Correspondence.

The Black Race.

To the Editor of the SCIENTIFIC AMERICAN:

In answer to the question suggested by Prof. Dexter in your paper of August 20, 1904, I venture an idea. It has been admitted by scientists generally that in the sun's rays are present certain radiations of the nature of X-rays, which are chemically active. These rays affect the human organism injuriously; e. g., in sunstroke the brain is permanently injured, which usually results in softening of the brain or immediate death. History presents a remarkable instance, which has often been commented upon, of the Roman soldiers enduring long marches under tropical sun, with very few cases of sunstroke, notwithstanding the large armies marching. This is attributed to the protection afforded by the polished metal helmets worn, the metal apparently resisting the injurious radiations in the sun's rays. Now, regarding the black races of the tropics, may not nature have provided the dark pigment in the skin and hair for the purpose of affording protection to the human organs from the dangerous chemical radiations of the sun? The heat produced by the sun's rays is therefore the less dangerous agent. For this reason the increased heat absorption of the black skin, as compared with white, is of little consequence. It is well known that men have remained in rooms with the temperature of the air equal to that of steam (212 deg. F.) without injury.

THOMAS W. COOPER.

Detroit, Mich., August 21, 1904.

The Work of a Tornado.

To the Editor of the SCIENTIFIC AMERICAN:

In your issue of July 30 is published an interesting description of the damage wrought by the recent tornado (or as you term it "cyclone") at St. Charles, Minn., in which the writer introduces some attempts at explanation of the different effects wrought upon the damaged buildings, which to his mind seem to be due entirely to a high wind.

Now it must be evident on very slight consideration that no wind, however high, could have produced some of these effects, as, for example, that shown in the upper left-hand corner of your illustration, illustrating the damaged dentist's office, which had the front wall and a part of the side wall of the second story blown out, while the house was otherwise apparently uninjured.

Without attempting here an explanation of the tornado's origin, I believe its nature is perfectly well understood, consisting of a free circular vortex of air about a moving vertical axis, the air rushing toward the axis from all directions, and assuming necessarily and inevitably a vortical motion. As is well known, the radial or centrifugal force exerted at different distances from the axis becomes continually greater (the linear velocity of the wind remaining the same), by the formula for centrifugal force $F = mv^2 \div r$; or in other words, the barometric gradient becomes continually greater as the center is approached, and this is another way of saying that the pressure of the air diminishes with increasing rapidity as the axis is approached, until at the axis it becomes theoretically zero, the velocity becoming infinite at the limit. Now as the axis moves rapidly over the earth's surface, it follows that at any point lying at or near the path of the axis the barometer experiences a very sudden and extreme drop, which causes a corresponding expansion of the air at this point. If then, any air is confined, as, for instance, by the walls of a building, the effect produced is identical in its nature with that of an explosion. Suppose, for instance, the sudden drop in pressure is 10 inches of mercury or five pounds per square inch, which is nothing extraordinary. This would produce a sudden excess of lateral pressure on the interior of a wall 10 feet square of 72,000 pounds, or 36 tons—enough to demolish any ordinary structure. It is not, therefore, surprising that this condition of affairs should have the effect of breaking windows and raising roofs, as gas explosions are known to do.

It follows that the proper way to avoid effects of this sort, where a tornado is anticipated, is to open the doors and windows of the building. Doubtless in the case of the tornado above alluded to, the shop door on the first floor was open, which permitted the confined air to escape without damage, while the windows in the upper story were shut. In like manner it may be observed that in the case of the schoolhouse all the window panes were broken in the main building, where the roof stuck on; but in the wing, where the roof was lifted off, only a few of the panes were broken. But the case of the furniture warehouse, in which 500 chairs were scattered in all directions, seems to be the best illustration of the explosive effects produced by confined air under such circumstances.

Incidentally the misuse of the word "cyclone" to mean tornado should not pass without comment. It is regrettable that this word should be so abused in common parlance to mean something for which we already have a perfectly good word, and which is altogether different from its proper signification. It should be scarcely necessary to say that a cyclone is not a tornado, but is one of those widely distributed circular storms which are constantly sweeping over the earth's surface in temperate zones, known by the weather bureau as "lows."

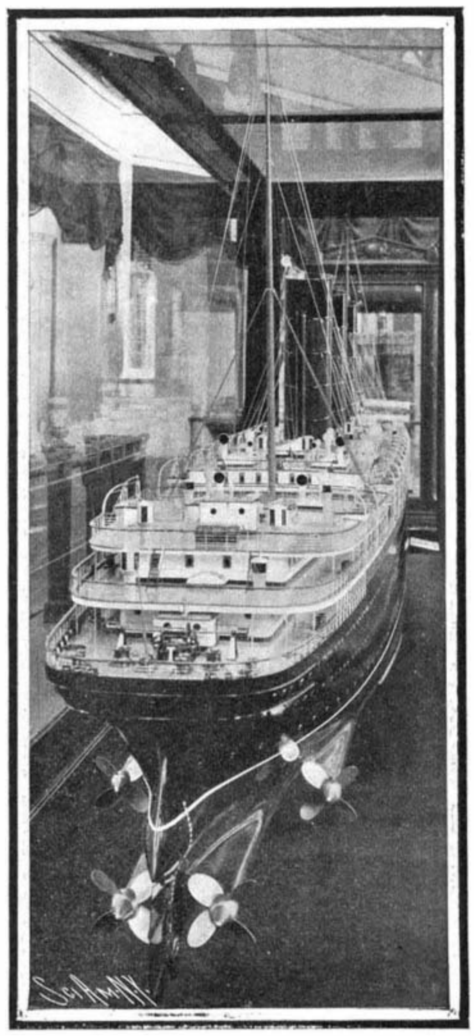
GEORGE W. COLLES.

Milwaukee, Wis., August 20, 1904.

THE NEW CUNARD TURBINE STEAMERS.

BY THE ST. LOUIS CORRESPONDENT OF THE SCIENTIFIC AMERICAN.

Among the nautical exhibits in the Transportation Building the most complete is that of the Cunard Steamship Company, which consists mainly of a set of handsome models illustrating the progress of the shipbuilding art, as shown by the various transatlantic steamships which have been turned out during the sixty-five years of the company's operations. The group of models is flanked by a large diagram which shows the progressive development in size, horse-power, and speed of the ships during the period under consideration. The smallest model is that of the historic "Britannia," the pioneer vessel of the company. This little craft, which was launched in 1840, was 200 feet in length (which by the way is only about 50 feet longer than the racing yacht "Reliance"), 34 feet 4 inches in beam, 24 feet 4 inches in molded depth, and she had a gross tonnage of 1,154 tons. With an indicated horse-



STERN VIEW OF MODEL OF 25-KNOT TURBINE CUNARDERS AT THE ST. LOUIS FAIR.

power of 440 she was capable of making a speed of 8.5 knots an hour. It is not our intention here to trace the development of the boats through the age of wood, which lasted till 1852, or through that of iron, which ran from 1852 to 1879, when the first steel vessel of the company made its appearance as the "Servia," of 9,900 tons and 16.7 knots speed. The three largest models are placed in line ahead and they represent the "Lucania," of 625 feet length and 22 knots speed, the "Caronia," one of the two new boats now under construction, to be placed on the line in 1905, and between them is the model of the new 25-knot turbine steamers. Of the two sister ships of the "Caronia" type, one is to be propelled by reciprocating engines, the other by engines of the turbine type; and as the two vessels are to be identical in everything except their motive power, an excellent opportunity will be given to determine the exact relative fuel efficiency of the two systems, to say nothing of the comparative data that will be obtained bearing upon the question of oil consumption, wear and tear, and the cost of attendance. These two vessels are to be 650 feet in length, 72.4 feet in beam, and 43.9 feet in molded depth; the tonnage will be 21,000, and with 21,000 horse-power they are expected to make a speed of between 18 and 19 knots an hour.

Of course the model that attracts most attention is that of the new 25-knot, 40,000-ton turbine steamers. The fact that the surrounding models are built to the same scale renders it possible to make an instant comparison, at least in point of length and bulk, between the new ships and the other large vessels. The result is striking; for the "Lucania," for all her length of 625 feet, looks positively a small vessel in comparison. The most notable features in the turbine steamers are the great height of the freeboard, the great diameter and lofty reach of the smokestacks, and the vast unbroken sweep of the upper decks. For reasons which can well be understood in this age of keen competition, the company has not seen fit to place upon the placard of this model any of the dimensions; but it is probable that when the vessels are launched their length will be found to run close to 800 feet, their beam to about 88 feet, their draft to 35 feet, and the displacement will be not short of 40,000 tons. By studying the model it will be seen that the side plating of the vessel has been carried up one deck higher than has been common in previous large ocean liners, thus adding about ten feet to the freeboard, and giving three lines of port holes. From abreast of the forward smokestack to the bow the plating is carried up yet another deck, thus providing a flush forecastle deck extending from 50 feet or more aft of the bridge clear to the bow. There is therefore no well to become flooded with water when the ship is driving into a head sea. The freeboard at the bow must be fully 45 feet and amidships it cannot be less than 32 to 35 feet. Above the water line there are six decks, three of them contained within the hull proper, and the other three being carried on extensions of the framing and affording vast promenades open to wind and weather. The smokestacks, which reach about 170 feet above the keel, are even larger than those of the "Lucania," which are 21 feet in diameter. They are elliptical in cross-section, and on the longer axis they measure 31 feet.

The horse-power necessary to drive this vessel at 25 knots an hour and provide a sufficient reserve for heavy weather will be not less than 75,000 and possibly more. It will be divided between four shafts. The outer propellers extend through the hull at a considerable distance forward of the stern post while the inner pair of propellers are located in the usual position near the stern post. This division of the power between four shafts will, of course, conduce greatly to the security of the ship, and will make sure that, even with one propeller disabled, she will be good for something over 22 knots an hour. It is expected that these vessels will be in service in the season of 1906.

The huge proportions of the new ships is shown very graphically in the comparison on the front page of this issue. The figures are drawn to the same scale. If placed on end, the big ship would be more than double the height of the Park Row Building, the largest office building in the world. If the 420-foot "Baltic," of 1871, and the 200-foot "Britannia," of 1840, were placed end to end, they would still be 180 feet short of equaling the total length of the turbine liner. Trinity Church spire—that old-time standard of lofty measurements—is 288 feet in height. If the new liner were placed in the churchyard alongside the church, its upper deck would be level with the ridge of the roof, its smokestack would reach half way up the spire, and the truck of its foremast would be within 30 feet of the cross that crowns the spire.

The Source of Radium.

Joly suggests in Nature that radium may not be derived purely as a disintegration product but as an atomic combination of radio-active products with some of the elements present in pitchblende. Thus radium would represent the synthesis of an element, not its decomposition, and the new atom not being very stable would be short-lived. Hence its radio-activity. The genesis of radium might be sought in molecular intermixtures of the radio-active elements with the various bodies conspicuously present in pitchblende. Ramsay considers that a more promising field of research appears to be to try to ascertain whether the immense amount of energy evolved in various forms during the disintegration of the radium emanation may not be able to cause chemical change of a constructive nature—for example, to change bromine into iodine. An attempt has been made to see if this was the case, but without a positive result.

The total number of British vessels entered with cargoes and in ballast at ports in the United Kingdom from foreign countries and British possessions in 1903 was 35,741, with a tonnage of 34,349,028 tons, as compared with 35,895, with a tonnage of 32,302,436 in 1902. The British vessels which cleared numbered 35,061, with a tonnage of 34,862,945 tons, the total in 1902 being 35,045, with a tonnage of 32,600,471 tons. The foreign vessels entering in 1903 amounted to 29,743, with a tonnage of 18,166,104, and in 1902 the number was 29,580, with a tonnage of 17,317,681 tons, while the foreign ships that cleared in 1903 reached the total of 29,320, with a tonnage of 18,241,267 tons, as against 29,462, with a tonnage of 17,652,131 tons in the previous year.