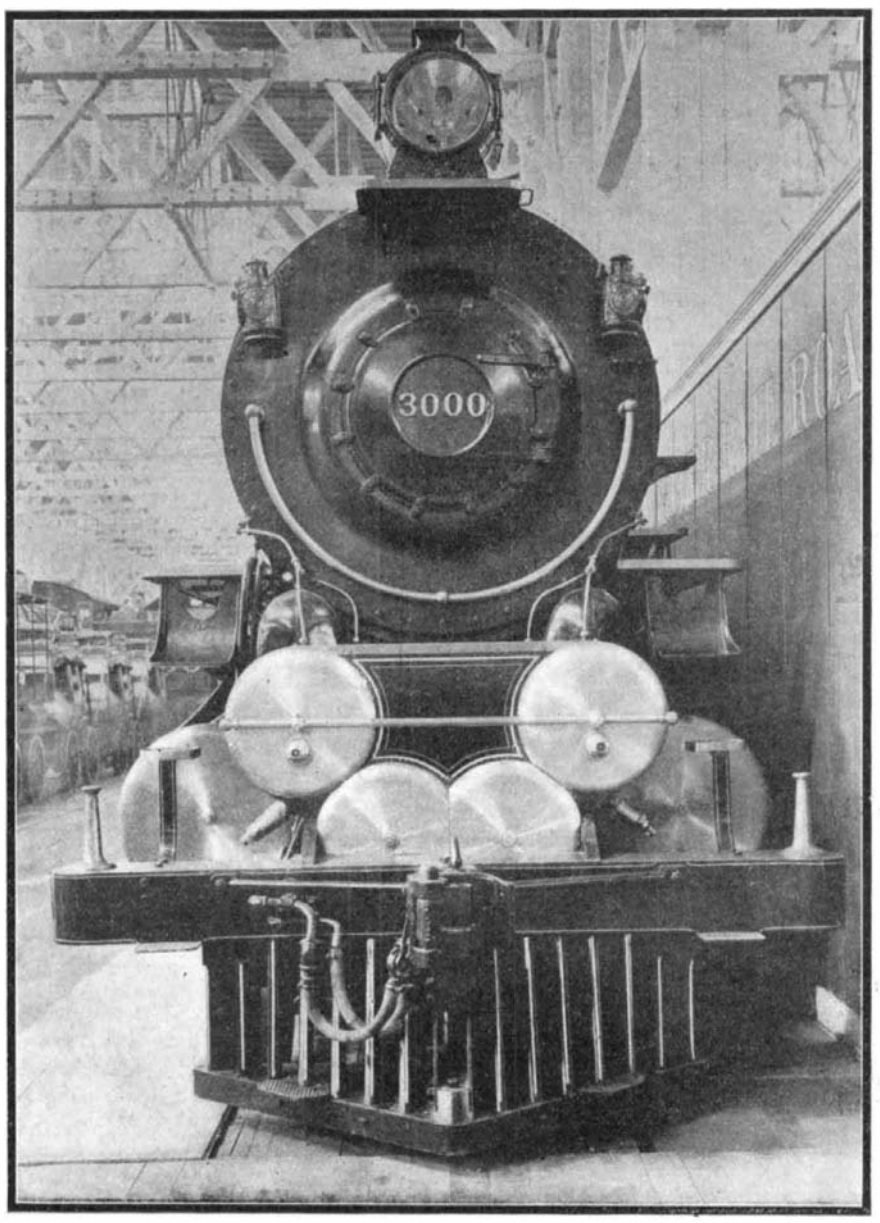
NEW YORK CENTRAL EXPRESS COMPOUND LOCOMOTIVE.

BY THE ST. LOUIS CORRESPONDENT OF THE SCIENTIFIC AMERICAN.

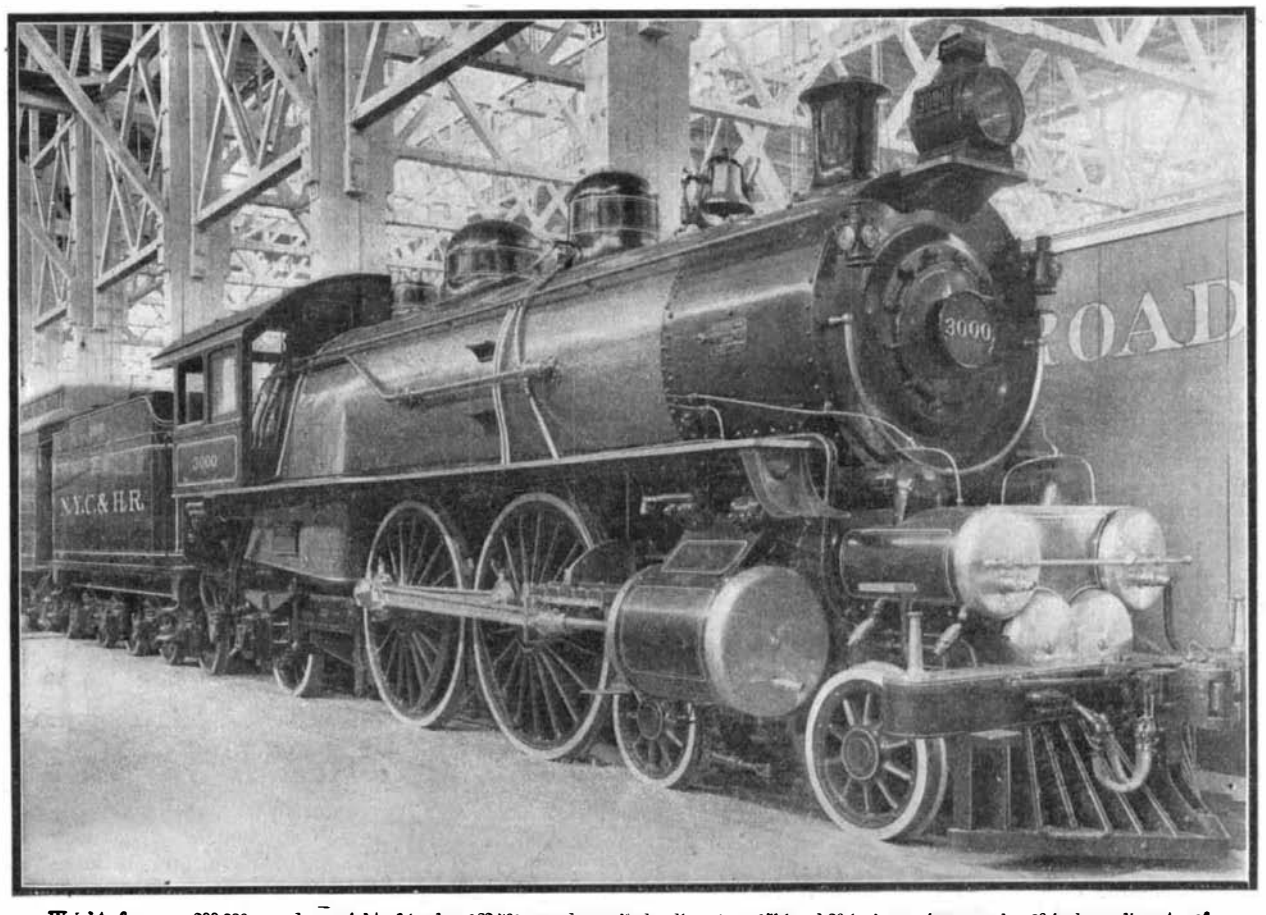
The feature of the New York Central exhibit in the Transportation Building of the St. Louis Exposition is a complete train of the Empire State Express type, consisting of an engine and four cars of the type which has helped to give this train its well-earned reputation. For the past two or three years, the Empire State and indeed all the fast expresses of the New York Central have been hauled by the new Atlantic type of simple engine, which the company brought out specially for this class of work. It was upon one of these engines that the editor of the SCIENTIFIC AMERICAN made a considerable part of a trip from New York to Chicago and back on the Twentieth Century Limited some eighteen months ago, the account of which trip was given in our special transportation number of Dec. 13, 1902. Reference is made to that article for the performance of those engines. The best work was done on a run with a six-car train weighing 360 tons, from Albany to Spuyten Duyvil, 131½ miles in 130 minutes. The new compound engine conforms rather closely in its general outlines, and in its leading proportions, weights, etc., to these Atlantic engines, the chief and very important difference being that four cylinders working compound are used instead of the two 21½-inch simple cylinders of the older type.

The leading dimensions of the new engine are as follows: The high-pressure cylinders are 15½ inches diameter by 26 inches stroke; the low-pressure cylinders, 26 inches diameter by 26 inches stroke. The boiler is 72½ inches in diameter, and its 390 tubes have a heating surface of 3,248.1 square feet; its firebox has 175 square feet and arch 23 feet, the total for the whole boiler being 3,446.1 square feet. The driving wheels are 79 inches in diameter and are coupled, and the total weight on the drivers is 110,000 pounds. The arrangement of the engine is as follows: There are two high-pressure cylinders, located just forward of the saddle, which connect to a pair of cranks in the axle of the leading pair of driving wheels. Outside the frames, and occupying the usual position abreast of the saddle, are the two low-pressure cylinders, and these connect to the rear pair of driving wheels. This is a distribution of the work which is good in principle, and has proved to be excellent in practice. It divides the stresses between the two axles, and facilitates the work of counterbalancing. So well has this problem been worked out that, in the trying-out service to which the engine was subjected for several weeks before being sent to the Fair, she proved to be by far the most steady-running engine that was ever handled by the New York Central engineers; and she has naturally aroused in them a considerable degree of enthusiasm. Two of the records which she has made are well worthy of being noted here. On one occasion, when hauling four Pullman cars between Syracuse and Buffalo, she covered twelve miles of level track at an average speed of 84 miles per hour; and on another occasion, with six Pullman cars, on the same division between Syracuse and Buffalo, she covered a distance of 69 miles, on practically level track, at a speed of slightly under 80 miles per hour. The four cylinders are provided with only two pairs of eccentrics and their accompanying gear, there being one set actuating a single piston valve for each pair of high and low-pressure cylinders on either side. The piston-valve cylinders are carried forward of the saddle above the low-pressure cylinders. In spite of the heavy work to which the engine was put in the working-out trials, she proved to be easy to fire, and the full steam pressure of 225 pounds to the square inch was easily maintained when she was being pushed to her full capacity.



Height of stack above rail, 14 feet 10 inches; width, 10 feet; length over all, 62 feet 2¾ inches; maximum tractive power, 27,500 pounds.

FRONT VIEW OF THE EMPIRE STATE EXPRESS BALANCED COMPOUND LOCOMOTIVE AT ST. LOUIS, SHOWING HEADS OF THE HIGH AND LOW PRESSURE CYLINDERS.



Weight of engine, 200,000 pounds; weight of tender, 122,500 pounds; cylinder diameters, 15½ and 26 inches; piston stroke, 26 inches; diameter of driving wheels, 79 inches; working pressure, 220 pounds per square inch; total heating surface, 3,446.1 square feet.

THE BALANCED COMPOUND LOCOMOTIVE AT THE HEAD OF THE EMPIRE STATE EXPRESS, EXHIBITED AT THE EXPOSITION ST. LOUIS.

Radium and How to Test It.

BY PROF. W. LASCELLES-SCOTT.

In consequence of the extremely minute proportion of this remarkable element—if it be an element—present in any mineral as yet known, and the difficulty of extracting and purifying that little in a satisfactory manner, the cost of metallic radium is very great. Unless more abundant sources of supply are opened out, the price—frequently some scores of dollars per grain—is not likely to diminish very speedily. Probably less than a ton, were it obtainable at all, would suffice, "at latest quotations," to extinguish both the American and the British national debts, and leave enough to pay all our taxes for a year or two into the bargain.

High as the price is, the demand is still greater, not only for scientific purposes and as a popular technical "toy" or curiosity, but also for medical and surgical applications of importance. Radium compounds, too—a trifle less costly than the metal itself—are eagerly purchased, and tubes containing a single particle of the "bromide" or "nitrate," etc., more or less impure, generally find a ready sale here at $5, $20, or $50 apiece. These tubes, or rather their contents, however, vary greatly in radio-activity, and they should, if practicable before the purchase is actually completed, be carefully tested in several ways.

The most energetic specimens of radium bromide are of a light orange-brown tint, those of a faint canary or other very pale hue being less powerfully radiant. Placed in close proximity to a tiny crystal of barium platino-cyanide, or, better, a fluorescent "screen" of this salt, it should render the latter brilliantly luminous (in the dark, of course), and, with suitable objects, give "radiograph" or 'skiagraph" effects very distinctly.

Fixed above a thin, perforated sheet of lead lying just over a smooth surface of sodium chloride (common salt) previously made slightly damp with hydrochloric acid, an hour's "exposure" should suffice to darken the salt's white surface to a fawn shade wherever the perforations in the lead have allowed the rays to pass.

Crystals of uranium nitrate, uranium glass, and pieces of white blotting-paper (or of chalk or plaster of Paris) soaked with a solution of quinine bi-sulphate, should be luminously excited on being held near the radium bromide.

Surfaces of zinc-sulphide, especially if viewed through the lens of a Crookes spinthariscope, should exhibit a scintillating glow-light on approaching the radium tube.

Lastly, this latter, its radio-active properties having been optically and photometrically tested, should have these increased by quite 20 per cent after exposure to the "magnetic field" of a good (4-inch to 8-inch spark) induction coil for about half an hour.

The new main shaft of the Waihi gold mine in New Zealand was sunk 83 feet in 18 days. The shaft is 32 feet long by 8 feet wide, and is timbered with 9-inch square sets, with lagging. The depth referred to was from 20 to 103 feet from surface, the shallowness being favorable to speed of sinking.