Scientific American.

ESTABLISHED 1845.

MUNN & CO., Editors and Proprietors.

PUBLISHED WEEKLY AT

No. 361 BROADWAY, NEW YORK.

O. D. MUNN. A. E. BEACH.

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The Scientific American Supplement

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NEW YORK, SATURDAY, NOVEMBER 8, 1890.

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(Illustrated articles are marked with an asterisk.)

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SCIENTIFIC AMERICAN SUPPLEMENT

No. 775.

For the Week Ending November 8, 1890.

Price 10 cents. For sale by all newsdealers.

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