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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 COMEDY OF THE MANHATTAN BRIDGE.

Is there not a strong element of the ridiculous in the present hysterical attempts to solve the problem of the Brooklyn Bridge congestion by building a three-and-a-half-million-dollar station and a thirteen-million-dollar subway—provisions which can merely modify and never cure the evil—when the whole congestion could be relieved by building the Manhattan Bridge, whose construction was authorized nearly ten years ago? The Brooklyn Bridge is crowded to its maximum capacity, if not beyond it. Eight or ten years ago the crowding had begun, and to provide for the present congestion, which was even then foreseen, the city did the obviously best thing, namely, authorized the building of another bridge within a quarter of a mile of the Brooklyn structure, the capacity of the new bridge being fifty to sixty per cent greater than that of the old bridge. Plans were drawn up, and everything was ready for a vigorous prosecution of the work, when the politicians got hold of the enterprise, deliberately stopped the work, and have been playing football with this, the most badly-needed municipal work of the day, ever since.

The Scientific American has kept the public pretty well informed of the course of this disgraceful fiasco, and less than a year ago, wrote an open letter to the present Mayor, respectfully calling his attention to the delay, and asking that he use his authority to expedite the building of the bridge—a communication which proved of so much interest to His Honor, that he has not yet found time to acknowledge its receipt.

Although the piers for the Manhattan Bridge were completed, ready for the erection of the steel, four or five years ago, not a pound of structural material has been erected even at this late day. Meanwhile, instead of going ahead with the new bridge, which would bring instant and abundant relief, the city officials, from the Mayor down, have been worrying about the best kind of a terminal station to build at the Manhattan end of the old bridge. The plans have been drawn for a structure which would seem to be capable of handling at least twice as much traffic as the old bridge can ever bring into it.

As if to make the folly more complete, the city has now authorized the construction, between the Williamsburg and Manhattan bridges, of a subway loop into which the cars of the Brooklyn Rapid Transit, not being suitably constructed for subway service, can never enter. When the subway is completed, the cars of the most important branches of the Brooklyn system of transportation will be barred from its use.

We have always believed, and still do, that a temporary elevated loop, usable by the elevated cars of the Brooklyn Rapid Transit, should have been built and used, until such time as the subway loop could have been constructed, and the Brooklyn Rapid Transit equipped with cars suitable for subway service.

## MR. HILL ON THE RAILROAD CRISIS.

In the course of a recent letter to the Governor of the State of Minnesota, James J. Hill, who unquestionably understands the railroad situation better than any other man in the country, makes a masterly analysis of the recent report of the Interstate Commerce Commission, and proves that the present alarming congestion in railroad traffic is the inevitable outcome of the disparity between the enormous increase in traffic and the relatively small mileage of new railroad track which has been built to meet it. The letter is remarkably devoid of theory and speculation; it deals with the cold facts and figures of the Interstate Commerce reports, and the analysis and deductions are so clear and convincing that he who runs may read.

In proof of his statement that of late years, although the volume of business has increased enormously, there has been built a relatively decreasing amount of track and terminal facilities, Mr. Hill compares the statistics of the growth of railroad business in the ten years from 1895 to 1905. During that decade the track mileage increased from 180,667 miles to 218,101 miles, or 21 per cent. But during the same time the passenger mileage increased from 12 billion miles to nearly 24 billion miles, or 95 per cent, and the freight-ton mileage from 85 billion ton-miles to 186 billion ton-miles, an increase of 118 per cent.

The above figures are even more alarming than they look to be; for within the ten years above mentioned, there has been a steady increase in the annual percentage of increase of each year over the preceding. Thus in the ten years 1870 to 1880, the per cent increase per annum in the total mileage of track was 7; from 1880 to 1890 there was a 7.46 per cent increase; but from 1890 to 1904 the increase fell to 2.19 per cent, and in the two years 1904 to 1906 the increase has fallen to 1.45 per cent per annum.

The situation is tersely summed up by Mr. Hill when he says that the limit of service of a common carrier has been reached when it has moving at all times over its systems as many cars as can be run on its tracks with safety, and transferred and dispatched from its terminals and junction points without unreasonable delay. Beyond that point, increase of business cannot be handled by increasing the number of cars and engines. The disparity between the growth of traffic and the additions to railroad mileage and extension of terminals, shown by a new mileage of less than 1½ per cent since 1904, to take care of a traffic increase averaging 11 per cent a year for ten years past, presents and explains the real problem. That the railroads have been making strenuous efforts to meet the clearly foreseen crisis is shown by the facts that, not only were there 25 per cent more locomotives and 45 per cent more cars in service in 1905 than in 1895, but each engine and car did much more work. The passenger miles traveled per locomotive increased more than 68 per cent, and the ton miles per freight locomotive increased more than 57 per cent.

The remedy proposed by Mr. Hill is staggering in its proportions and cost. He states that the best judgment of many conservative railroad men in the country is, that an immediate addition of not less than 5 per cent per annum should be made to the railroad trackage of the country for the next five years. For modern requirements, the additional track and the needed terminal facilities would cost not less than $75,000 per mile; that is to say, the cost of the new work would amount to a total of five and one-half billion dollars, or a yearly average of one and one-tenth billion dollars. Two remedies are proposed. For the reason that any considerable enlargement of the present terminal facilities in the city is absolutely prohibited by the enormous cost of real estate, the terminal congestion will have to be met by a decentralization of traffic. New centers for the transfer and forwarding of freight must be secured at points where land can be bought in adequate quantities and at a reasonable cost. Furthermore, there must be an all-round decentralization of traffic, with more points for export and more interior markets. Mr. Hill suggests that a 15-foot canal or channel from St. Louis to New Orleans would do more to relieve the middle West and Southwest than any other work that could be proposed.

In this, as in all great crises, it is essential that there should be harmonious co-operation in working out the solution. Although the railroads, or many of them, have unquestionably shown in the past too little inclination to strike a fair balance between their own interests and those of the general public, we believe that the fault has by no means lain entirely with the railroads. Mr. Hill says truly that it was not by accident that railroad building has declined to its lowest within a generation at the very time when all other forms of activity have been growing most rapidly. The investor declines to put his money in enterprises which are under the ban of unpopularity, and even threatened with confiscation and transfer to the State. This feeling must be removed, and greater confidence mutually established, if any considerable portion of the vast sum necessary to meet the crisis is to be available for the work.

## BROOKLYN BRIDGE TERMINAL STATION AND SUBWAY LOOP.

The new Brooklyn Bridge Terminal, for which the Board of Estimate has recently appropriated three and a quarter million dollars, will be nearly three blocks in length and probably six or seven stories in height. The present terminal at City Hall Park will be completely removed, and it will then be possible to obtain from the City Hall an unobstructed view of the bridge structure and of the Brooklyn shore beyond.

To enable the surface cars to reach their own station, which will extend for two blocks north and south, and will be entirely below ground, North William Street will be closed, and the roadways on which the trolley cars run will commence to the east of William Street on an easy descent, which will bring them down below surface level without interfering with street traffic. The elevated trains will be loaded and unloaded at two different levels within the station, the first of which will be one story and the second two stories above the street surface.

It is not to be expected that the station will cause any material increase in the number of cars or trains that can be run across the Brooklyn Bridge, which is already crowded to its maximum capacity. The advantage of the terminal station, which will extend north from the present terminal as far as the junction of Duane and Center Streets, is that traffic will be more completely organized, the passengers who take the surface cars being distributed to the proper platforms reserved for each particular line of travel. Furthermore, it will be possible to permit trains from all sections of Brooklyn to cross the bridge without change during the rush hours.

The Subway loop, which has been authorized by the Board of Estimate, begins at the Williamsburg Bridge plaza in Brooklyn, crosses that bridge to Manhattan, and extends below Delancey Street to Center Street, beneath which it runs to the Manhattan Bridge. After crossing that bridge to Brooklyn, it runs by way of the new Flatbush Avenue extension—Fulton Street, Lafayette Avenue, and Bedford Avenue—back to the Williamsburg Bridge plaza. In Manhattan the line will be carried southerly below Center and William Streets to a point between Maiden Lane and Wall Street, with an eventual connection with Brooklyn by one or more tunnels. Moreover, it is probable that ultimately the loop will have an extension through Grand and Desbrosses Streets to the North River.

The most serious objection to the proposed loop is that the cars of the elevated roads of Brooklyn are not built of that fireproof construction which is considered to be necessary for the safe operation of a modern subway, and therefore they could not be sent through Manhattan by way of the loop. Had a temporary elevated loop been built, its construction could have been rapidly completed, and the Brooklyn elevated cars have made immediate use of it. Meanwhile, the construction of the permanent subway might have been undertaken, and special cars constructed by the Brooklyn roads for service by way of the loop.

## A NEW ELECTRIC LAMP FILAMENT.

After seven years' research by Prof. H. C. Parker and Mr. Walter G. Clark, of Columbia University, these gentlemen have discovered and perfected a new incandescent lamp filament that is a marked improvement over the usual carbon filament both in the quality of light produced and the economy and life of the lamp. The inventors have christened their new filament the "Helion," on account of the resemblance of the spectrum of the light produced by it to the solar spectrum.

The new filament is composed chiefly of silicon, which is reduced and deposited upon a very thin carbon coil similar to that used in the ordinary incandescent lamp. The completed filament is mounted on a base in an exhausted bulb like those ordinarily used.

The Helion filament is remarkable in several respects. Foremost among these is the white quality of the light, which is obtained at a comparatively low temperature and with a consumption of electrical energy of but one watt per candle power produced. The new filament, while non-metallic, produces the unit of light with the unit of electrical energy at a much lower temperature than do some of the more recent metallic filaments when giving like results. The consumption curve in watts per candle is practically a straight line from 1,575 deg. C. (3½ watts per candle) up to 1,730 deg. C. (1¾ watts per candle). From this point on the curve gradually flattens until, at 1,800 deg. it is a horizontal line corresponding to a consumption of but one watt per candle power. Each filament has a point of maximum candle power, and increasing the current beyond that normally used at this point does not increase the candle-power. Filaments have withstood 100 per cent overload of current beyond the point of maximum brilliancy without rupture. The amount of overload one of the new filaments will stand was forcibly demonstrated by mounting one of them in a bulb on two pieces of copper wire several times greater in cross-section than the filament. The filament withstood without damage a current that fused the wire. Comparison between the luminosity of a Helion filament lamp and that of an ordinary incandescent shows that the former produces three and one-half times more light with the expenditure of considerably less energy at the point of greatest luminosity, which corresponds to the same wave-length for each. The high efficiency of the Helion filament is thought to be due largely to selective radiation, for although an increase in temperature above 1,720 deg. increases the intensity of the light, it does not make much change in its color, as is the case with the usual carbon filament lamp.

The life of the new filament appears, from the few tests which have thus far been made, to be comparatively long. The extremes of eight lamps tested were 485 and 1,270 hours. The short-lived lamp showed a decrease in candle power of 15 per cent, while the long-lived one fell off only 3 per cent. One lamp that burned 735 hours showed a gradual increase in candle power of 2 per cent. The long-lived lamp mentioned showed an increase in candle power for the first 400 hours, followed by a gradual and slight falling off in candle power for the balance of its life. Starting with 37 candle power and 37 watts, after 200 hours this lamp began to show an increase in candle power without, however, any increase in current. At the end of 400 hours the candle power had run up to 40. During the next 100 hours it fell again to 37, and then declined gradually to 35½ at the end of 1,230 hours, while the consumption was diminished about half a watt. As these lamps that were given a life test were rather crudely made in the laboratory, and as they had been submitted to tests of various kinds before undergoing it, this probably accounts for the non-uniformity of the results obtained. The break in the filament occurred at the same place in each lamp, i. e., near the cement terminals, and it was due, the inventors believe, to a cause which can be corrected when the lamp is made commercially. Filaments of 30 candle power have been made for voltages of from 100 to 115 and of about the same length as the carbon filament of the ordinary lamp.

From the foregoing description of the Helion filament and the tests which have been made with it, one can see that it is apparently a very marked improvement over the filament now generally used, giving as it does approximately twice as much light with half the current consumption, and furnishing a much whiter light at that. The fact that it can be used in the ordinary vacuum lamp bulb is a point in its favor, as it can thus be readily employed wherever the ordinary incandescent lamp is at present in service.

### THE JAMAICAN EARTHQUAKE.

From the meager details available at the time of this writing, it would appear that the recent earthquake which destroyed Kingston, Jamaica, was hardly less destructive in severity and extent than that which resulted in the destruction of San Francisco, or the subsequent one which effected such terrible devastation at Valparaiso. The past twelvemonth has been signalized by a series of natural phenomena which have been seldom equaled in any similar period within the history of mankind. Beginning with the terrible volcanic outburst of Vesuvius, various points of the earth's surface have been convulsed by volcanic outbursts or earth tremors, which have had the most disastrous effect, and have resulted in great loss of life and vast destruction of property. These various cataclysms have not occurred, furthermore, in a single so-called volcanic or earthquake belt. They have taken place in the most widely-separated localities, and our seismologists have not been able to ascribe their origin satisfactorily to a common cause. Whether or not it is merely coincidence that these happenings should all have taken place within a twelvemonth, or whether there is some great underlying action with which we are unfamiliar, and which has given rise to them, is still unexplained.

From the information at hand, it seems that the earthquake which destroyed Kingston consisted of a great number of shocks, with a shock of maximum intensity near the beginning of the series of tremors. The light architecture prevalent in the southern city was poorly adapted to resist a convulsion of this character, and even more substantially-built edifices collapsed under the exceptional severity of the earthquake. The usual accompaniment of tidal wave and Stygian darkness due to dust was present in this case too, and added to the general horror of the situation. It has been estimated that hundreds of lives were lost and that the damage to property will be found to reach many millions of dollars. The bottom of the harbor has sunk many feet, and there is danger, apparently, that the entire city—or rather what is left of it—may gradually sink into the sea.

While we are reluctant to ascribe a common origin to all these recent seismological phenomena, there may be some cause beyond our knowledge which has compelled vast internal changes in the structure of the earth, resulting in these alterations and readjustments upon the surface thereof. For instance, such cause might be found in the recent sunspot maximum. It must be remembered that a slip of a few inches only in rock strata which are poorly balanced or under heavy strain is sufficient to cause an earthquake of the greatest extent and intensity.

Prof. John Milne, the great English seismic authority, has advanced a theory to account for recent disturbances of this character manifested here and abroad in various parts of the world, which has been held tenable by Sir Norman Lockyer and Prof. Archenbold. Prof. Milne declares that the disturbances are due not to a merely normal readjustment of the earth's strata or to the shifting of the surface to meet a gradual contraction in the size of the globe, but are caused by displacement of the globe itself from its true axis and are really due to the jar incident to the subsequent swing back of the earth upon that true axis. It is conceivable that such a return movement to the axis as well as the original distortion would cause a tremendous strain upon the crust, and could easily account for the most terrific seismic convulsions imaginable. Sir Norman Lockyer declares further that the deviation from the true axis, a fact which, by the way, can be scientifically proven, is due to the great sunspots which recently sent more energy to the earth than at any other time during the thirty-five years sunspot period, and which, through the great differences in the corresponding temperatures, caused the formation of vast ice-masses at one or the other of the poles, of such weight that the distortion takes place, to be subsequently remedied by other variations.

As has been stated before in these columns, the consideration of a terrible calamity of this character immediately calls to the mind of the New Yorker the thought of what would happen should a similar disturbance occur in this region. From the experience to be gathered in the San Francisco earthquake and from what has been learned on other occasions, it would seem that many of New York's great modern buildings would stand a fair chance of immunity unless the convulsion were one of extraordinary violence, for not only is the great majority of the later structures of the riveted steel-frame type, but the underlying formation, particularly of the island of Manhattan, offers a solid rock foundation of the most substantial nature. Little apprehension need be felt, however, for it is generally conceded by authorities on the subject that the city is not in any one of the various earthquake belts and that this vicinity is part of an area which, considered geologically, is past the formative period by many thousands of years.

### METHOD FOR ELECTRO-DEPOSITION AND SEPARATION.

BY EDWARD C. BROADWELL.

There is an intermediate method between deposition from aqueous solutions and the high-temperature, chiefly endothermic, reactions rendered possible by the joulage of an arc or resistance electrical furnace.

A double borate or phosphate of barium or lithium and any metal the electro-positive nature of which does not exceed that of manganese furnishes a molten bath, from which the metal is easily deposited in pure carbon-free condition. Borates, phosphates, or silicates of the volatile alkaline metals, although giving good solvent baths, are useless if a perfectly smooth coating of the chem-energetic heavy earth metals is desired, as the greater part of the alkaline metal volatilizes, leaving the coating pitted.

While Mn, Cr, Mo, Ti, W, etc., produced by thermic reactions due to Winkler and perfected by Goldschmidt, can be had over 99 per cent purity, these metals are in infusible lumps, and only suitable for alloying.

In an endeavor to get metallic chromium in particular, as well as Mn, Mo, Ur, W, etc., in soft, pliable sheet form for tests as to their suitability (when shredded) for use as incandescent lamp filaments, I found, as claimed in several electro-chemical books and journals, that at even high E. M. F.'s these metals could be deposited only as pulverulent coats if at all; moreover, in either the arc or resistance furnaces, their carbides, which lack the qualification of infusibility at incandescent lamp temperatures, are always obtained, and for the purpose found useless.

In my initial experiments the ordinary blowpipe Pt wire loop was utilized as the retaining vessel and anode; the wire, being somewhat stouter than usually employed, was pushed through a clay pipestem, leaving enough of stem to seal in the glass rod as a handle, and around this pipestem, and curved so as to dip concentrically into the bead retained by the loop, was coiled a finer platinum wire, to act as the cathode, its tip being withdrawn from the bead and cut off and re-immersed in the bead as the work progressed.

My bead or electrolyte bath consisted of potassic fluoride, when the metals having a so-called higher solution pressure than manganese were to be deposited from the ore dissolved by the fused fluoride, and the borax or microsmic salt bead was found best for metals belonging to the iron, zinc, and heavy-metal groups. The oxide or roasted ore is picked up by the bead in the usual manner, and when the solution is complete and the bead clear, the fine curved Pt wire, previously connected to the negative pole of the generator, is then immersed and electrolysis begun. As practice, it is interesting to decolorize a blue cobalt bead, and if a milliamperemeter is handy, to estimate the amount of metal deposited. When two or more metals are in the bead or fusion, the metals, owing to non-interference of hydrogen, can be sharply separated by watching the inverse E. M. F. shown by the voltmeter when the external source of energy is cut out. In a potassic fluoride bead the complete and decisive separation of didymium into its nine more or less elements ought to be easily possible for the electro-chemist who is also master of the spectroscope; in fact, the separation into praseo and neo metal is within reach of the chemist who is not a physicist, as it is a matter of withdrawal of the old and substitution of a new cathode or wire tip the instant the potential difference across the bead or fusion suddenly jumps to a higher point, while the temperature is not varied.

With larger quantities of oxide under test, a platinum crucible is needful; and when a carbon rod is concentrically immersed, without touching the inside of same, into a bath of fluoride, borate, or phosphate as above mentioned, but made basic by a slight excess of baric or lithic carbonate, the metal will be deposited as a smooth bright coating upon the inside of the crucible when the carbon rod is put in electrical contact with the crucible by a stout wire, i. e., we have here primary pyro-electrolysis, I think for the first time intentionally, although Castner undoubtedly got this effect with his iron carbide particles in his wonderful improvement in sodium manufacture.

The dissolving or rather oxidizing carbon rod in the above case furnishes the E. M. F. and hence the electric energy. With chromic borate made basic with lithic carbonate, as high as 0.07 volt is shown by the carbon, even over and above the back or inverse E. M. F. due to the tendency of the deposit to redissolve in the bath. When an external source of energy is used, and a platinum plate taken for the anode in a borate or phosphate bath containing an excess of $B_2O_3$ or $P_2O_5$, should the P. D. across the crucible attain 30 volts or more, there is deposited with the metal the elements boron or phosphorus, thus giving the phosphids or borides and a loss of the crucible.

It is just possible chromium gun tubes and gas-engine cylinders are only a matter of the near future, and these articles cited as examples could only be manufactured by pyro-electric deposition, since a temperature of 5,400 deg. F. is required to fuse carbonless chromium, and an arc cannot be used or the metal will contain carbon, which even in small amounts greatly lowers the desired high fusion point, which allows of great resistance to erosion by intensely heated gases.

I have coated smooth tinplate sheet steel with a tough and beautifully uniform coat of pure chromium, which can be easily gotten from the steel by solution of the latter in alkaline bisulphites containing an excess of $SO_2$, and have hardened this stripped sheeting to chromic carbide by cementation for a couple of hours in hide charcoal, and find a material able to wear away carborundum as easily as a glass-hard file would a salmon brick.

For those who fractionate the photogenic oxides by the present tedious aqueous chemical methods, I am sure the above opens a new and valuable path, though it is evident metallurgy upon the large scale could hardly benefit by the above analytic methods.

### THE BITE OF A GILA MONSTER.

In a recent issue of the SCIENTIFIC AMERICAN an article appeared written by D. Allen Willey describing and illustrating the Gila monster. The statement was made in the article that scientists had questioned whether its bite was fatally poisonous, as has been supposed. Mr. W. C. Barnes, of Las Vegas, N. M., claims to know of two cases, in one of which death resulted. Mr. Barnes writes as follows:

"The first man was in Tombstone, Ariz. The Gila was tied by the leg in a saloon as a curio, and a drunken gambler named Brown was teasing it. He carelessly stuck his first two fingers into its mouth, which immediately closed down on them, and could not be released until the reptile's head was cut off and the jaws cut apart. Brown suffered horrible agony for almost two days, and in spite of all efforts he died.

"The second case was in the fall of 1889. Walter Vail started from the 'Empire' ranch, near Benson, Ariz., to ride into town on horseback, some fifteen miles. A short distance from the ranch a monster was sluggishly dragging its way across the road. Thinking to take it in for a friend, he got down and killed it—or at least he thought he killed it. To carry it easily, he tied it on his saddle behind him, using his saddle strings for the purpose. As he loped along he thought to assure himself it hadn't dropped off by reaching around behind him with his right hand and feeling for the monster.

"It was there, and not nearly as dead as he thought. His first finger went into the reptile's mouth clear to the knuckle, and instantly those jaws with the long, sharp, dagger-like teeth closed on Vail's finger. With his left hand he managed to get his knife out and cut the saddle strings, and then had to dissect the head and jaws to get his finger from their grip.

"Vail then spurred his horse into Benson and found an engine in the yards. A hasty exchange of telegrams with the division superintendent and Tucson took place and in a few moments he was on the engine and racing over the road for Tucson, where an eminent surgeon resided at that time. Vail lay at death's door for two months and that finger to-day is useless and shriveled up from the effect of the bite."

At a mild red heat, good steel can be drawn out under the hammer to a fine point; at a bright red heat it will crumble under the hammer, and at a white heat it will fall to pieces.