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

THE TWO HUNDRED AND FIFTIETH ANNIVERSARY OF NEW YORK CITY.

Although it might have been possible to find a more sentimental event than the incorporation of the city on which to base the recent 250th anniversary of New York, such, for instance, as the landing of the first settlers, or the purchase of Manhattan Island by the Dutch for sixty guilders, it cannot be denied that the incorporation marks the actual birth of the city and is the logical landmark from which to measure its life and progress among the great cities of the world. There is, of course, an unavoidable sameness in all such celebrations, but in this particular case there were circumstances which gave to the celebration a special interest, and served to draw the attention of the civilized world. In all the world's history there is no parallel to the extraordinary rapidity of the growth of New York city in wealth, extent and population. In 1653 we find a little settlement of 1,500 souls, housed in a few modest homes in a clearing at the southerly end of forest-covered and rocky Manhattan Island. Two hundred and fifty years later, New Amsterdam is represented by splendid New York, with a population of close upon four millions of souls. The forests of Manhattan have been swept away, the swamps filled in, the rocky hills laid low, and the island covered from end to end and from river to river with majestic buildings devoted to commerce and industry, with the magnificent homes of its successful merchants and financiers, and the lofty apartment and tenement homes of its busy toilers, while its streets and avenues are seamed and undermined with a veritable network of railways for the quick transit of its inhabitants.

It would be a distinction for any city to have grown in two and a half centuries from a mere village to be the second greatest metropolis of the world. But New York city has been favored by holding a commanding geographical position which in itself has undoubtedly given it a prestige unique among the cities of the world. Most fitly has it been named the gateway of the western hemisphere, for into its harbor and outward through its radiating network of railways, has poured and been distributed that marvelous stream of cosmopolitan humanity which has contributed so largely to our growth in population, and to the development of that national versatility to which our commercial success is largely due. New York city has increased by a steady influx from every quarter of the compass; from the East by the immigration of foreign races, a large percentage of which has made New York its home, while from the West, North, and South it has grown by the steady inflow of the more energetic among its own native population, whose ambition has drawn them to a city that holds out promises of wealth and fame, promises, by the way, that it frequently redeems with a most lavish hand.

Although the municipal history of New York city has been extremely turbulent and much of it discreditable, allowance must be made for the fact that the city is so largely cosmopolitan, and that it has ever been the favorite hunting ground of the political adventurer. When we remember how many thousands of immigrants settle each year within its boundaries, and that these people, many of whom cannot even speak the language of the country, are early invested with the privileges of the franchise, the marvel is not that the city should have had so much, but rather that it should have had so little, that is disastrous and humiliating written in its records. Moreover, there is much promise for the future in the fact that whenever the best elements among the citizens of New York city have set themselves to reform municipal abuses, they have been easily able to obtain full control and have proved, as at present they are proving, that the city can conduct its affairs righteously and justly and in the best interests of the individual citizen.

It is pardonable at a time like the present to make a forecast of the future; and it may safely be said that if the city continues to grow at the present astonishing rate, it will hold, sooner than many of us expect, the proud position of being the leading metropolis of the world, pre-eminent not merely for its numbers, extent, and wealth, but also, let us hope, for the purity of its government and the high ideals and political integrity of its citizens.

REMARKABLE EFFICIENCY OF ELEVATED RAILWAY ELECTRIC SERVICE.

That electric traction is more economical and in every way more efficient than steam traction for rapid transit on a road of the great traffic and very frequent stops of the Manhattan Elevated Railroad in this city, needs no demonstration at this stage of electrical development. Yet, the economical results shown in the operation of this system since the installation of electric traction have more than borne out the predictions made at the time that the change was determined upon. The average speed of the trains has been accelerated about twenty-five per cent, which, of course, means that the capacity of the road has been increased to that extent. The total time for any given trip over the line being twenty-five per cent less, it is possible to run, under the same headway, just twenty-five per cent more trains than formerly. The gain in speed is chiefly in the rapid acceleration at starting, and quicker stopping due to the introduction of the Westinghouse air brake. The speed of the train when under way is also higher than it was when steam locomotives were in use. There is a further gain due to the fact that in the busy hours the trains are six cars instead of five cars in length, there being a further increase in capacity of twenty per cent from this cause alone. The total number of persons carried daily by the elevated system has now reached the great average of 800,000. To work this service requires the exercise of 45,000 electrical horse power. No such results as these could be accomplished by the old steam engines, whose greatest tractive effort was equal to about 7,000 pounds pull on the drawbar. The maximum tractive effort exerted under the present system, in which the motors are distributed throughout the train and a much greater load is therefore available for adhesion, is about 20,000 pounds. The remarkable increase in the starting power and in the brake power is not secured, however, without some expense of personal convenience, many of the motormen seeming to be rather slow in learning to handle the greater power which they have at command with proper discretion. The starting and stopping is more jerky and irregular than it need be; although with every added month of operation there is a marked improvement as the incapable motormen are being weeded out.

COST OF HIGH-SPEED STEAMSHIP TRAVEL.

In connection with negotiations between the British Admiralty and the Cunard Company for two new vessels of 25 knots average sea speed, an investigation was made of the comparative size, horse power and cost of first-class Atlantic passenger steamers designed to steam at speeds that increased in each vessel by one knot per hour. Estimates were made of the size, cost of construction and cost of operation of steamers of from 20 to 26 knots per hour, and the investigation was based upon a 20-knot steamer 600 feet in length, with engines of 19,000 horse power and consuming in a single trip across the Atlantic 2,228 tons of coal. Such a vessel would cost $1,750,000 and it would receive from the government an annual subsidy of $45,000. A 23-knot steamer, built under the same government conditions as to subsidy, would be 690 feet long, would require 30,000 horse power; would cost $2,875,000 and would require an annual subsidy of $337,500. A 25-knot steamer would be 750 feet long, would require 52,000 horse power; would cost $5,000,000, and would require an annual subsidy of $750.000, while a 26-knot steamer would have to be 780 feet long, would require 68,000 horse power, would cost $6,250,000, and an annual subsidy would have to be paid by the government of $1,020,000.

In the machinery department of a 20-knot vessel 100 men would be required; in a 23-knot vessel, 150 men; in a 25-knot vessel 260 men, while for a 26-knot ship there would have to be 340 engineers, oilers, etc. It will thus be seen at what an increasing rate the first cost and the operating expenses of these high-speed steamers run up. For the increase in speed of a single knot an hour, or 24 knots per day, it is necessary to add 30 feet to the length of a 25-knot ship, 16,000 horse power to the motive power and 1,255 extra tons of coal must be put into the bunkers. The displacement must be increased by 3,100 tons; 80 more men must be added to the engine and boiler room staff, and the total cost will be increased by $1,250,000.

THE ABUSE OF A NOBLE SPORT.

It required only a series of shocking fatalities such as happened in the recent Paris-Madrid automobile race to bring the governments concerned and the general public to their senses, and demonstrate to what criminally absurd lengths the sport of automobile racing has been carried. On the other hand it is well to remember that in the presence of a great disaster there is always a risk of panic legislation, and it is to be hoped that, while the Paris-Madrid horror will result in the abolition of road racing under the extremely dangerous conditions that have hitherto been allowed, it will not lead to the prohibition of such racing when it is governed by reasonable restrictions as to the contestants, and surrounded by absolute safeguards for the general public.

The French government has sanctioned and, indeed, officially promoted these contests on the ground that it was automobile racing that was largely responsible for the rapid development of the automobile industry in France. This is probably true; for it necessarily follows that in endeavoring to produce cars that will stand the enormous strain and the tax upon the endurance, of these long-distance road races, there is a stimulus both upon the inventor and builder such as could be afforded by no other means. The miserable mistake and folly of the whole business is in permitting the races to extend over such great distances that it has become impossible to adequately police the course and surround the contestants with adequate safeguards. In the present system there was absolutely no tax upon the weight or power of the cars. Any amateur who possessed sufficient money and foolhardiness was at liberty to have built for him and to run a veritable locomotive over the course. This, in itself, was an invitation to disaster; but when he was allowed to send this machine crashing along the public highways between lines of densely packed peasantry at speeds of from 50 to 80 miles an hour, the conditions were ripe for slaughter.

If automobile races are to be conducted in the future—and seeing that these races are a direct stimulus and benefit to the industry, it is certainly desirable that they should continue to be held—they must take place either on specially constructed and carefully guarded courses, or on stretches of public highway from which the public is absolutely excluded. Moreover, the contestants should be limited to successful candidates who have been selected after a series of trial races. This is the plan that is to be followed in the forthcoming races in Ireland, where instead of several hundreds there will be but a dozen competitors and where the course, which is of limited length, will be kept guarded by some 7,000 or 8,000 of the constabulary.

But even in the case of the Irish race it will be impossible to eliminate one inevitable cause of disaster, namely, the unevenness and curvature of a public highway. When a machine is traveling at a speed of 60 to 80 miles an hour, slight inequalities in the surface, which would not be noticeable at 30 or 40 miles an hour, become, by virtue of the terrific jar imparted to the machine, a positive source of danger; while in rounding curves which have no banking on the outer side a heavy cross strain is thrown on the tires, and should the speed exceed a certain rate, either the tires will skid or the machine will be overturned by the great centrifugal force set up.

Perhaps it may prove that these difficulties (which are inherent, if the public highways are to be used by high speed vehicles) are not unmixed disadvantages; for they may lead to the recognition of the fact that if we are to utilize the high speed possibilities of the automobile, we must solve the problem along the lines upon which we have so successfully solved it in railway travel, and build special road-beds for high speed automobiles. The indications are that the time is not far distant when the increase in automobiling will be such as to guarantee the construction of special roads with perfectly true surface, with small curvatures properly banked on the outside, and with ample protection, by the exclusion of all grade level crossings, against collisions with passenger and vehicular traffic.

We close with a brief summary of the race and the times made by the leading cars.

The first stage of the ill-fated race, from Paris to Bordeaux, a distance of 300 miles, was covered by the racers early on Sunday morning, May 24, with so many fatalities and serious accidents to the participants and onlookers that the running of the two remaining stages was forbidden by the French and Spanish governments. Seven were killed and three others critically injured as a result of the terrific speed and the failure of the authorities to keep the road clear. Marcel Renault, the winner of the Paris-Vienna race last year, and two chauffeurs on two other racers, were killed by their cars upsetting when their drivers tried to avoid obstacles in the road, while two

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women and two soldiers who got in the way were run down and killed instantly.

The best time from Paris to Bordeaux was made by Gabriel on a Mors racer. His running time was 5 hours 13 minutes 31 1-5 seconds, which made his average speed about 66 miles an hour. Louis Renault, on a Renault car, was second in 5 hours 22 minutes 59 seconds; and J. Salleron on a Mors, third, in 5 hours 46 minutes 1 4-5 seconds. Jarrott, the Englishman, on a De Dietrich, arrived fourth about five minutes later.

PROF. GOODSPEED ON SECONDARY RADIATION INDUCED BY X-RAYS.

The first printed statement issued over his own signature by Prof. Arthur W. Goodspeed of the University of Pennsylvania concerning secondary radiation induced by X-rays since his announcement of important discoveries in this direction is published in the university's official organ, The Pennsylvanian. The article reads:

Having occasion last winter to examine critically some radiographic records, I was surprised to find the clear outlines of some metallic bodies that had been behind the plate during exposure. This recalled that I had been consulted once by somebody who had found similar anomalies, and that I had been unable to throw any light upon the subject. For obvious reasons, I determined now to spare no trouble to hunt down the cause of the effect which I had observed, and after a series of upward of one hundred progressive experiments I was convinced that when an X-ray tube is in operation not only is every particle of matter which is impinged by the X-rays secondarily radiant, but that also in some cases this secondary radiation had in all probability imparted activity of some sort to air particles and to portions of the wall which had not been impinged directly by the primary rays.

The cause, then, of the impressions on the plate of articles behind it was established. All of the later experiments leading up to this conclusion had been made with the Crookes tube completely inclosed in a dark box, eliminating thereby every trace of fluorescent emanations which one usually does not take the trouble to cut off and which are always emitted by the glass with which the bulb is made.

Next, from a portion of the space outside the box, the X-rays, which, of course, passed freely through the wood, were completely cut off by heavy lead plates, properly placed on the top of the box, and it was on these plates, screened thereby from the X-rays, that the radiographic films employed for receiving the records were placed. Above this, and to one side, freely accessible to the X-rays, the various bodies to be tested for secondary activity were arranged, including zinc, brass, wood, my hand, and a variety of articles too numerous to mention. In every case unmistakable evidence of secondary action appeared upon the plate.

Presuming, of course, that others besides myself may have been working along similar lines, I proceeded to look up carefully the literature on the subject in order, if possible, to determine what parts of the investigation, if any, might claim priority as well as originality. Two Frenchmen, Perrin and Sagnac, I found had demonstrated the property of secondary activity induced by the X-rays, and along some lines of investigation had given some interesting quantitative values; and still a third Frenchman, Guillox, had demonstrated the possibility of using the hand as a secondary source.

None of these three, however, seems to have excluded the optical fluorescence which always accompanies the X-rays, unless special care is taken to cut it off, as already explained. Inasmuch as I found that an Englishman of the name of Townsend had demonstrated that some differences in the numerical values given by Perrin and by Sagnac must have been due to a difference in the primary rays they employed, it seemed to me that putting everything in absolute darkness, from an optical point of view, and then experimenting in the night, thereby cutting off every trace of optical light, was a distinct step in advance of the work of the men referred to.

In brief, then, it has been shown possible to produce secondary radiograms on a sensitized film, inclosed in a perfectly dark receptacle, by means of absolutely invisible emanations from various articles, including the human body, which have been excited by X-rays generated within a black box in a perfectly dark room.

This apparently startling conclusion loses much of its mystery when we contemplate that it is entirely proved at the present time that only about 2 per cent of the radiant energy that comes to us from the sun is capable of affecting the human eye. That bodies on the earth, therefore, while bathed in a portion of the other 98 per cent may be capable of diffusing some of it is what any thoughtful person will admit.

A piece of white paper in a beam of sunlight, or even in a space diffusely illuminated, as is the room of a house, receives a small portion of the 2 per cent of the total energy incident upon its path, and diffuses again a small portion of what it receives, thereby making it visible to the eye. Why, then, might we not expect that a piece of zinc or copper favorably posed to receive a portion of the other 98 per cent, i. e., of the dark energy, should be capable of diffusing some part of that in such a way as to be objectively visible to some appropriately devised apparatus for observing it?

It is to be noted in passing that the most favorable location for getting some of the 98 per cent without some of the visible 2 per cent is in a dark room. We have been using the word dark, of course, as applied to the human eye. It is quite possible, to my mind—entirely probable—that a mouse, and very likely a cat, could, if it had the proper intelligence, give us valuable assistance in rooms to us totally dark which are doubtless to them comfortably illuminated.

In connection with the work just referred to, a somewhat painful personal experience seems to me to be suggestive as to the possible cause of the well-known inflammation which sometimes follows prolonged exposure to the X-rays. A year ago I had occasion to sleep in the same room in which experiments had been conducted during the day. At the end of that time I left town, but developed at once an aggravated attack of inflammation of the eyes and throat, which yielded to treatment after a few days. During the first week of this month again I found it convenient to sleep in the same room where I had been conducting experiments during the day and evening. At the end of about the same time all the symptoms reappeared with which I had suffered a year ago, with same result—on changing sleeping rooms the difficulty at once disappeared.

In drawing conclusions from these experiences, it must be noted that no trouble has been experienced in the meantime nor before, although I have frequently, during the last six weeks, spent several hours each day for a week or two at a time around the X-ray apparatus. In the night the room had been nearly or quite closed, preventing free air circulation, and the potent protection of eyeglasses was wanting.

I am forced, under the circumstances, to believe strongly that the immediate cause of the troublesome inflammations was the secondary emanations from the air or bodies in the room, or the human body itself, rather than the primary X-rays. This theory would, of course, necessitate the assumption that the activity lasts for an appreciable time after the exciting cause has ceased.

To prove this by objective experiment would indeed be difficult, since the ions developed by the passage of the X-rays through the air are, of course, present for a considerable time after the cessation of the rays, and the electroscope, which would be expected to indicate the activity sought, would be discharged by these ions, and we would still be in the dark.

ALKALI MANUFACTURE BY ELECTRICITY FROM NATURAL SALTS.

The first six months' working of the electrolytic process of manufacturing alkali from natural salts in England has proved so successful that a wider adoption of the process is to be carried out. The general system of manufacturing the alkali from the natural product is by the decomposition of the two fundamental constituents—chlorine and soda—by complicated and not expensive chemical processes, in which sulphur plays an important part. The methods invented by M. Leblanc, a French chemist, more than 120 years ago have been generally followed ever since that time. During the past few years, however, Mr. James Hargreaves and Mr. Thomas Bird have been conducting an elaborate series of experiments, with the object of devising some simpler and more economical method of bringing about the decomposition of the salt with the aid of electricity.

For the purposes of these experiments a small plant was laid down at Middlewich, Cheshire, the center of the salt industry of England. The salt abounds in the form of brine in large subterranean lakes. In the electrolytic process, the brine after being pumped to the surface is conducted into rectangular cells, through which is passed a strong current of electricity. The effect of this is to release the chlorine, which escapes in the form of gas into pipes, and is conducted into other chambers, where it is brought into contact with lime, and produces chloride of lime. The solution of sodium which is left in the cells passes out through a diaphragm, and is converted by a bath of steam into soda solution. By a very simple arrangement in the construction of the chambers, carbonic acid gas, from the furnaces which supply the power, meets this soda solution and its properties are absorbed, with the result that a strong solution of carbonate of soda is formed. Then it flows away into vats, where the soda gradually hardens into crystals, and the processes are complete. It is then only necessary for the great blocks of soda carbonate to be broken up to a suitable size for sale.

A battery of only 56 cells has been at work, but the profit upon six months' experimental work is $37,500. The main features of this new process are economical production, with very little waste, and the reduction in price to the consumer of the finished products.

SCIENCE NOTES.

The anti-diphtheria serum discovered by Prof. Roux, of the Pasteur Institute, is now being made in the form of lozenges for use during convalescence. The professor had observed that bacilli found in the mouths of patients several weeks after recovery were liable to convey the disease to others. The lozenges overcome this and also render preventive inoculation unnecessary.

The Greeks and Romans paid special attention to the physical culture of their youth, to public water supplies and baths, and Athens and Rome were provided with sewers early in their history. During the middle ages, sanitation received a decided check. Ignorance and brutal prejudice prevailed and this was the most unsanitary period in history. Most European towns were built compactly and surrounded by walls. The streets were narrow and winding, and light and air were excluded. The accumulation of filth was frightful. Stables and houses were close neighbors. The dead were buried within the churchyards or in the churches. Wells were fed with polluted water. All conditions were favorable for the spread of infectious diseases, and in the fourteenth century alone the Oriental or bubonic plague—the Black Death of recent historians—carried off a fourth of the population of Europe. The birth-rate was much less than the death-rate normally. The cities had to be continually repopulated from the country. These sentences from a review in Science of new works on sanitation in our own times illustrate, by provoking a comparison, the improvement in our day.

H. D. Richmond points out that it is quite fallacious to endeavor to test the acidity of milk with litmus-paper, since it is possible to condemn all fresh milk as the result of applying that test. Litmus-paper may be either red containing only the acid, or blue containing the acid with such an amount of alkali that no red ions are formed, or at some intermediate stage. If those papers be used to test a partially neutralized mixture of acids of various strength, contradictory results may be obtained. Phosphoric acid is a good example of three different acidities in one molecule; the first acidity is strong, the third is very weak, and the second is intermediate between the two, and about equal in strength to the acid of litmus. It has been shown that milk contains phosphates with the third acidity completely neutralized and the second only partly so, and therefore milk is an excellent substance to show the peculiar behavior of litmus. If blue litmus-paper be dipped into milk, the blue litmus, having the acid completely neutralized, is more alkaline than the milk, and the two tend to come into a condition of equilibrium by a portion of the alkali of the litmus passing to the milk; the consequence is that the litmus becomes less alkaline and turns slightly red. If red litmus-paper, which is more acid than the milk, be used, alkali will tend to pass from the milk to the litmus, and turn it slightly blue. This is the so-called amphoteric reaction. A litmus-paper of some intermediate stage would be unaffected.—Chemical News.

A German chemist, Herr Gerold, has discovered a means of preventing the ill-effects which sometimes arise from the excessive use of tobacco, which is liable to produce attacks of vertigo, a particular form of dyspepsia, palpitation, and diseases of the chest. His procedure consists in steeping the leaves of tobacco, before being made up, in a solution of tannic acid, which combines with the nicotine and forms a substance quite inactive and harmless. In order to increase the flavor of the tobacco, it is then treated with a decoction of marjoram. The flavor of the tobacco prepared as above described differs in no way from that of ordinary tobacco; and experiments made with it on weasels, frogs, and even human beings, have demonstrated that its use produces no toxic effects on the organism. The pressure of the blood remains normal, the heart beats regularly, and the paralysis which overtakes animals who have been poisoned with nicotine is entirely obviated. Our contemporary adds that all smokers will hail with satisfaction the discovery of Herr Gerold. We fear that, as a smoker, we can scarcely agree with this optimistic statement. Supposing that Herr Gerold succeeds in removing all the nicotine, what is left? We doubt that the vast proportion of tobacco smokers suffer from consequent dyspepsia, palpitation, and diseases of the chest, and believe that they will prefer to continue the use of tobacco than to adopt Herr Gerold's substitute. If, on the other hand, a smoker does suffer as our contemporary suggests, he would do well to refrain from the "noxious weed" altogether.

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