edge. It moves with the mirror and can be raised and lowered. The observer looks at the instrument so as to see the image of a cloud reflected at its center, and at the same time, by combining the motions of the mirror and the vertical strip, the end of the latter is brought into such a position that it also is projected on the center, on the image of the cloud. If the cloud is motionless, its image will remain at the center. If the cloud moves, its reflection will leave the center and the radius that it follows will indicate the direction of motion.

"The height of the end of the vertical strip above the mirror and the number of seconds taken by the image to move from the center to one of the concentric circles, enable us to determine the angular velocity of the observed cloud. To obtain the actual velocity—that is, the distance moved over in a given time—we must know the height of the cloud above the mirror. In using the nephoscope, a fixed position for the observer is obtained by the necessity of looking at the end of the strip in such a way that it is always in line with the center of the mirror. . . .

"The price of the instrument is quite high; so we advise meteorologic stations and individuals who do not wish to obtain it, but who desire to determine with precision the directions of clouds, to use the following arrangement, which is both good and cheap:

"On four posts three to four yards high, fixed in the ground so as to form a square whose diagonals are respectively north and south and east and west, are fastened the four angles of a wooden frame on which wires are stretched parallel to the diagonals. The posts serve as resting places for the observer's head, and he can thus very easily determine the direction followed by the clouds by watching them and the wires at the same time.

"As much as possible he should observe the regions of the sky that are not too far from the zenith, and choose for observation clouds that are very distinct and not too large. It is important, in fine, to prove that the whole cloud is moving in the same direction, which it is not always easy to do when the cloud is of vast dimensions. By limiting the observation to the displacement of one of the edges or of a part of the cloud, large errors may be introduced, especially in the case where the mass of the cloud has only a slight velocity. For, if the cloud is increasing in size, it may happen that the eastern edge may appear to move east, the southern edge south, etc.

"If we have to do with long cirrus clouds, we should look at the axial region, which is also the whitest, the clearest, and keeps its shape longest.

"There is one illusion that must be carefully guarded against. It is generally produced when one is looking at the same time at very high and very low clouds. . . . The first seem to move slowly, because they are far away, while the second appear to move rapidly, because they are nearer. So, even when the two are following a common direction, the higher will appear to be moving in the opposite direction to the lower. . . .

"A good point of view, and, above all, a nephoscope or the system of wires described above, prevent this illusion, which is very common, and which affects many persons, even when they think they can avoid it."

Submarine Photography.

The most recent developments in this branch of photography are thus summarized in the Photographic Times (November) by Lieut. Albert Gleaves, following an article by Captain Boiteux, of the Brazilian navy, in the Boletino do Club Naval. Says Lieutenant Gleaves: "This application of photography is not new, but previous attempts have been barren of practical results. Once realized, however, the hydraulic engineer will have a sure method of estimating for any kind of submarine work. It will be useful alike to the navy and merchant marine in the inspection of under-water bottoms when docking is not possible, and in the examination of sunken wrecks. By this means the floor of the sea may be investigated, and the flora and fauna of the ocean depths photographed and studied. In naval warfare the submarine camera will establish the location of booms, torpedoes, and mines. Two essentials are requisite for the satisfactory working of the apparatus: there must be sufficient light and the camera must be absolutely watertight. Captain Boiteux obtains his light from an incandescent lamp of the Bernstein system, 50 volts and 5 amperes, which is secured in a box on the top of the diver's helmet. The light is projected in a cone to a reflector placed in the rear part of the box, and then passes through a glass in the front part. The lamp may be fed by a dynamo or accumulator in a steam launch. The photographic apparatus consists of a detective camera (short focus) in a hermetically sealed metallic case. The case has glass windows corresponding to the objective and view finder, and is carried in a box attached to the diving suit. The lens is operated by a screw passing through the watertight case. The results of experiments with these instruments are reported to be excellent. Objects at a distance of three meters (nearly ten feet) could be seen as plainly as by daylight and were readily photographed."

Hunting for Andree.

A dispatch from Tromsöe says that British and Russian steamers are going to search the Siberian coast for Prof. Andree, who, on July 11, started from Dane's Island in a balloon to attempt to cross the north pole area. Nansen reached the neighborhood of the New Siberian Islands on August 18 of last year, and Nordenskiold was not able to skirt the entire Siberian coast in one season, and was frozen in for the winter off the northeast coast. So it is possible that though a steamer might cross the Kara Sea to the mouth of the Obi or the Yenesei in northwest Siberia, it would not advance much further, unless it expected to winter in Arctic waters.

ENGLAND has sent an expedition to explore the river Jub, boundary between the Italian and English spheres of influence in Somaliland. It is under the command of Major McDonald, who made the survey of Mombasa to Lake Victoria.

THE MICROMOTOSCOPE.

BY D. F. ST. CLAIR.

The principles of the kinetoscope or mutoscope have been applied to the microscope, with some interesting results, by Dr. Robert L. Watkins, of this city. The instrument, though simple, was made a success only after many experiments and failures in adjusting the objective of the microscope in a line with the right sort of light and a rapidly moving film.

The principal difficulties in making a mutoscope out of so delicate an instrument as the microscope are the light and the lens. Every electric lamp in the market, when its light has been concentrated sufficiently for photography, will after a short time, with its heat, kill, dry up, or impair almost any kind of life in the microscopic field. The greater the magnification, the more intense the light must be and the nearer the microscope. This difficulty was often enhanced by the length of time it took to get a focus on the sensitive film, but most of the pictures taken were good and show well the various characteristics of the action taking place in cell life, so far as it can be observed with the microscope.

Whatever is to be photographed, once it is put in the field of the lens, is adjusted to a horizontal plane. Near one end of the microscope is placed an electric lantern containing a small arc light concentrated on the object. Near the other end is the box that covers the apparatus for moving the long, sensitive gelatine film. The film runs like a belt on wheels and passes in front of a tiny window in the box and on a direct line with the lens and light. This machinery is turned by a crank and its ordinary capacity is about 1,600 pictures per minute. It is possible to increase it to 2,000 or 2,500, but for most purposes 1,000 or even less per minute will record every motion taking place in most cell life. Dr. Watkins found, however, after a number of trials, that he could not turn the machine fast enough to photograph the motion of the blood circulating in the web of a frog's foot. He simply needed a larger wheel.

The advantages of mutoscopic photography to microscopy are quite evident, especially as regards the action of bacteria and blood cells. Nearly all the numerous families of bacteria have motion, often motion that the eye cannot always follow clearly. It has already been discovered that the same kind of bacteria will act very differently under different circumstances. For instance, a flash of bright light will suddenly drive some kinds to cover. Some kinds will readily seek the negative pole of the battery. They will also seek food with avidity and reject poison with true instinct. All such phenomena can, of course, be followed with the eye, but not with the same detail in the microscopic field as in a series of clear photographs. The fact is that, on account of the motion of some bacteria, it has been well nigh impossible to photograph them. The books have had to depend upon the eye and hand of the draughtsman and vague description. This may not be of much importance either way, but as yet comparatively little is known about bacteria. It is not yet known whether they are the cause of disease or its results, or neither. Photography, under the proper circumstances, is most needed for the investigator, and it can be only moving photography.

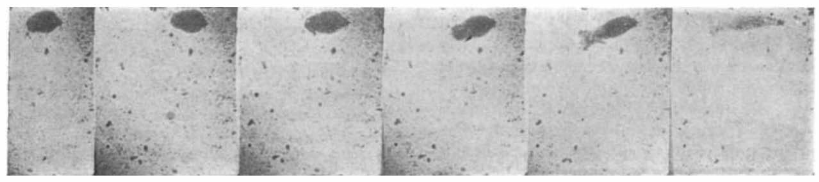
The capillary or circulatory motion of the blood cells, after the blood has been drawn, are comparatively slow at best. But the amœboid movement of the white cells and the changes taking place in the nuclei are complicated, and often hard to intelligently watch in the field. Many of these changes occurring in the white cell are certain to escape attention, but all of them will be clearly recorded on the rapidly moving sensitive film. These motions in the white cells, though they are as yet imperfectly understood, are full of meaning to the physiologist and pathologist. The offices that the blood performs in the body are believed to be due mainly to the action of the white cells. Certainly, the character of their amœboid action is one of the surest indications of health or disease.

But with the micromotoscope it need no longer be impossible to photograph the blood in actual circulation. With a better light the cells may be seen in the thin tissue of the ear or the web of the fingers. They have often been examined in the peritoneum during an operation, and Dr. Watkins himself has made a close study of them in the web feet of some birds and the tails of fishes.

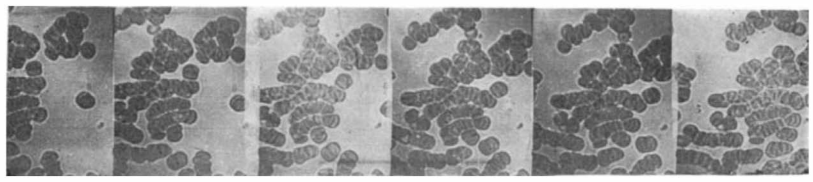
The illustration of blood here reproduced, unfortunately, does not show the white cells. They stuck to the glass; while the red cells, it will be perceived, retain something of their motion, continuing to flow across the field for half an hour after the blood was drawn.

The photograph of the rotifer in a drop of stagnant Croton water is the most interesting form of cell motion yet reproduced. This rotifer is moving with about the speed of a fly on the wing, and every action is photographed at the rate of about 2,500 pictures per minute.

Numerous photographs of bacteria were taken, but the motion happened to be an up and down one and showed no change of position in the field.



A ROTIFER AS SEEN IN THE MICROMOTOSCOPE.



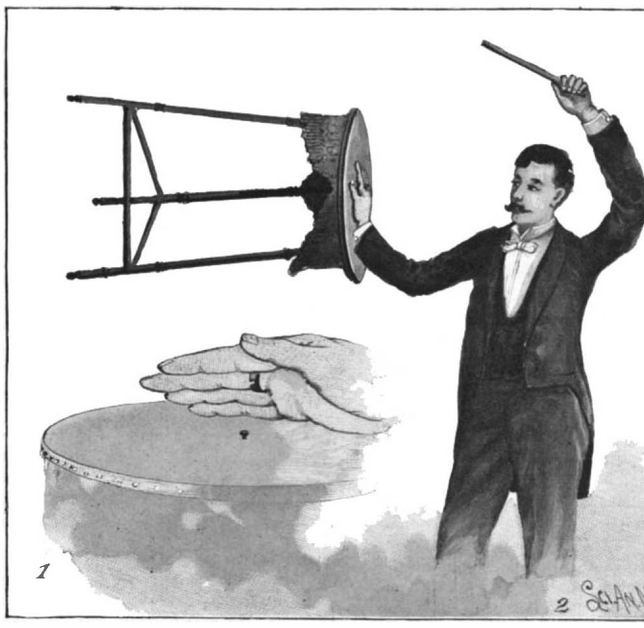
MOVEMENT OF BLOOD CORPUSCLES SHOWN BY THE MICROMOTOSCOPE.

Heart Burials.

The body of Louis IX, after his death at Carthage in 1270, is related to have been boiled in wine and water in order to preserve it for transportation, and it was then shipped by Charles of Anjou (I) to Sicily. Here the flesh and viscera were deposited in the Benedictine Abbey of Monreale, near Palermo. The heart and bones remained, by desire of the soldiers, in the camp. Later, his son Philip (le Hardi) having carried them and those of his brother Tristan into Italy, they were taken to Paris in 1271. On March 21 of that year, the bones, reduced to ashes, were deposited temporarily in Notre Dame, whence they were presently borne in state to the Benedictine Abbey of St. Denis, and at each spot by the way where the bearers paused, seven in number, Philip subsequently caused a cross to be raised. Charles of Anjou, dying at Foggia, 1285, his heart was sent to Angers, while his body was entombed in San Gennaro, at Naples. His viscera remained in the Duomo at Foggia. Philip II (le Hardi) died of pestilence at Perpignan, October 5, 1285. His flesh was buried at Narbonne. His bones were transferred to St. Denis. His heart was given by Philip IV (le Bel) to the Dominicans of Paris.—Notes and Queries.

THE MAGIC TABLE.*

This was a trick of the late Alexander Herrmann. In the center of the stage is placed a light table with three legs and a plush top. The prestidigitator moves his hand over the table; suddenly it rises in the air and follows his hands wherever he moves them. The secret of the trick will be easily understood by reference



THE MAGIC TABLE.

to our engraving. A small nail is driven in the center of the table. This nail is not noticed by the audience and the plush top tends to hide it. The magician wears a ring which is flattened on the inner surface and a small notch is filed in it. The ring is placed on the middle finger of the right hand; the hand is spread over the table until the notch fits under the head of the nail. The table can then be lifted with great ease and it appears to follow the hand of the conjuror in obedience to the magic wand.

* Copyrighted, 1897, by Munn & Company. From "Magic, Stage Illusions and Scientific Diversions, including Trick Photography." This work will be ready September 1, 1897.

Peary Off for Greenland.

The steam sealing bark Hope, with Lieut. R. E. Peary and party on board, bound for North Greenland, left Boston on July 19. The object of the voyage is to establish a settlement at a remote northern point of Greenland which will be used as a base of supplies for an expedition under Lieut. Peary in a search for the North Pole in 1898. To this end a party of Esquimaux will be left at the new settlement and will be engaged during the next summer in making preparations for Lieut. Peary's expedition. The Hope will make directly for Sydney, C. B., where she will take in coal for the remainder of the voyage. She will skirt the coast of Greenland, dropping scientific parties at various places and taking Lieut. Peary to Whale Sound, where he will establish a settlement. The return voyage will be begun, it is expected, in five weeks after the Hope arrives, and the parties will be picked up on the way back.

In the party which left Boston are forty-three persons, including, besides Lieut. and Mrs. Peary and their daughter, their servants and the crew, Mr. and Mrs. H. J. Lee, of Meriden, Conn.; Robert Stein, of the United States Geological Survey; Albert Operti, the Arctic scenic artist; J. D. Figgings, of Falls Church, Va., taxidermist; Dr. Frederick Sohon, surgeon, of Washington; and several investigating parties, one under the direction of Prof. C. H. Hitchcock, of Dartmouth, who will study glaciers and the relics of the Norse colonists from Iceland, and another from the Massachusetts Institute of Technology, under R. W. Porter, who will remain in the north through the next winter to hunt the big game of the country and bring back zoological specimens. There are also on board two representatives of the National Museum, who are expected to bring home several tons of fossil flora for various museums.

Decadence of the Mediæval Trades Unions.

The moral havoc wrought by these monopolies was greater even than the industrial havoc. It crushed all feelings of justice and humanity, making its victims more grasping and cruel than Shylock; it led them to the practice of every trick and deception of a Newgate sharper to evade the laws; it stirred up a contention that rivaled the quarrels of the Guelphs and Ghibellines. Apprentices became no better than serfs and slaves. They were not merely pitilessly fined and brutally punished; they were often left in ignorance of the craft that they had purchased the right to learn. In that frightful social and moral revulsion following the long and devastating wars of the sixteenth and seventeenth centuries the corporations became more determined than ever to maintain their industrial aristocracy and monopoly. They refused to admit any trade less ancient and honorable than their own to the rights and privileges of the law; they soiled themselves by contact with no person of illegitimate birth; and in their savage and relentless pursuit of persons engaged in unauthorized traffic they invaded the homes of contraband workmen, confiscating both their tools and the hidden products of their toil, leaving them and their families destitute and starving. To such absurd lengths was the creation of corporations carried for the production of new taxes and new places for court favorites that occupations like the teaching of dancing, the selling of flowers, and the catching of birds were organized, and homogeneous occupations like the hatmakers' and carpenters' were divided and subdivided beyond the comprehension of the modern mind. —Appletons' Popular Science Monthly.

149 Miles in 143 Minutes.

On July 16, the Empire State Express of the New York Central Railroad ran 149 miles in 143 minutes. The train was twenty-three minutes late when it left Syracuse, and when the express reached Rochester ten minutes had been made up and eleven minutes more were saved between Rochester and Buffalo, which was reached at 4:47, the express being two minutes late.

THE American manufacturer, says an exchange, sells the Japanese one-twelfth dozen of machines, which the Japs use as a pattern. They build factories and make all they want in future. That is no doubt so, yet any new invention may be patented in Japan, and it behooves our manufacturers to take advantage of the privilege and thus prevent the manufacture of their inventions in Japan without their permission.

RECENTLY PATENTED INVENTIONS.

Engineering.

GAS OR VAPOR ENGINE.—Eugene P. Woillard, Sugden, Fla. According to this invention an explosive engine is provided having high pressure cylinders with reciprocating pistons, a low pressure cylinder with a piston rigidly connected to one of the high pressure pistons, the working chambers of the low pressure cylinder and the corresponding high pressure cylinder being between the respective pistons, and the exhaust from the high pressure cylinders discharging into the low pressure cylinder. It is designed to utilize the motive agent expansively to the fullest advantage in a double acting tandem engine having a high pressure impulse in one direction and a low pressure or compound expansion impulse in the other direction, so that every stroke is a working stroke.

STEAM BOILER.—John B. Fleming, Frisco, Utah. Two horizontal shells, with a furnace beneath each, according to this invention, are supplied with feed water from a feed water heating and purifying shell located above and between the boiler shells, there being fire tubes in the heating and purifying shell, and the water being thrown from a pump into this shell in the form of a spray to cause the separation of its impurities. Blow-out pipes are provided for removing sediment or scum from the heating and purifying shell, and, when it is not necessary to heat and purify the feed water, the shell may be conveniently cut out of operation by valves provided for such purpose.

DRIVE WHEEL BRAKE RELEASE.—Walter O. Pelham, Denison, Texas. This is an improvement on a former invention of the same inventor, and provides an automatic valve mechanism arranged in the brake pipe and connected with a pipe leading to the locomotive steam chest, the mechanism having a valve adapted to establish communication between the brake pipe and the outer air. The improvement is applicable to air, steam, or vacuum brake systems, the brakes being instantly released at the time the train is in motion and before the braked drive wheels are on the point of sliding on the rails, or before the triple valve acts to release the brakes.

VALVE.—George W. Graffin, Allentown, Pa. A valve adapted to make a tight closure, and so constructed as to permit of conveniently repairing the working parts without dispensing with the services of the valve, has been devised by this inventor. The improvement comprises a valve casing having inlet and outlet and valve seat at the inlet, two valves proper movably mounted in the casing and adapted to be seated on the valve seat, guideways in which the valves loosely slide, extending from one end of the casing to the other, a slidable stem for each valve and a ball and socket joint for connecting each valve with its valve stem, while a movable abutment in the casing is adapted to be engaged by either of the valves.

Railway Appliances.

CAR AXLE LUBRICATOR.—James S. Patten, Baltimore, Md. This is a device adapted for ready insertion in a car axle box and removable therefrom, and comprises a plate spring of novel construction adapted to support at its rear end a dust guard at the rear end of the box and a wiper bearing on the under side of the axle, the spring also supporting on its central portion a roller which bears upon the axle while its lower edge is always immersed in the oil. The spring is of nearly the same width as the oil chamber, and its front end is bent up to form a hood, preventing oil from reaching the axle box lid. The spring in position normally serves as an oil baffle, in addition to its other functions, but is sufficiently flexible to be readily removed, with its attachments, from the axle box.

RAILWAY TRACK SLEEPER THREAD CUTTER.—Albert Collet, Paris, France. A boring tool devised by this inventor is more particularly intended for screw cutting the holes already made in railway sleepers for fastening screws, although it may be employed for screw cutting cylindrical holes in wood generally. The tool has a cylindrical cavity and an exterior thread, and a removable cutting part is dovetailed into its body and held in place by a metal strap. The tool has a longitudinal hole opening at both ends and a transverse hole for the escape of the chips.

Electrical.

WATER REGISTERING DEVICE.—Samuel J. Evans, Elkhorn, West Va. For indicating and registering the height of water in a tank or similar receptacle, this inventor has constructed a device wherein an electric circuit is closed by means of a float controlled by the water in the tank, a registering mechanism being also operated accordingly at any convenient point. The mechanism is also designed to sound a high and low water alarm, the pointer of the registering device indicating on a dial the raising and lowering of the water in the tank or reservoir by successive steps.

IGNITER FOR GAS ENGINES.—Harry S. Dosh, Baltimore, Md. An igniter designed to operate successfully and with certainty and uniformity with a single battery cell has been devised by this inventor. It comprises two electrodes having their ends formed as extended plates, and means for suddenly separating the plates, which lie sufficiently close together to cause by their separation a rarefaction of the gaseous medium between them. The invention thus affords a means of creating in the gas cylinder a partial vacuum or reduced pressure between the spark electrodes and simultaneously transmits through this more tenuous medium of gas and air the electric spark, which permits the use of a very weak battery of a single cell.

ELECTRIC RAILWAY SYSTEM.—Lawrence K. Devlin, Havre, Montana. This invention is for an improvement in systems where the trolley is adapted to run on a sectional contact rail, in a slotted conduit, and normally out of electrical communication with the feed wire, the sections of the contact rail being put in communication with the feed wire by contact devices actuated by the movement of the car. One of the track rails forms one side of the conduit wherein the trolley of the motor car travels, an inclined slotted rail forming the other side of the conduit, which is slotted at its top and open at its bottom. Track boxes are inserted at suitable intervals between the ends of the slot rail sections, and pivoted projecting levers are connected to the adjacent ends of the respective contact rail sections.

Bicycles, Etc.

MECHANICAL MOTOR FOR BICYCLES, ETC.—Charles P. Labatt, Los Angeles, Cal. A novel foot power device has been devised by this inventor, according to which the driving gear comprises sliding pedal levers in connection with a guide box having a longitudinally extending partition forming two raceways, there being a pivoted spring-pressed tongue at each end of the partition and a stud projecting from the levers and alternately moving through the raceways. The levers have geared connection with the rear traction wheel, and the improvement is also designed to facilitate the driving of small stationary machines of different kinds.

ELECTRIC BICYCLE LAMP.—Malcolm P. Ryder, Westfield, N. J. This invention provides a peculiarly constructed electric generator connected with an incandescent lamp by a novel current collector, the generator being actuated from the tire of the wheel, and being supported to rock on projections from the frame. The current transmitter comprises an elastic-limbed brush held in an insulating holder block by a central screw and a nut held from turning by the flanges of the holder block, the brush having enforced contact with a current collector ring forming part of the generator. The improvement is also adapted for use on vehicles other than bicycles.

Mining, Etc.

CONCENTRATOR AND AMALGAMATOR.—Angus McKellar, Salt Lake City, Utah. To sift fine flour or flake gold from placer gravel, a contracted pan or basin, according to this invention, receives the material from a screening surface, and a hopper beneath takes the material from the pan, while a cylinder with mercury in its bottom is connected by a pipe with the hopper. A valve in the lower portion of the cylinder is connected with a pipe through which the mercury and the material it carries may be withdrawn from the valve casing. The machine is of simple, durable and inexpensive construction, and is designed to automatically and thoroughly remove from the screen and deliver outside of the machine all coarse material.

Mechanical.

MECHANICAL MOVEMENT.—Julius Manigold, Dexter, N. Y. A movable stool and a swinging hand lever are, according to this invention, both mounted on certain means by which the motion from the stool and lever are synchronized and regularly transmitted from the apparatus to a rotary crank shaft or other device to which motion is to be imparted. One seated on the stool grasps a hand pin passing through a lever, and, bearing on the pedals, rocks back and forth, causing the stem on which the seat is mounted to reciprocate vertically and horizontal levers to rock. The power is applied at three points—at the stool, at the pin, and on the pedals, and these several movements act on a lever and link.

Agricultural.

HAY RAKE.—Benjamin Mellinger, Topeka, Kansas. In a horse hay rake this invention provides guards for the ends of the rake to prevent the hay gathered from being spilled at the ends of the row of teeth, a cleaning device being also provided for the teeth, operating in connection with a lever to raise the teeth. The guard comprises a shield formed of adjustable sections attached to and projecting rearwardly from the rake head, spring teeth being rearwardly and downwardly curved from the shield over the space between the end rake teeth and the forward portion of the rake head. A substantially straight and rigid tooth is located at the forward end of the shield.

CHURN.—Jakob Widder, New York City. Within the cylindrical casing or body of this churn is a fixed hollow cone at the top, between which and another similar cone at the bottom of the casing the dasher is reciprocated, the dasher also being conical and perforated. The dasher rod is surrounded at its upper end by a helical spring, so that the dasher is normally held up within the upper cone. As the dasher is reciprocated, the cream is violently compressed between the cones and forced through the perforations of the dasher as so many streams or currents, causing the quick formation of butter.

Miscellaneous.

BRICK DIE.—Clarence M. Steele, Statesville, N. C. A die designed to form the greatest variety of lays with the least friction is afforded by this invention, the die having polished metal surfaces through which the clay is forced, forming it into bars for making brick. The die is composed of two die sections, a partition and a cylindrical shell or casing, the latter having a steam inlet and an outlet, with valves controlling the supply of lubricant. The circular shell bears all the outward strain upon the dies, and the several parts may be easily dressed out and polished, and securely put together with only two bolts and cap screws.

BRISTLE WASHING MACHINE.—Charles E. Tyler and James Dempster, Halifax, Canada. To clean a large number of bundles of bristles simultaneously and to permit of removing a washed bundle of bristles and replacing it by an unwashed bundle during the washing operation, this machine is made with a reciprocating comb and a disk capable of movement over the comb, and adapted to carry the bristles and bring them into the path of the comb teeth. The comb is mounted to slide on the bottom of a liquid receptacle, and the comb teeth pass in every direction through the bristles in each bundle.

PISTON FAUCET.—Edwin R. Greene, Providence, R. I. A faucet for drawing beer, ale, etc., and arranged to prevent a large amount of liquid from standing in the faucet, has been devised by this inventor. The faucet barrel is made with a cap inclosing its outer end, the cap having an inwardly extending cup-shaped bearing through which the piston rod extends to the inner end of the faucet barrel. A collar near the outer end of the rod rests against the cup-shaped bearing when the piston is flush with the inner end of the barrel, the barrel of the faucet being then completely emptied when the faucet is closed.

POCKET KNIFE.—Alexander Normand, Klerksdorp, South African Republic. This knife has interchangeable blades to permit the user to readily and quickly remove one blade and substitute another, or to place in the handle a tool particularly adapted for the work in hand. The handle has two pivots especially adapted to facilitate making changes of blades or the insertion of a tool, one of the small tools provided for use with the knife having an adjustable wrench head.

BOOK SUPPORTER.—Henry L. Pinney and Franklin Leuzner, Cass City, Mich. A device for supporting books which may be attached to arm chairs without marring them, and adjusted to different heights, positions or angles, consists, according to this invention, of an adjustable pivoted arm which carries a board for the support of a book, with means for adjusting it to any angle, and a leaf holder consisting of wires pivoted near the upper edge of the board. The device may be conveniently swung in or out, closer to or further away from the reader, and will hold the book from an almost flat to a nearly vertical position.

HARNESS SHAFT TUG.—William Fawcett, Brooklyn, N. Y. The frame of this tug is formed of a single piece of metal, curved at its lower portion to form a shaft support and bent over with a loop and pin, there being an adjacent loop to engage the belly band. The inner portion of the frame forms a buckle, with two pins, one above the other, one of which engages a movable tongue. The tug can be very cheaply manufactured and is quickly attached to the saddle strap of the harness.

DRESS SKIRT LIFTER.—Esther Manning, No. 2273 Seventh Avenue, New York City. This simple device enables a woman to elevate the bottom of her dress skirt at all points, where others have been made to lift the rear portion only of the skirt. The device consists of tapes extended one from each breadth seam of the skirt and extended through guide rings along the seams and terminating in two tapes which are projected through the placket, whereby the several tapes may be simultaneously drawn to lift the bottom of the skirt. The device has met with ready sale—a fact which proves its utility.

MEAT SHAVER.—Caleb R. Turner, Brooklyn, N. Y. To facilitate the shaving or slicing of meat in a neat and expeditious manner, this inventor has perfected a device of simple and durable construction, arranged to properly feed the meat to the slicing or shaving knife, and permit the operator to regulate the feed for thinner or thicker slices. It has an L-shaped trough to receive the meat, and a standard at the front end carrying a pivot for a knife frame to be swung by a handle to draw the cutting edge of a segmental knife across the meat, a longitudinal carrier or pusher moving the meat forward bodily or pushing it in the trough toward the knife. By the shifting of a nut, less or more feed may be given to the carrier, and a gate at the front end of the trough protects the operator from getting his fingers under the knife.

COVER FOR WASHTUBS, ETC.—Mark Delaney, Union Hill, N. J. This cover is preferably made of five parts, two cleats or side bars, two leaves having each a longitudinal groove in its inner side edge, these grooves receiving, when the leaves are brought together, a central lag screw or connecting bar for the side bars or cleats. Tongues on the end portions of the leaves fit in grooves on the inner side edges of the cleats or side bars, and a cover is thus made which is adapted to withstand to a maximum degree the effects of steam, dampness and water without warping.

NOTE.—Copies of any of the above patents will be furnished by Munn & Co. for 10 cents each. Please send name of the patentee, title of invention, and date of this paper.

NEW BOOKS, ETC.

THE ENTROPY TEMPERATURE ANALYSIS OF STEAM ENGINE EFFICIENCIES. With a blank diagram arranged for easy application to any concrete case. Prepared by Sidney A. Reeve. 1897. New York: Progressive Age Publishing Company. Pp. 20. Price $1.

A work of twenty octavo pages devoted to an explanation and mathematical analysis of engine efficiency on the lines of heat energy as representative in the Carnot cycle. The diagrammatic display of the details of engine efficiency so gratifying to the eye is made the principal object in the illustrations in the booklet and the full working chart of volume and temperature curves accompanying the work. A schedule blank is also detailed on the diagram sheet in the order of observation and as a guide to uniformity in the work of engine testing. An excellent study sheet for expert work.

THE AERONAUTICAL ANNUAL, 1897. Devoted to the encouragement of experiment with aerial machines, and to the advancement of the science of aerodynamics. Edited by James Means. Boston, Mass.: W. B. Clarke & Company. Pp. 178. 8vo. Paper. Price $1.

The Aeronautical Annual is always a welcome visitor, and the third volume of this really important publication surpasses in interest those which have preceded it. It is got up in the same handsome style and is profusely illustrated. The contributors include Dr. S. P. Langley, Octave Chanute, Otto Lilienthal, Hiram S. Maxim and others. The progress in aeronautics in 1896 was very marked, the development being chiefly along three lines: First, the development of the self-propelled aerodrome; second, the development of the motorless air sailer; third, the development of the motor. Each of these departments has now a well defined point of vantage which is accessible to every intelligent experimenter who is inclined to carefully study the ground already traversed, so as to thoroughly understand the results reached. Among the interesting articles in the present number are "The Aerodrome in Flight," "Recent Experiments in Gliding Flight," "The Best Ship for Wings," "The Way of an Eagle in the Air," "Screw Propellers Working in Air," "Blue Hill Measurements of the Velocity of Flying Ducks," etc., and biographical notices of Samuel Pierpont Langley, Ph.D., LL.D., D.C.L., and Otto Lilienthal.

THE STEAM ENGINE CATECHISM. A series of direct practical questions, mainly intended for young engineers and for examination questions. By Robert Grimshaw. Eleventh edition. New York: Norman W. Henley & Company. 1897. Pp. 194, 219. Price $2.

This work is now in its eleventh edition, which is a satisfactory indication of the value with which the book is held. The popular question and answer form is retained, and the questions are answered in a remarkably lucid manner. The tables of calculations are very clear. The work is provided with an excellent index.

ARCHITECTURAL DRAWING FOR MECHANICS. By I. P. Hicks. A comprehensive treatise on architectural drawing for building mechanics, showing the learner how to proceed step by step in every detail of the work. New York: David Williams. 1897. Pp. 94. Price $1.

This is a comprehensive treatise on architectural drawing for building mechanics, showing the learner how to proceed step by step in every detail of the work. Even a superficial examination of this work will satisfy the reader that it is written by one who thoroughly understands the needs of the beginner in architectural drawing, and especially the building mechanic. It is not intended for architects proper, but it is for the use of builders and those who execute the designs of architects. The popularity with which the author's other work, entitled "Builders' Guide," has been received has brought many letters of inquiry, which have been convincing proofs of the wants and needs of the mechanic for a work of the kind on architectural drawing. It can be commended most warmly.

THE INDUCTION COIL IN PRACTICAL WORK, INCLUDING ROENTGEN X RAYS. By Lewis Wright. London: Macmillan & Company, Limited. New York: The Macmillan Company. 1897. Pp. 172. Price $1.25.

A work by such an eminent physicist as the author of "Light" and "Optical Projection" will certainly command attention. It is written simply and solely as a practical help to the efficient and safe use of an induction coil, with especial reference to the extensive use in surgical and physiological work with Roentgen rays. This new field of experiment has brought many into personal contact with coils who have never had any acquaintance with such instruments before. Not a few of such have actually stated their need of such information as it is here attempted to supply, and it is thought that some will like to have an outline of the many experiments in which the induction coil bears a part. The work is illustrated with well selected engravings.

EIGHTEENTH ANNUAL REPORT OF THE MANAGERS OF THE BINGHAMTON STATE HOSPITAL, AT BINGHAMTON, N. Y. For the year ending September 30, 1896. Transmitted to the State Commission in Lunacy. Albany, N. Y. 1897. Pp. 190.

HOUSE PLANTS AND HOW TO SUCCEED WITH THEM. By Lizzie Page Hillhouse. New York: A. T. De la Mure Printing and Publishing Company. Pp. 220. Price $1.

For dwellers in cities, and especially those who live in flats or apartments, this little book affords a good deal of practical information which will enable the housekeeper to raise and care for many beautiful plants, and give one, even in such limited space, some of the delights of the country and of out of door life. The text is fully illustrated.

EUROPEAN ARCHITECTURE: A HISTORICAL STUDY. By Russell Sturgis. New York: The Macmillan Company. Pp. 578. Price $4.

Of books on architecture there are many, but of treatises which a reader of good intelligence, not himself an architect, can consult with profit and satisfaction, there are comparatively few, and of these we know of no one so comprehensive, so free from prejudice and narrow ideas, and which discloses such ample knowledge and sound judgment, as this volume of Mr. Sturgis. Historians as careful and learned as Mr. Freeman examine as closely into all distinguishable details of the earliest structures, many of them prehistoric, as they do into the roots of words in all languages, in endeavoring to throw light upon those far-back times in which were planted all over Europe, and particularly in all regions near the Mediterranean, the evidences of races antecedent to, but powerfully affecting, those which came later upon the stage, of whom we have more or less complete authentic data. But it is not every author who has the qualifications to correctly read the ancient landmarks, as they mark the history of the races of the earth; and when the architect seeks to piece them into studies of the origin of different orders of architecture, and thence trace out their later development, one does not have far to go, in most cases, before feeling that he has left the solid ground of established fact and is in an atmosphere of doubt and conjecture. In this work of Mr. Sturgis, however, the prefatory pages on archaic and prehistoric building, and the succeeding chapters on Grecian and Roman architecture, show us, as a connected whole, and more clearly than we have elsewhere seen it set forth, how it is that "somewhere in Grecian lands, about seven hundred years before our era, a beginning of architecture was made; two centuries and a half later this had grown into the architecture which we admire; from this it came to pass that Roman building was what it was, and from Roman building has come all that of later Europe." The history of architecture in Europe from 350 A.D. up to recent times is covered by nine chapters, in which is crowded a vast deal of valuable information and most interesting comment. The book is embellished with ten plates and 256 other illustrations.

A TREATISE ON ARCHES. By Malverd A. Howe, C.E. New York: John Wiley & Sons. Pp. 371. Price $4.

This is a book particularly designed to facilitate the work of the practicing engineer, saving his time in the making of many essential mathematical demonstrations, and furnishing formulæ and tables adapted to his wants for a wide variety of work. The author is professor of civil engineering in Rose Polytechnic Institute, and the demonstrations are designed to be such as may be readily followed by senior students in technical schools.

The large and valuable catalogue of manufacturers' and machinists' hardware, issued by Charles H. Besly & Company, of Chicago, presents an extent and variety of tools and supplies which one seldom finds in a single volume. It comprises 300 closely printed pages in fine type, with profuse illustrations and ample index, the articles catalogued including almost everything from an engine lathe to calipers or from a differential pulley to a scratch awl.

SCIENTIFIC AMERICAN BUILDING EDITION

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No. 2. Colonial house at Richmond Hill, N. Y., recently erected at a cost of $4,200. Perspective view and floor plans. An attractive and pleasing design. Architects, Messrs. Haugaard Brothers, Richmond Hill, N. Y.

No. 3. A residence, in the Colonial style, recently erected at Larchmont, N. Y., for Mr. William Murray, at a cost of $7,700 complete. Two perspective elevations and floor plans. A pleasing design, with excellent interior arrangement. Mr. Frank A. Moore, architect, New York City.

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No. 5. "Wyandauk," the country residence of Lieut. Morton at Southampton, Long Island. A most excellent design in the Colonial style. Two perspective elevations and floor plans. Mr. James B. Lord, architect, New York City.

No. 6. A modern dwelling at Binghamton, N. Y., recently erected for Mr. William Mannis at a cost of $3,000 complete. A good example of a suburban house. Two perspective elevations and floor plans. Messrs. T. Q. Lacey & Son, Binghamton, N. Y., architects.

No. 7. A Colonial residence at Ardmore, Pa., recently erected for Dr. Louis O. Lusson. Perspective elevation and floor plans. Messrs. Boyd & Boyd, architects, Philadelphia, Pa.

No. 8. A Colonial residence at Bensonhurst, Long Island, recently erected for Mr. Thomas A. Ritson. Two perspective elevations and floor plans. A handsome design. Architects, Messrs. Parfitt Brothers, Brooklyn, N. Y.

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No. 10. A residence at Attleboro, Mass., erected for E. P. Clafin, Esq., at a cost of $5,500 complete. An artistic and pleasing design. Messrs. George F. Barber & Company, architects, Knoxville, Tenn.

No. 11. Perspective and interior view of the Walhalla of Ratisbon on the Danube. A costly reproduction of the Parthenon at Athens. This temple was erected at a cost of about $6,000,000, and is devoted entirely to the display of busts of distinguished Germans.

No. 12. Design for a "cozy corner."

No. 13. View of the library of Mr. Henry L. Hotchkiss, New Haven, Conn.

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Notes & Queries

HINTS TO CORRESPONDENTS.

Names and Address must accompany all letters or no attention will be paid thereto. This is for our information and not for publication.
References to former articles or answers should give date of paper and page or number of question.
Inquiries not answered in reasonable time should be repeated; correspondents will bear in mind that some answers require not a little research, and, though we endeavor to reply to all either by letter or in this department, each must take his turn.
Buyers wishing to purchase any article not advertised in our columns will be furnished with addresses of houses manufacturing or carrying the same.
Special Written Information on matters of personal rather than general interest cannot be expected without remuneration.
Scientific American Supplements referred to may be had at the office. Price 10 cents each.
Books referred to promptly supplied on receipt of price.
Minerals sent for examination should be distinctly marked or labeled.

(7179) W. D. M. says: Is shellac considered a good bicycle wood rim cement? If so, how is it prepared for that purpose? Also, how should it be applied? A. Cements for Tires.—

1. Shellac .... 2 oz. av.
   Gutta percha .... 2 " "
   Red lead .... 90 gr.
   Sulphur .... 90 "

Melt the shellac and gutta percha, and add, with constant stirring, the red lead and sulphur melted. Use while hot.

2. Isinglass .... ½ oz. av.
   Gutta percha .... ½ " "
   Caoutchouc .... 1 " "
   Carbon bisulphide .... 4 fl. oz.

Mix and dissolve.

3. Caoutchouc .... 2 oz. av.
   Resin .... 140 gr.
   Shellac .... 100 "

Carbon disulphide, a sufficient quantity to dissolve the other ingredients.

4. Crude rubber .... ½ oz.
   Carbon disulphide .... 4 "

Macerate twenty-four hours, and then add a solution of—

Resin .... 1 oz.
Beeswax .... ¼ "
Carbon disulphide .... 4 "

(7180) G. R. S. says: Will you kindly inform me through your Notes and Queries of a cleaner and polish for tan shoes that will not injure the leather? A. We have published directions for making preparations for cleaning and polishing shoes, in our SUPPLEMENT, Nos. 1063, 1073, 1078, ten cents each.

(7181) J. C. McK. writes: I have been constructing an induction coil along the following lines and would be pleased to have your opinion as to the spark we might reasonably expect from the same. Length of coil inside heads will be a little over 13 inches. Three sections of 4 inches each. Size of coil when finished, 7 inches. Size of core, 1⅜ inch. Wire on primary, No. 16, two layers. Wire on secondary, No. 38, 100 layers approximately. Winding, 116 to inch. No. 200 thread (cotton) between, making it a solid mass. Amount of wire on secondary, 5 pounds. Insulation between layers is two thicknesses of finely paraffined paper. The winding is very perfect. We have one pound of wire on now, and a 10,000 ohm magnet, will not ring through it, although some current passes. As No. 38 wire has a resistance of a little over 10,000 ohms to the pound, the insulating must be very near perfect. We get quite a good shock by using a 10 volt battery, but it would seem to us that we ought to get more from No. 1 wire. We have no core, and no condenser, simply trying the coil in the winding apparatus. A. Your coil should give at the longest a 4 inch to 6 inch spark from its dimensions, though in a six inch coil as large a number of sections as eight are used in the secondary. The induced current would be very weak without condenser and core. Should say you would better have used No. 12 copper wire cotton covered in two layers of primary, but additional current can be used to overcome your larger resistance. In doing so more heat will of course be developed, and the coil cannot be run as long at a time. With an odd number of sections in secondary, one end of the wire will come out on inside of spool. An even number of spools should have been used. The larger the number of sections, the less the risk of breaking down the insulation between the turns of secondary, because there is less difference of potential between adjacent parts of the coil.

(7182) R. E. R. writes: I have made the caustic potash battery you describe in "Experimental Science." I used a cast iron kettle for the cell after heating the water. I added the potash (½ pound), which was in stick form, and after this was thoroughly dissolved I put in a pound of black oxide. The sheet zinc is three feet long and six inches wide, rolled in spiral shape. The inside of kettle seemed to corrode to a considerable thickness. Can you account for it? Would not a copper pail be a good substitute for the kettle? A. The cell with oxide of copper in an iron dish, and a solution of caustic potash or soda, must have a thin layer of heavy petroleum oil on the top of the liquid to prevent the action of the carbonic acid of the air upon the potash or soda. You do not mention using this. In the action of the cell a dark brown or nearly black mud is formed from the black oxide. This may be what you have thought to be the corrosion of the kettle. If the kettle corrodes, it will be seen by the formation of holes or pits in the iron. This should not take place. The zinc of this battery, for best effect, should be amalgamated. This is difficult with ordinary sheet zinc; probably impossible with so large a piece as you use. This battery is properly to be used on closed circuit; that is, it should be left with current flowing through a large resistance when you are not at work with it. From your description it is difficult to see why you have had a complete failure. The suggestions above may lead you to better success. A copper pail would be more expensive. If you would use copper, we would advise a dish bent up from sheet copper to hold the black oxide. This set into a glass jar would form a good negative plate. Rivet an insulated copper wire to the copper dish, so that neither the liquid nor the zinc can touch the wire on its way out. Then, if you can get a plate of zinc such as is used in the gravity battery and amalgamate it, the result will be much better.

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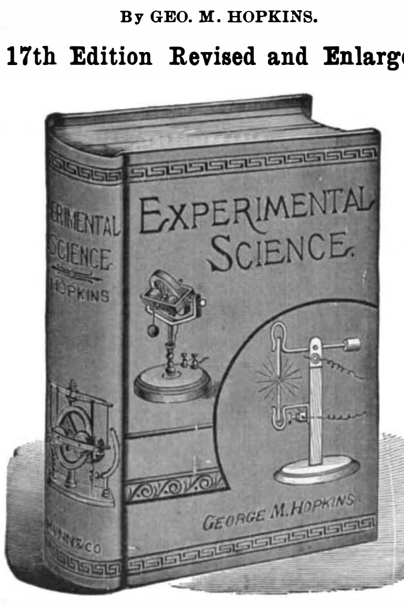

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