A TELESCOPE FOR SCHOOLS AND GENERAL USE.

The telescope shown in the illustration is designed and arranged especially for educational purposes, and, as will be seen, is mounted on a handsome and substantial equatorial stand, which is exceedingly portable and at the same time firm, supporting the telescope without the slightest tremor or vibration. The tripod is made of polished black walnut, and is so arranged that the legs can be spread out or closed, so as to accommodate the instrument to the height of the observer. It is also provided with a clamping device, which holds it securely in any position. The right ascension and declination axes are carefully ground and fitted, so as to secure smooth and uniform motion. Hence a star can be kept in the field of view by a simple movement in right ascension. Suitable clamps are also provided, by means of which any degree of friction can be placed on the axes; if necessary, they can be clamped tightly, each independent of the other. A balance weight is attached to the declination axis, so that the telescope is perfectly balanced in any position.

The tube is of brass, handsomely finished and provided with a fine, smooth-working rack motion for focusing. Each instrument is furnished with one erecting and four celestial eyepieces, giving powers from 75 to 280.

The object glass is a compound achromatic lens of full 4 inches aperture and 50 inches focal length, and is made in the most approved manner. It is guaranteed to show all the delicate test objects given in Webb's "Celestial Objects for Common Telescopes.

By this instrument may be seen the spots on the sun, the rapid formation and disappearance of which show the tremendous physical action going on in that great luminary; the mountains and their deep shadows thrown across the valleys on the surface of the moon, the evident result of fierce volcanic action in the distant past; the belts of Jupiter, demonstrating its very rapid rotation, and the four satellites of the planet alternately advancing and receding as they revolve about their great primary, exhibiting the phenomena of eclipses, transits, and occultations; the moons and rings of Saturn, which at the present time are in a most favorable position for observation, the rings being thrown with their surfaces toward the earth, thus giving a fine view of these most extraordinary appendages to the planet; the crescent of Venus, which increases and diminishes as it revolves about the sun, one of the most satisfactory proofs of the correctness of the theory of Copernicus; together with the asteroids, Mars, Uranus, Neptune, comets, various double stars, and nebulæ. Very fine terrestrial observations may also be had by using the erecting eyepiece.

The value of such an instrument in teaching and studying astronomy cannot be overestimated, as, in fact, a telescope is a necessity in the pursuit of this grand science.

In order to put this instrument within the reach of all persons its manufacturer, Mr. F. W. Gardam, of No. 58 Ann St., New York City, has spared no pains to perfect every part and to reduce the cost to the lowest possible figure.

A FOUR INCH EQUATORIAL TELESCOPE.

Armor Plate Trials.

Important and gratifying as were the results apparent at the recent tests of American armor on the Naval Ordnance Proving Grounds, other deductions of great interest and value have since been obtained through detailed investigation.

One thing which attracted attention was the irregularity of the penetrations in all three plates. Of two successive and similar projectiles fired at different corners of the same plate with exactly the same charge, from the same gun, one might enter more than one-third further than the other. For example, the first shot at the Bethlehem high carbon nickel plate, at the upper left-hand corner, showed a penetration of 13·25 inches; the second, at the upper right hand corner, a penetration of only 10·07; the third, at the lower left hand corner, a penetration of 13·90 inches; a fourth, at the lower right hand, a penetration of only 10·37. Differences of a fraction of an inch were, of course, looked for, but not differences of nearly four inches.

It was observed, in the instance just given, that these contrasts were presented by alternate shots, and further, that the first and third shots were about alike in penetration, while the second and fourth were also about alike and much less than the other two. In other words, the right half of the plate showed much more resisting power than the left. Similar inequalities were observed with the Pittsburg low carbon nickel plate of Carnegie, Phipps & Co., except that there one end showed greater resisting power than the other.

A study of these facts soon disclosed the reason for the lack of uniformity in results. The cranes used both at Bethlehem and Pittsburg for dipping the plates in oil were so slow in action that in the case of the Bethlehem plate one side was tempered harder than the other, while in the Carnegie plate one end was tempered harder than the other. It was, therefore, evident that hereafter the cooling liquid must be applied simultaneously to all parts of the plate. The quality noted in the best parts, as shown by the results, will then presumably become uniform throughout.

This principle was illustrated very strikingly in the all-steel Harvey plate, which had been sprayed with water on both sides. Being held perpendicularly between the two sprays, the discharged water from the upper portion of the spray, running down over the heated plate, was itself heated, and thus to a certain extent protected the plate from the chilling action of the lower portion of the spray. The upper part of the plate was distinctly harder than the lower, as shown in the trials, and, in fact, was the only portion in a proper condition for yielding the best results of the Harvey process.

The uniform chilling of a plate at all points of its surface will accordingly be the aim at both the armor-making establishments hereafter. But we must expect lack of uniformity in penetrations in the remaining plates to be tried. We may, indeed, look for better performances of the Harvey nickel plates furnished by both companies than that of the Harvey all-steel plate, since the nickel diminishes the tendency to crack. But these plates were alike tempered in the upright position, and subjected to the same unequal effects from the running water, with the consequence of unevenness in the hardening.

While these important gains in our ship armor even over the specimen plates tested at the proving grounds are thus assured, the comparison of the latter with the best European armor is gratifying. The Bethlehem high carbon nickel plate showed an average resistance to penetration, measured in inches, of about three inches less for each shot than the best plates furnished by France last year.

In the next place, the remarkably good performance of the Carnegie rolled plate, which doubtless can be improved upon with increased knowledge and experience on the part of the makers, would at once enable the Navy Department to quadruple the output of armor in a single year. The reason is that rolls like those used by the Pittsburg works can easily be set up in half a dozen places. Instead of waiting years for the necessary armor for our war ships, it could be turned out more rapidly than any other sort of war material. Another consequence must be a reduction in the prices of armor. Some steel makers have estimated that the prices will be brought down from $650 a ton to $350. Congress may therefore be more inclined to resume the construction of battle ships, now that it can no longer be said that the ships already under construction will engage the entire armor-producing capabilities of the country for several years.

Still another valuable result of recent studies is the conclusion that, in applying the Harvey process, both Bethlehem and Carnegie will probably try to introduce the carbon on one side of the ingot prior to any forging. This change alone, it is said, would save not only a great deal of time, but nine-tenths of the entire cost incident to the new treatment. In a new process of manufacture like this the successive stages of improvement depend on trials like those now going on. Yet the fullest and most successful development of the Harvey process may be expected within the next twelve months, and a year of further progress in naval armor making may also be looked for, possibly not less remarkable in its way than the one whose results are being shown at Indian Head.—*N. Y. Sun.*

Edison's Electric Railway Motor.

Mr. Edison has explained to the New York *Herald* his belief that the locomotive will be displaced on steam railways, and that his electric motor will be used instead. He said the economy would be large; he would get one horse power out of from one to two pounds of cheap coal, while the locomotive only got the same one horse power out of six pounds of dear coal. He intends to demonstrate that there need be no such thing as waiting for trains between cities now considered a long distance apart. He intends to run a train, say of two cars, every twenty minutes.

"I cannot go into details," said Mr. Edison, "for fear of injuring my rights on the other side—though, by the way, I never made anything out of European patents—but I will say briefly that the current will pass from the stationary engine to a central rail between the tracks, thence through the mechanism attached to the bottom of the cars or motor. A freight train, of course, would need a motor, because of the number of cars, although a single passenger car could be run carrying its own motor beneath it—thence to the wheels, and thence back by the side rails to the power house or stationary engine."

"And how many of these stationary engines would be needed?"

"Three of them, with a horse power of 10,000 or 12,000 each, would run the whole Pennsylvania railroad system between here and Philadelphia."

"Freight, local, express trains and all?"

"All of them, and at a great reduction of expense. Not only is each horse power produced at much less expense, but the depreciation of rolling stock and roadbed is much less. Every exertion of steam power is in the nature of an explosion, and when you take into consideration the fact that four or five hundred engines are on a road like the Pennsylvania at one time, each exercising a different degree of this explosive power, the depreciation is a great factor. But with electricity, it is always the smooth, rotary motion, imparted in the same way by the same men at the stationary engines."

"Can equipment be devised which will stand the strain of this system at full speed?"

The Wizard smiled. "Full speed of this system," he said, "is, or I see no reason why it should not be, 200 miles an hour. But as for practical purposes, I feel sure that a 100-pound rail on a rock-ballasted track would stand the speed of 100 miles an hour."

Whitened Cape Diamonds.

It is stated that artificially colored diamonds have been sold lately in Belgium. A French chemist finds out that on being dipped in a weak aniline solution the diamonds lose their yellowish tinge, and appear as pure white as the Indian or Brazilian stone. The aniline can neither be seen by a magnifying glass nor rubbed off with a chamois leather; so Mr. Guillot thinks that the dye must lodge in the sharp angle of the facet which remains unpolished, and so affect the light as it falls on the flat surface. A bath of nitric acid will show the fraud, or a little alcohol, which M. Guillot recommends diamond merchants to use for testing.