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(Illustrated articles are marked with an asterisk.)

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No. 775.

For the Week Ending November 8, 1890.

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DECREASING COST OF INCANDESCENT LIGHT.

Incandescent electric lamps are lessening in cost of manufacture while, at the same time, increasing in efficiency, that is to say in length of life. This, too, in the face of a largely advanced price for platinum, of which the wires connecting the outside circuit with the carbon loop within the globe are made. This metal, so important in electrical manufacture, has, indeed, almost trebled in price since the earlier lamps were fashioned, and still has an upward tendency, the supply being inadequate to the demand, and its scarcity forcing the substitution of other and less recommended metals in some departments of electrical manufacture. As to the little incandescent lamps: they must have it, its increased cost not proving so important as was feared, because of the discovery of more economical processes in the making of other parts of the lamp.

Those who have watched the development of the lamp from its earliest stages will recall the laborious work with the mercury pump in creating the vacuum, the amount of hand labor that used to be required to put the parts together, and even when completed how uncertain was its tenure of life. Nature hates a vacuum, or, at least, seems to. With the old processes the most cunning artisan was unable to attain anything like that stage of air exhaustion which now we know is within nature's permissible limits. Some few lamps would glow for nine hundred, perhaps twelve hundred hours before the combustion, always going on, would be sufficient to disintegrate and destroy the carbon loop; others would live for only a small part of that time and die prematurely of too much oxygen. All was uncertain. A manufacturer might set up a score of lamps and have half the number returned to him impotent within a month. Now, with improvements in exhausting apparatus, it costs but a tithe of the old figure to produce a more perfect vacuum; the sealing of the platinum wires is done by machinery, and as a result a far more certain and a longer-lived lamp than that which once cost $1 may be had for considerably less than the half of it, and even then leave a margin of profit for its manufacturer.

NEW GUNPOWDER AS WELL AS NEW GUNS.

Great as have been the improvements of the past twenty years in gun efficiency, the changes in the explosive agents employed are no less remarkable. In fact, one branch has been constantly supplementary to and dependent upon the other. As guns have increased in size there has been a corresponding necessity that the action of the powder should be modified, that less heat might be produced and the nature of the explosion rendered more gradual. The first attempts were in the direction of modifying the size and compactness of material of the grains, pebbles, bowlders, or cubes of the old style of brown powder. These were followed eventually by the production of the brown prismatic or cocoa powder, which has somewhat more saltpeter than normal black powder, while the charcoal is but slightly burned to a reddish brown color. The action of this powder in guns is comparatively gradual and long sustained, and some modifications in its composition have been made where it is to be used in very large charges in heavy guns.

The smokeless powder adopted by the French government about five years ago attracted great attention, and wonderful efficiency was claimed for it, in addition to the obvious advantages it possessed for quick-firing and machine guns on vessels, as well as for field artillery and small arms in shore service. Its composition was kept a close secret, but "it is now known that more than one smokeless explosive has succeeded the original, and that the material at present in use with the Lebel repeating rifle belongs to a class of nitro-cellulose or nitro-cotton preparations,"* of which several have been patented in England, and many varieties of which have been brought forward in Germany and in this country. These nitro compounds do not produce smoke, because their products of explosion are exclusively gases and water vapor, while gunpowder furnishes products of which over fifty per cent are not gaseous, and which are in part deposited as a solid to foul the arm, and in fact distributed in fine particles through the gases of the explosion as smoke.

Gun cotton is smokeless, but thousands of experiments in varying its density and mechanical condition have not yet given us complete methods of regulating its explosive force. Comparatively small charges of compressed gun cotton, arranged in built-up cartridges with the object of regulating the rapidity of explosion, will give high velocities, but the necessary uniformity has not been obtained. Both camphor and liquid solvents, as well as acetic ether and acetone, have been used with gun cotton, and a nitro-cellulose powder containing nitro-glycerine has been brought forward which is almost entirely smokeless, while developing very high energy. This powder, the pressures of which are but gradually developed, and various other descriptions of nitro-cellulose powder, are now being carefully investigated by experts in many countries. The powder adopted in Germany is a description of the nitro compounds which is not entirely smokeless, but the almost transparent film of smoke produced by independent rifle firing with it is hardly more visible than a puff from a cigar. In the British service also an almost absolutely smokeless powder is now used with machine guns and field artillery, the effect of a discharge appearing only as a flash of flame and a slight cloud of dust. The conditions, therefore, under which the next armed conflict between powerful countries must take place are of an altogether different character from those known heretofore; but in such future contest, come when it may, it is safe to say that science and skill, rather than brute force, will have a determining influence to an extent never before known in the annals of war.

* Sir F. A. Abel's address before British Association, SCIENTIFIC AMERICAN SUPPLEMENT, 772.

PALÆONTOLOGICAL STUDIES IN BRAZIL.

Recently an interesting contribution to the palæontology of Brazil, from the pen of Professor John M. Clarke, of the New York Geological Survey, has been published at Rio Janeiro, Brazil. It embraces an examination of the trilobitic remains found in the sandstones of the Ererê and Maecurú districts. The fossils are found in ferruginous sandstones whose elements are quartz, feldspar, and, in the Ererê region, mica. Many of the specimens are inclosed in a crumbling rock which, partially from disintegration, and partially from the presence of sesquioxide of iron, replacing the test of the fossils, are in a perilously frail condition, so that the greatest care is requisite to preserve them.

It has long been known that the fauna of the Ererê region was Devonian, and that it presented striking and deeply interesting similarities to the upper Devonian fauna of New York State. The results reached by Professor Clarke are in the main confirmatory of this important conclusion, except that the Maecurú beds indicate, as far as their crustacean remains go, a pre or early Devonian aspect. He would explain their association with molluscan fossils that are very distinctly Hamilton or upper Devonian in character by an assumption that these molluscan types, originating in the southern continent, have passed northward and have been developed in the seas of our latitude at a later date than they existed in Brazil. The assumption seems rather hazardous, as a migration over such a distance would have involved a passage in the equatorial regions through strongly contrasted climatic areas, unless the further assumption is made that climatic conditions up and down the American seacoast of both continents were markedly uniform at that distant date. The essay is of great interest, and would repay a close study of its various statements and comparisons.

JOB AS A STEAM ENGINEER.

The last place in which one would naturally look for a description of the modern steam engine would be the book of Job. Yet a recent author has presented in a large octavo volume of 362 pages his conclusions on this very point. They are to the effect that the entire steam plant, railway organization, boiler and engine practice, are treated of by the inspired writer. We allude to the work of Mr. Samuel O. Trudell, entitled "A Wonderful Discovery in the Book of Job." If the author's view of the case were adopted, a new chapter in the history of the steam engine would be supplied, and the Marquis of Worcester would have to yield to Job as the pioneer in steam engineering.

Behemoth and the Leviathan have always been fertile subjects of controversy. The whale and hippopotamus respectively have been adopted by many commentators as the animals referred to. But Mr. Trudell goes beyond the most daring innovator, and in a revised version of the passages relating to these monsters finds allusions to the steam engine of to-day. A description of the method followed in his new interpretation will give the best idea of this most striking effort in the field of biblical criticism.

The author, fully to support his theory, has been compelled to furnish a new rendering of the parts of the book of Job which he uses. Accordingly we find a translation given of the passages in chapters xl. and xli. which relate to the Behemoth and Leviathan. The claim is made without reserve that it is the modern steam engine in its different forms that is there described. It is evident that our space does not permit us to give the full bases for the argument. The separate verses are made subjects of as many chapters, and the analogies traced between the descriptions in the poetry of Job and the more prosaic steam motor are really surprising. The most curious details are traced out, such as the supply of water to the boiler, the upright smoke-stack, and even the manipulation of the stock of railroad companies is found described. The size and number of pages in the volume give the best evidence of the work bestowed by the author upon his labor of love.

It may be worth while to cite from the special translation appended to the book some of the most striking passages. The account begins chapter xl., v. 15, "Behold now one with great heat, . . . he will

consume fodder as well as cattle do," which is a pretty fair description of a steam engine. A little further on, v. 17, it says, "His tail will set upright like a cedar." This, the author concludes, refers to the smoke-stack. In v. 18 we find, "His hollow bones are tubes of brass, his solid bones are bars of iron," which is a very good embodiment of modern engineering practice. In v. 21, which the special translation renders, "He will rest beneath light shelters and within a covering of fibrous reeds and clay," the author finds an allusion to non-conducting covering for boilers and steam pipes. Going on to the next chapter, we find v. 6 thus rendered, "Companies will feast upon him, they will share him among speculators," which it is needless to say fits the case of modern railroad companies and speculators exactly. This is one of the extraordinary parallels of the work. It is perhaps equaled by v. 2 of the same chapter, where the hook (ring) in the monster's nose is construed as an allusion to the piston rings of a locomotive, and where the jaw bored through with a thorn supplies an allusion to the piston head bored through with its piston rod. The bad effects of an engineer allowing his water to run down is given in the same chapter, v. 26, "From dryness rendering him furious, he will not have power to withhold; the curved vault being caused to break up and also the armor." This, of course, means that the engineer must watch his water gauges or there will be an explosion.

For a portion of v. 23, chap. xl., and for v. 24 immediately following the author furnishes the following translation: "Behold he will absorb a river and will not fret; . . . . . he will gather it up in his fountains by means of traps and with a perforated nozzle." Our author in this finds described the action of a pump with its valves (traps), and the perforated suction pipe with a screen at its end to exclude solid particles. Even the coupling together of a train of cars is found in v. 1 of the next chapter: "Thou wilt extend Leviathan with a hook, or with a snare which thou wilt cause his tongue to press down." The tongue our author believes is the representative of the coupling link, and the hollow drawhead and pin is the "snare." The caulking of the seams of the boiler is found in v. 15 of this chapter: "His strength depends on courses of shields closed up tightly with a seal." Our author finds nothing clearer than that the "shields" are boiler plates, and the "seal" the caulking iron. He reserves, however, the possibility that the steam riveter is the sealing mechanism.

This much is enough to give an idea of the book. The author has been his own Hebraist. The Semitic student and author Rabbi Benjamin Szold, of Baltimore, testifies to his high opinion of Mr. Trudell's translations. It must also be said in conclusion that the subject is treated throughout with full evidence of critical discernment and laborious investigation.

POSITION OF THE PLANETS IN NOVEMBER.

JUPITER

is evening star, and shines brilliantly in the west as soon as it is dark enough for him to be visible. He is in conjunction with Mars on the 13th, at 5 h. 52 m. P. M., being 59′ north. As the event occurs about an hour and a half after sunset, it may be easily observed. Jupiter with a diameter of 36″.0, almost eclipsing his ruddy rival, whose diameter has dwindled down to 8″.0. The five days old crescent moon is in conjunction with Jupiter on the 17th at 6 h. 54 m. P. M., being 3° 25′ south. The moon, Jupiter, and Mars will then form a lovely celestial picture. Much of the planetary interest of the month clusters around this regal star, the most distinguished member of the sun's family, almost a sun himself.

The right ascension of Jupiter on the 1st, at noon, is 20 h. 27 m., his declination is 19° 59′ south, his diameter is 37″.0, and he is in the constellation Capricornus.

Jupiter sets on the 1st at 10 h. 25 m. P. M. On the 30th, he sets at 8 h. 50 m. P. M.

MARS

is evening star. His course, through the month, is closely allied to that of Jupiter. Both planets are moving eastward or in direct motion. Mars moving faster gains upon Jupiter until the 13th, then passes him and recedes from him during the rest of the month, being about 9° east at its close. The moon is in conjunction with Mars on the 17th at 11 h. P. M., being 2° 39′ south. Moon and planet will be below the horizon when the conjunction takes place, but the approach of the two heavenly bodies will be interesting to observe.

The right ascension of Mars on the 1st, at noon, is 19 h. 55 m., his declination is 22° 49′, his diameter is 8″.3, and he is in the constellation Sagittarius.

Mars sets on the 1st at 9 h. 43 m. P. M. On the 30th, he sets at 9 h. 40 m. P. M.

VENUS

is evening star. Her reign as evening star practically closes in November, for she disappears from view during the passage of its closing days, her slender crescent approaching the sun so closely as to be hidden in his rays. She is still very beautiful, shining with a soft, pearly luster, low down in the southwest. The two days old moon is in conjunction with Venus on the 14th at 0 h. 14 m. P. M., being 4° 2′ north. The event takes place in the daylight, but the narrow crescent and the evening star will be fair to see when they appear upon the twilight sky.

The right ascension of Venus on the 1st, at noon, is 17 h. 2 m., her declination is 28° south, her diameter is 43″.8, and she is the constellation Ophiuchus.

Venus sets on the 1st at 6 h. 24 m. P. M. On the 30th, she sets at 4 h. 37 m. P. M.

MERCURY

is morning star until the 16th, and then becomes evening star. He is in superior conjunction with the sun on the 16th at 10 h. 29 m. P. M., when, passing beyond the sun, he reappears on the sun's eastern side, and commences to run his race as evening star. Moving eastward from the sun, he encounters Venus moving westward toward the sun. The conjunction occurs on the 29th at 2 h. 29 m. P. M. and is a very close one, Mercury being 10′ north. The planets are then too near the sun to be visible, and the phenomenon can be seen only in the mind's eye.

The right ascension of Mercury on the 1st, at noon, is 13 h. 59 m., his declination is 10° 44′ south, his diameter is 5″.0 and he is the constellation Virgo.

Mercury rises on the 1st at 5 h. 45 m. A. M. On the 30th, he sets at 4 h. 44 m. P. M.

NEPTUNE

is morning star until the 27th, and then evening star. He is in opposition with the sun on the 27th at 11 h. A. M., and is then nearest to the earth and in fine position for telescopic observation.

The right ascension of Neptune on the 1st, at noon, is 4 h. 18 m., his declination is 19° 42′ north, his diameter is 2″.6, and he is in the constellation Taurus.

Neptune rises on the 1st at 6 h. 16 m. P. M. On the 30th, he sets at 6 h. 42 m. A. M.

SATURN

is morning star. He is a shining light in the sky in the small hours of the morning, and is coming into more convenient position for observation, rising about midnight at the close of the month. The waning moon is in conjunction with Saturn, on the 7th, at 2 h. 17 m. A. M., being 3° 46′ north.

The right ascension of Saturn on the 1st, at noon, is 11 h. 5 m., his declination is 7° 42′ north, his diameter is 15″.8, and he is in the constellation Leo.

Saturn rises on the 1st at 1 h. 48 m. A. M. On the 30th, he rises at 0 h. 5 m. A. M.

URANUS

is morning star, and is too far away to be visible. His right ascension on the 1st, at noon, is 13 h. 44 m., his declination is 10° 12′ south, his diameter is 3″.4, and he is in the constellation Virgo.

Uranus rises on the 1st at 5 h. 30 m. A. M. On the 30th, he rises at 3 h. 44 m. A. M.

Mercury, Venus, Jupiter, Mars, and Neptune are evening stars at the close of the month. Saturn and Uranus are morning stars.

Project for Building a Railroad through the Cañon of the Colorado River.

Once more the project of building a railroad in the cañon of the Colorado River has come up for consideration, and this time in such definite shape that it would seem that before very long the undertaking would be actually begun. The project has always been a very popular one with engineers, owing partly to the almost insurmountable obstacles to be overcome. The country is so wild, the mountains so high, the walls arising on both sides of the river so precipitous and so lofty, that the mere work of surveying this district has been almost impossible. This, however, has at last been accomplished, and it is now announced that the work is by no means as hopeless as has always been supposed—in fact, that it is perfectly feasible.

In 1869, Major Powell, of the United States Geological Survey, made his memorable trip down the Colorado River, he and his party being the only persons who had ever succeeded in accomplishing this feat. Since then, several attempts have been made to accomplish this, but always fatally, and it was destined that this scientist should, for twenty years, hold the honor of being chief of the only party that had ever descended the entire length of the river. In 1889, a party of railroad men and surveyors started to make the descent of the river, and succeeded in reaching a point about the middle of the Marble Cañon, when disaster overtook them, and several of their number were lost. Since that time, however, the rest of the river has been traversed and examined, and the report of the chief engineer, Mr. Robert B. Stanton, has been handed in to the directors of the Denver, Colorado Cañon and Pacific Railroad Company.

In spite of the loss of life that has been met with in making the surveys, the report of the engineer is favorable, and he believes the work is practicable, not only from an engineering standpoint, but that the expense of building it will not be so great as to render the work impossible.

The entire length of the Colorado is about 2,000 miles, and it is navigable as far as Callville, a distance of some 600 miles from its mouth at the Gulf of California. The object of the present road is to connect the coal fields of Colorado with the Pacific coast. It is at present difficult to procure cheap fuel on the Pacific coast, much of the fuel used there being brought by steamer from foreign ports.

It is proposed to start the new road from Grand Junction, Colorado, which point is already connected with the coal fields by the Denver and Rio Grande Railroad.

The new road has been surveyed from that town to the Gulf of California, and also from the town of Yuma to San Diego, the most southerly seaport of California, this being a distance of 190 miles, and affording excellent communication with the Californian coast. The general survey has been divided as follows.

Starting from Grand Junction and proceeding toward the mouth of the river, we find the subdivisions to be as follows:

	Miles.
The Grand River	140
Cataract and Narrow Cañons	54
Glen Cañon	157
Marble Cañon	62
Grand Cañon	217
From Grand Cañon to the Needles	161
From Needles to Yuma and Yuma to Gulf	245

making a total of over a thousand miles.

The engineers, under the able direction of Mr. Stanton, have prepared an exhaustive report, with a detailed description of the work required to be done and the material encountered. By a very complete series of photographs, over 900 in number, each principal section of work has been put on paper, and the description refers to each photograph, by means of which the character of the work can be easily identified.

The first part of the route from Grand Junction down the Grand River to the head of the Colorado does not present any great difficulties. In fact, the Denver and Rio Grande Western R.R. have constructed a road along one bank of the river that is already in operation. The great difficulties of the route are not encountered until the great gorge of the Marble and Grand Cañons are reached. Of the 62 miles of road through the Marble Cañon, 26 miles are to be built on talus slopes, 32 on cliff bench work. There are about 2¼ miles of tunnel. The Grand Cañon is supposed to combine every difficulty that it is possible for the railroad engineer to encounter. Of the 217 miles through this section, 51 miles are hillside slopes, 43 heavy talus slopes, 11 miles cliff bench work, 19 miles marble bench work, 85 miles of sloping granite walls. Of the total length of the road, amounting to 1,019 miles, 403 miles are through what is known as earth work. This is not expensive work, and can be done with plow and scraper, as in any ordinary mountain country. The 86 miles of hillside slopes consist of earth and loose rock. The 191 miles of rough talus slopes consist of loose rock and bowlders and earth with slopes of stratified lime and sandstone. There are 99 miles of excavation through solid granite walls. There would be in all about 20 miles of tunnel.

Should this road be completed, it will open up a country that is practically closed to-day to the general traveler. The country is so rough and so extraordinary that only those who are especially favored with time, means, and physical strength can penetrate this wonderful region and enjoy its superior beauty.

Clarence E. Dutton, of the U. S. Geological Survey, in one of his reports, says that "Those who have long and carefully studied the Grand Cañon of the Colorado do not hesitate for a moment to pronounce it by far the most sublime of all earthly spectacles. If its sublimity consisted only in its dimensions, it could be sufficiently set forth in a single sentence. It is more than 200 miles long, from 5 to 12 miles wide, and from 5,000 to 6,000 ft. deep. There are in the world valleys which are longer, and a few which are deeper. There are valleys flanked by summits loftier than the palisades of the Kaibab. Still the Grand Cañon is the sublimest thing on earth. It is so not alone by virtue of its magnitudes, but by virtue of the whole—its ensemble."

Something New in Belting.

One of the most recent improvements in the line of belting for machinery is the Midgley wire belt, made by the Midgley Wire Belt Company, of Beaver Falls, Pa. It is not affected by heat, drought, or moisture; is nine times stronger than leather of equal weight, and far more durable. Among many examples of its use is that to be seen at Park Brothers' great steel works, where a 3-ply belt, 22 inches wide, 96 feet long, weighing 1,200 lb., has been run day and night for several months. It distributes the power of a 200 horse power engine to a train of rolls.

The Town of Tunnels.

At Port Huron, Mich., it is said there is a scheme to cut a third tunnel under the St. Clair River to Sarnia, to be used by street cars, foot passengers, and wagons. The Grand Trunk will begin work on their second tunnel soon.