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NEW YORK, SATURDAY, MAY 26, 1900.

PROGRESS OF THE NEW YORK RAPID TRANSIT TUNNEL.

Although several weeks have passed since the letting of the contract for the construction of the rapid transit tunnel in this city, it was only on Monday, May 14, that the actual excavation of the tunnel was commenced. If we bear in mind that this contract is by far the most costly of the kind that has ever been let to a single contractor, involving as it does the expenditure of \$35,000,000, and that the whole twenty miles of the work had to be divided into sections, and a selection made of the most reliable and capable from scores of would-be sub-contractors, the present status of the work may be considered as satisfactory.

At the present writing sub-contracts have been let for practically the whole of the road, the section between Thirty-third and Eighty-fourth Streets being still under consideration. The first two contracts to be let covered the important preliminary work of lowering the Bleecker Street sewer and diverting the great sewer at Canal Street, which is being prosecuted as rapidly as the necessities of street traffic will allow. At Bleecker Street the sewer is to be lowered some twenty feet to clear the floor of the tunnel, while at Canal Street it will be necessary to build practically a new sewer. Here the present flow is toward the Hudson River, but as soon as the new work is completed, the sewage will be discharged easterly into the East River.

Although the formal inauguration of work took place on March 24, in front of the City Hall, when the first spadeful of earth was turned by the present Mayor, there will be no actual excavation at the site marked by the commemoration tablet. The spot chosen for the function of May 14 was at One Hundred and Fifty-sixth Street, where the first actual digging of the tunnel is taking place. This particular section, which extends from One Hundred and Fifty-fifth to One Hundred and Sixty-second Street, will be excavated by what is known as the "cut and cover" method; that is to say, an open cut will be made, in which the steel-and-concrete floor, sides, and roof of the tunnel proper will be built, the material being subsequently filled in and the roadway restored to its former condition. The greater part of the excavated road will be built on this system, there being only about three and a half miles of straight rock tunneling.

The location of the road with regard to the surface and the nature of the material encountered is such that, contrary to the popular expectation, there will be no use made of the shield which has figured so largely in the Thames tunnel and the various London underground railways. These roads are being constructed at a considerable depth below street grade, and largely in a bed of clay which lends itself admirably to the use of the shield. In the New York subway, on the other hand, wherever the road lies too deep for cut and cover work, the material is chiefly solid rock and the use of the shield is not necessary. Even where the east side branch of the road passes beneath the Harlem River, it is estimated that it will be more economical to construct the tunnel by sinking caissons—the short distance, about 400 feet, beneath the river, not warranting the expense of sinking and driving a costly shield.

The methods of construction used on the successive sections of the tunnel will be as follows: Cut and cover from the present terminus at City Hall Park to Thirty-third Street; tunnel from Thirty-third to Forty-first Street; cut and cover from Forty-first to One Hundred and Fiftieth Street, except the viaduct over Manhattanville and a short length of tunnel at One Hundred and Twentieth Street; tunnel from One Hundred and Fiftieth to One Hundred and Fifty-fifth Street; cut and cover to One Hundred and Sixty-second Street, and tunnel to Fort George at about One Hundred and Ninety-fifth Street. On the east side branch there will be tunnel construction from One Hundred and Fourth to One Hundred and Tenth Street; cut and cover to a point across the Harlem River at Girard Avenue; tunnel to Third Avenue; and elevated structure from Third Avenue to Bronx Park.

It is very gratifying to note the unanimous favor with which the proposal to extend the tunnel to South Ferry and beneath the East River to Brooklyn has been received. The necessary surveys for the extension to the ferry were made some years ago, and the surveys for the tunnel beneath the river are now under way.

From this brief survey of the situation, it is evident that before the next century is five years old, New York will be possessed of a completely new system of transit, which in location, capacity and speed will be unsurpassed in any city of the world. With its easy accessibility, ample ventilation, and the thoroughly up-to-date electrical equipment that will be put in, we are sanguine that it will meet all the high expectations to which it has given rise in the people of this city.

SOME NEEDS OF MODERN CHEMISTRY.

Our modern system of mechanics begins practically with the invention of means for measuring force and for calculating its effect upon matter. Mechanics has not alone profited by the labors of Helmholtz and Maxwell, Robert Mayer and Joule; the achievements of these physicists were also the means of elevating chemistry to the rank of an exact science. Chemists were compelled to retrace their steps, to re-explore fields which they thought had been thoroughly investigated, and to study old processes in the light of the new discoveries. The laboratory investigator was no longer content to measure only the matter at his disposal; he found it necessary to know how great was the force released or rendered latent by chemical processes. Thus it was that thermochemistry originated; and thus the prophecy made by Richter one hundred years ago, that chemistry was but "a branch of applied mathematics" was fulfilled. The gap that once separated physics from chemistry is now bridged. Our study of the phenomena of dissociation and of dissolution, carries us directly into the province of molecular physics.

But great as the strides have been which chemistry has made within the last half century, there still remains many a weary path to be pursued. Although physicists have done much to clarify the chemist's conception of matter and force, they have not told him all.

Those seventy elements which are daily used in the laboratory, surely they are but the variant forms of a single matter. We have but one force; and why should there be seventy matters? That wonderful periodical law, with its puzzling numbers, seems to contain within it the means of discovering the primeval matter for which chemists have long been seeking. The old alchemist with his theory of the transmutation of elements again lives; but he is now a chemical physicist, who endeavors not to convert a base metal into gold, but to prove the existence of one form of matter.

The mysteries of chemical energy are also still to be unfathomed. The forces which we have learned to observe and to measure are phenomena of a secondary nature. The chemical energy whose transformations give rise to these forces is still a puzzle to chemists. Instruments of measurement can reveal only the sum total of this energy, but not the nature of the intramolecular changes which occur. For this reason we have no clear conception or numerical expression for the relation of chemical energy to other forces; in other words, we have no chemical equivalent of work. We know that chemical energy is converted not only into heat, but also into light and electricity. That a chemical work can be directly transformed into motion seems also probable.

It cannot be for a moment doubted that the problem of chemical energy and matter will eventually be solved. When adequate laws shall have been formulated by the twentieth century investigator, we may possibly speak of a "mechanical" or "kinetic" chemistry, which will be added to the list of exact sciences.

TWO IMPOSSIBLE BILLS.

There is a certain sense in which it is true that none of the bills presented for the consideration of Congress are so dangerous as those that are obviously impossible and silly. A vicious bill, or one that carries its condemnation visibly written across its face, if it possesses but one favorable feature, is likely to receive sufficient debate to insure its defeat; but there is always a danger of the absolutely ridiculous measure slipping through Congress because of the very contempt and neglect with which it is received.

In the latter class belongs Representative Chanler's bill to grant an extension of seven years to a patent for insulating submarine cables, which was originally granted on the twenty-first of May, eighteen hundred and sixty-seven to one George B. Simpson, and, therefore, has now been an expired patent for over sixteen years.

Under the law which was in force until the year 1861, all patents expired at the end of fourteen years, with the privilege of renewal for seven years if the patentee could show that the difficulties, delays and costs of developing his patent had been so great as to pre-

vent him from realizing within the fourteen years a reasonable profit from his invention. Under the law which went into effect on March, 1861, the life of a patent was extended to seventeen years, that being considered an ample period of time to cover all possible delays in developing the patent, and allow of its subsequent profitable operation. The Commissioner of Patents cannot grant an extension except under a special act of Congress, and it is understood that only on most exceptional grounds will a petition for extension be entertained, the period of seventeen years being considered as a generous grant, and one that is just to the interests both of the inventor and the public.

The patent under consideration claims "the combination of gutta-percha and metallic wire in such forms as to incase a wire or wires, or other conductors of electricity within the non-conducting substance of gutta-percha, making a submarine telegraph cable, etc.," and one asks with considerable astonishment on what grounds renewal should be asked for such a patent. It surely cannot be that seventeen years was too brief a time in which to put into practical commercial shape the simple device which forms the subject of the claim, and as far as its commercial aspect is concerned, the gutta-percha covered conductor is suggestive, in the period covered by the patent, rather of ample profits than of the struggling and poverty-stricken inventor. The only suggestion of a motive for the preferring of this extraordinary request is found in the last provision of the bill, "that the benefits accruing from the use of said patent shall inure solely to the heirs of the widow." Possibly there is a motive of philanthropy behind this measure; but in any case we are certain that Congress will require something stronger than sentimental reasons before renewing a patent on a gutta-percha covered conductor.

The zeal of Representative Chanler for his constituents is quite eclipsed by that of Representative Underhill, who has introduced a bill for the extension for seven years of a patent that has yet three years to run. The patent is for an improvement in analytical balances. It would be interesting to know what are the special conditions which enable Representative Underhill to determine, three years before a patent has expired, that its owner is entitled to seven more years of protection than are granted to the thousands of contemporary applicants at the patent office.

THE POSTAL SERVICE IN THE TIME OF QUEEN ANNE.

The postal service in England in the time of Queen Anne was not as rudimentary as might be supposed. There were six great offices in London for taking in letters, and there were 600 smaller ones in different parts of London for the convenience of correspondents. The penny post was started in 1683 by an upholsterer named Murray. The service seems to have been an excellent one, and even bundles weighing a pound could be sent, provided that the bundle was not worth more than ten shillings.

Articles of value could be sent if an account of them was given at the office. In 1711 an act was passed abolishing the penny post. They were taxed with the rates and stamped with the mark of the general post office and the rate was 1 shilling per ounce for parcels. Letters could be carried 80 miles for two pence; letters more than 80 miles, three pence and six pence. A letter to Dublin cost six pence single, and double letters one shilling, and one shilling and six pence an ounce. Foreign postage was not very expensive. In 1705, for instance, a letter of a single sheet could be carried to the West Indies for one shilling and three pence, and in 1708 Mr. Povey established a foot post carrying letters in the London district only, for half a penny; it was not long, however, before the postal authorities stopped him.

TEXTILE MANUFACTURING IN THE NEW SOUTH.

BY J. A. STEWART.

The growth and development of the South in industrial enterprise during the past decade has been phenomenal, and its advancement in textile industries must be regarded as a natural and a national development. The South, it stands to reason, should be particularly interested in everything pertaining to the growth of cotton and in cotton products. As the chief source of the world's supply of raw cotton, the southern section of the United States has held a unique and distinctive place. It looks now as if it would also earn prestige as a cotton manufacturing stronghold. Though the South built its first cotton mill about the same year in which Samuel Slater laid the foundations of New England's magnificent textile industry, no noticeable advance was made until recently. Now South Carolina ranks second only to Massachusetts in the number of her spindles. North Carolina contains more factories than South Carolina, though her plants average smaller, and Georgia and Alabama are rapidly following the lead of the Carolinas.

There are two chief advantages in the South for cotton manufacturing: Proximity to the sources of supply of raw material and an abundance of cheap labor,

The value of these requisites to successful industrial enterprise needs no exposition. In addition to these prime advantages, are claimed cheap mill sites, low taxes, cheap building material, cheap fuel, a low rate of living expenses, and present freedom from labor agitation.

It is the tardy, but now general, recognition of these economic advantages which has brought about the present general awakening of industrial movements in the South. The growth has largely taken place within the past five years. In textile manufacturing, as has been indicated, the gain is prodigious. While there were 7,160,000 spindles in Massachusetts at the beginning of 1895, there was no State south of Mason and Dixon's line with 1,000,000. In 1898 both of the Carolinas had over one million apiece, with Georgia close behind. From 1896 to 1898 the number of spindles in Massachusetts had increased only $1\frac{1}{2}$ per cent.; but South Carolina had made a gain of 26 per cent. In Alabama the increase in the number of spindles for the same time was 36 per cent.; Kentucky, 17.35 per cent.; Arkansas, 16.43 per cent.; and North Carolina, 13.12 per cent. The increase in both the Carolinas for the decade ending 1896 was over 300 per cent. During the current year mills are being rapidly erected and the development continues on a colossal scale. It is estimated that the increase in the price of raw cotton to nearly 10 cents a pound had added almost \$200,000,000 to the available wealth of the Southern people in a single season. It is evident that this accretion of wealth demands investment. The Southern capitalists are putting their money into new factories as the best possible outlet for surplus capital. It has been stated that every Southern cotton mill is making over 15 per cent. on its capital. In many cases, it is declared, the profits for 1899 ran up to 75 per cent., and there is a certainty that this prosperity will be exceeded during the present year.

Perhaps in no section has the Southern movement been viewed with livelier interest than in New England, the citadel of the cotton industry. In the large cotton centers of Massachusetts and Maine, the manufacturers have claimed that a reduction in wages was necessary to enable them to make goods in competition with the low wages and long hours in the South. In New England nearly uniform laws respecting hours of labor and employment of children make the conditions more equal in the competition of these States.

However, although a healthful competition may arise, no serious antagonism is anticipated between the industrial interests of the North and South. The outcome will undoubtedly simply be that the entrance of the South into the arena of cotton manufacturing will bring about a readjustment of producing centers. It is aptly pointed out that as our textile manufacturing grows, it is fast becoming separated into distinct classes, each class starting about some special place. Thus Fall River leads in the manufacture of prints. Providence is the center of the worsted industry. New Bedford sets the standard in finer white cottons, and Lowell in coarser goods. New England as a whole is coming year by year to finer counts. As long as no other part of the United States was engaged in manufacturing coarser goods, New England retained her grasp in that field, leaving the finer makes to foreign looms. But each year sees a finer product from New England looms. Climatic advantages over the South in the way of the essential degree of humidity will always be in favor of New England. This fact seems to relegate to the South the coarser products, for which humidity is not so necessary. The rapid perfecting of humidifying apparatus, however, is minimizing to some extent the climatic disadvantage of the South.

The commercial interests of the North and the South are too interrelated to become antagonistic. The Southern mills are wisely welcomed by the broad minded New England manufacturers as notable additions to American industries. The Southern movement is providing a direct stimulus to national production. It is working primarily as a lever in educational progress in promoting schools for training textile workers and skilled craftsmen and designers to produce the finer and more valuable products which will in the future more and more constitute the output of Northern looms.

If no other proof were at hand to show the advance of cotton manufactures there, the consumption of cotton in the Southern States would reveal the fact. In 1891-2, 686,080 bales of cotton were used in Southern mills. In 1894-5 this amount had increased to 862,838 bales. In 1898-9 to 1,413,923 bales. North and South Carolina are now using 50 per cent. of their cotton product. The 75,000 spindles in operation at Columbus, Ga., have just been increased to 100,000 and the 30,000 bales of cotton required to 60,000 bales. Local mill men are thus displacing the dealers, and what has been successfully accomplished in the Carolinas is rapidly becoming a fact in Georgia as well. With the growth of manufacturing and consequent increase in the consumption of raw material will come the demand for greater production of cotton. It is well held that the South could produce two bales of cotton for every

one now marketed. The real relief to the over-supply of cotton products would, of course, come from the opening of foreign markets. Commercial expansion is in the air. Our export trade already shows the trend in this direction. The increase of manufactures is fifty million dollars greater for 1899 than the amount for the corresponding months in 1898.

Attention is called to the fact by a recent writer that only one-third of the cotton grown in the United States (which in 1898 reached 10,000,000 bales), has hitherto been used in this country. The other two-thirds has been shipped to England, Germany, France, Russia, India, Japan and other countries. We have been shipping three billion pounds of raw cotton at from 5 to 7 cents a pound when we might have exported manufactured products worth 15 to 25 cents a pound. The British exports of cotton goods in 1896, aggregated 5,218,248,600 yards in a year. American exports were only 281,211,521 yards. The query naturally is suggested, "Why may we not hope to manufacture our entire cotton product and export only manufactured product?"

It is evident to the thoughtful onlooker that the rapid development of textile manufacturing in the South does not necessarily involve its decrease in New England or in Great Britain. The ever-growing demands of the world furnish new industrial marts to conquer. And industrial progress in the South can only be regarded with satisfaction in view of the emancipation it is calculated to bring to that section through the nobility of well-requited labor.

THE HEAVENS IN JUNE.

BY HENRY NORRIS RUSSELL, A.M.

June, as well as May, is favored with an eclipse visible in America, but it is one of far less importance than its predecessor. While on May 28 the moon interposed itself exactly between the earth and the sun, on June 12 the earth is so far out of the direct line joining the sun and moon that only $\frac{1}{1000}$ of the moon's diameter falls within the shadow. Since, however, the earth hides most of the sun from parts of the moon near the shadow's edge, the darkening of the moon's southern limb by the penumbra will be easily seen, though it will require instrumental means to detect the tiny notch in the limb, due to the true shadow.

The circumstances of the eclipse are:

Moon enters penumbra June 12, 8:15 P. M.	Eastern standard time.
Moon enters shadow " " 10:24 P. M.	" " "
Moon leaves shadow " " 10:31 P. M.	" " "
Moon leaves penumbra June 13, 12:17 A. M.	" " "

The earlier part of the eclipse is therefore visible only in the East, as in the West the moon has not risen.

THE HEAVENS.

The Milky Way, inconspicuous for the last few months, has returned to the eastern sky by the middle of June. Along its course lie several of the most easily recognized of the stars and constellations in sight—the irregular W of Cassiopeia in the north, the cross of Cygnus in the northeast, Altair, marked by a smaller star on each side, in the east, and Scorpio in the south, identified by the fiery Antares, and the long curved stream of stars sweeping southward and forming the tail of the monster. West of the Galaxy, near Cygnus, is the brilliant Vega, and about as far from the zenith on the opposite side shines Arcturus. Ursa Major, Leo and Virgo are the most conspicuous ornaments of the western sky.

Vega, Arcturus and Antares offer a striking contrast in color, the first being white with a strong tinge of blue, the second yellow and the third red. This difference, beautiful as it is to the eye, becomes far more impressive to the mind when we know that these three stars are good examples of the three classes into which the spectroscope divides the vast majority of all stars observed, and that there is good reason to believe that they represent three different degrees of stellar temperature—the white stars, as might be expected, being hottest, the yellow intermediate, and the red coolest. So these three stars present to us at a glance types of three stages in the life history of a sun—displaying at one time conditions separated by countless ages in the gradual cooling down (or perhaps warming up) of a single star.

THE PLANETS.

Mercury is evening star throughout June, but is too near the sun to be seen in the early part of the month. It travels rapidly eastward among the stars, passing from Taurus through Gemini into Cancer, and at the end of the month is easily visible in the evening twilight, setting about an hour and three-quarters after sunset.

Venus is also an evening star in Gemini, approaching the sun all through the month, and losing brightness as its crescent becomes narrower, in spite of its steady approach toward the earth. On the 21st it is in conjunction with Mercury, being a little over 2° distant, and affording a particularly good opportunity for those unfamiliar with the latter planet to recognize it. By the end of the month Venus sets less than an hour later than the sun, and is no longer conspicuous.

Mars is morning star in Aries and Taurus, rising

about two hours earlier than the sun, but is still faint and distant.

Jupiter has just passed opposition and is by far the most conspicuous object in the Southern sky. His satellites are easily seen with a field-glass, especially if its power has been doubled by placing both the concave eye-lenses in the same tube, (which must usually be lengthened with cardboard to allow for the change of focus). With such an arrangement the crescent form of Venus, the disk and satellites of Jupiter, and the elliptical outline of the ring of Saturn may all be seen, as well as the larger craters of the moon.

The study of the motions of Jupiter's satellites from night to night is interesting. The two inner ones move so fast that it is difficult to identify them without reference to the figures given in the Nautical Almanac. The third satellite which is the brightest of the four, will be east of the planet on the 2d, 9th, 16th and 23d and west on the 5th, 13th, 20th and 27th. The fourth and most distant reaches its eastern elongation on the 3d and 20th and its western on the 12th and 28th.

Saturn is in Sagittarius, rising about 9 P.M., on the 1st and 7 P.M. on the 30th. It is in opposition on the 23d, and the northern side of its rings is seen at as favorable an angle as possible, but it is so far south that the time during which it is far enough above the horizon to be observed is shorter than usual.

Uranus is in Scorpio, about $4\frac{1}{2}^\circ$ north and $2\frac{1}{2}^\circ$ east of Antares, and is barely visible to the unaided eye. Neptune is in Taurus. It is in conjunction with the sun on the 17th and is too close to it throughout the month to be seen.

THE MOON.

First quarter occurs on the night of the 4th, full moon at the time of the eclipse on the 12th, last quarter on the evening of the 19th, and new moon on that of the 26th.

The moon is farthest from the earth on the afternoon of the 5th, and nearest on the evening of the 18th. It is in conjunction with Jupiter on the afternoon of the 11th, with Uranus the same night, with Saturn on the afternoon of the 13th, when an occultation is visible in Europe, with Mars on the morning of the 24th, with Neptune on that of the 26th, and with Venus and Mercury early on the mornings of the 28th and 29th respectively.

Comment on the results of observation of the total eclipse is necessarily delayed till next month.

Princeton University Observatory, May 16, 1900.

THE EMIGRATION TO CAPE NOME.

An attempt has been made by the transportation companies interested in Alaska, and particularly in Cape Nome travel, to approximate the probable emigration to the latter port for the coming season, and the conclusion is that the estimates of 30,000 or 50,000 persons made by sanguine observers will hardly be reached. There are, at this time, fifty-eight steamers of all classes chartered for Cape Nome, to sail before June 1. The capacity of all these vessels is not beyond 15,000 travelers, and probably not more than 13,000 will take passage on the first trip.

As far as learned, every steamer has been sold up; but, as is always the case, many persons will defer the trip and await further advices before making the uncertain venture.

It is estimated that 5,000 tickets have been sold from San Francisco and 8,500 from ports of Oregon and Washington. If all of these are used, the full capacity of all vessels now chartered will be appropriated.

Estimating at 2,000 the number of people who wintered at Cape Nome, and the same number coming from other Alaskan points added to the 15,000 estimated to arrive from the States, would give 19,000 as the number likely to be found on the peninsula by July 1, 1900.

The early arrivals are likely to experience great hardship in landing. In 1899 the ice disappeared on June 21st. How those who arrive about the 1st of June are to land is a problem of infinite difficulty. The steamers will delay not a moment, and landing over the ice will be accompanied by great exposure and many uncertainties. The fatality is likely to be great.

The subsequent voyages will be eminently easy. The crowd is out of the way and the difficulties of landing will all disappear.

SIR WILLIAM H. BAILEY, of Sale Hall (England), has presented a meteorological clock to the new Sale Park. This unique gift will indicate the time on a large dial, while at the same time the mechanism of the clock will actuate a drum, upon which there will be recorded the fluctuations of the barometer, the direction of the wind, the rainfall, and variations of temperature. The diagrams will constitute weekly records. The clock is a great improvement upon any existing time piece of its character. It is to be erected in the Joule Memorial Tower, which has been erected to commemorate the fact that Dr. Joule, who discovered the mechanical equivalent of heat, and who was also one of the greatest investigators of the age in physical science, resided for several years in Sale.