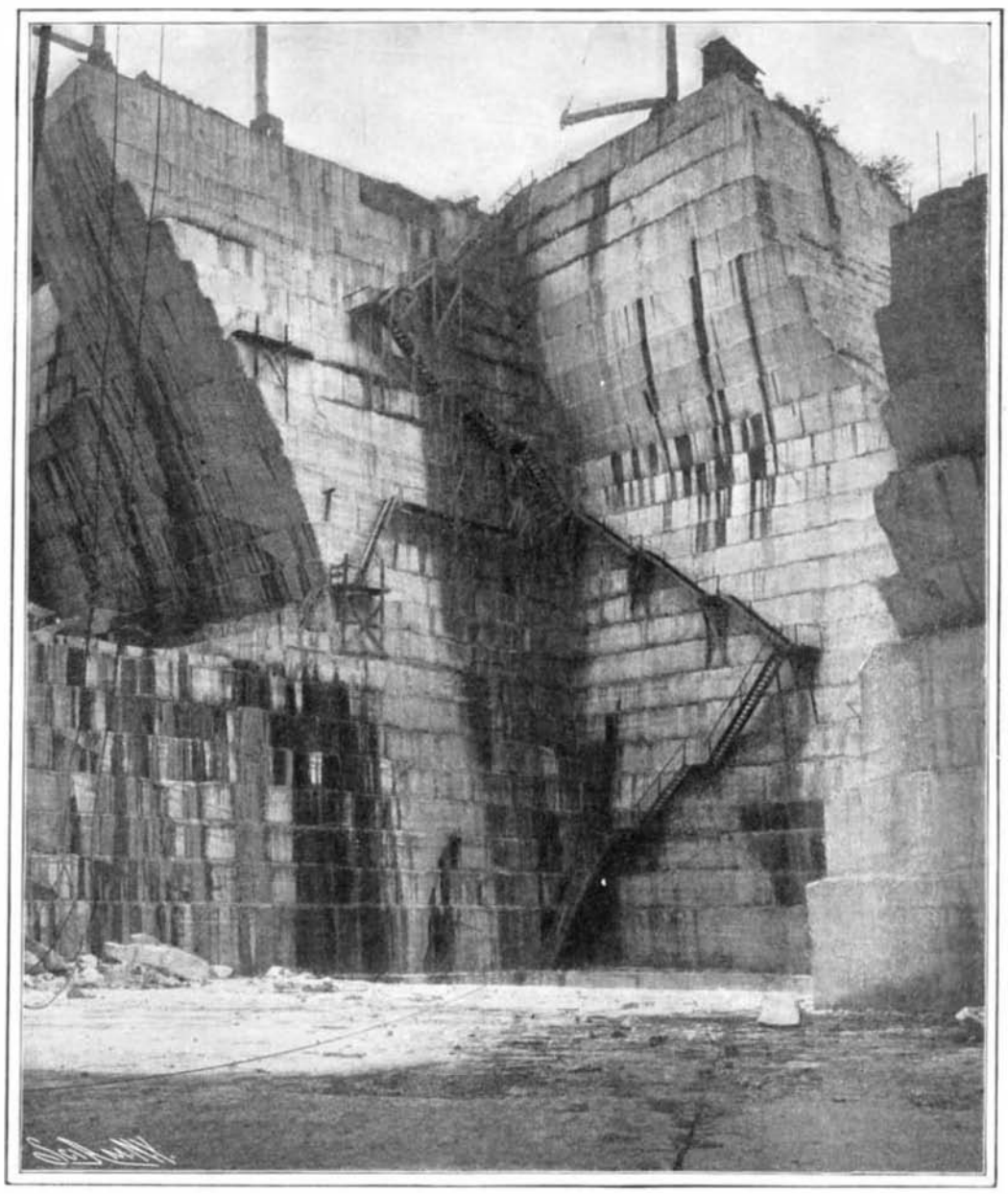
THE CARRARA OF AMERICA.

BY DAY ALLEN WILLEY.

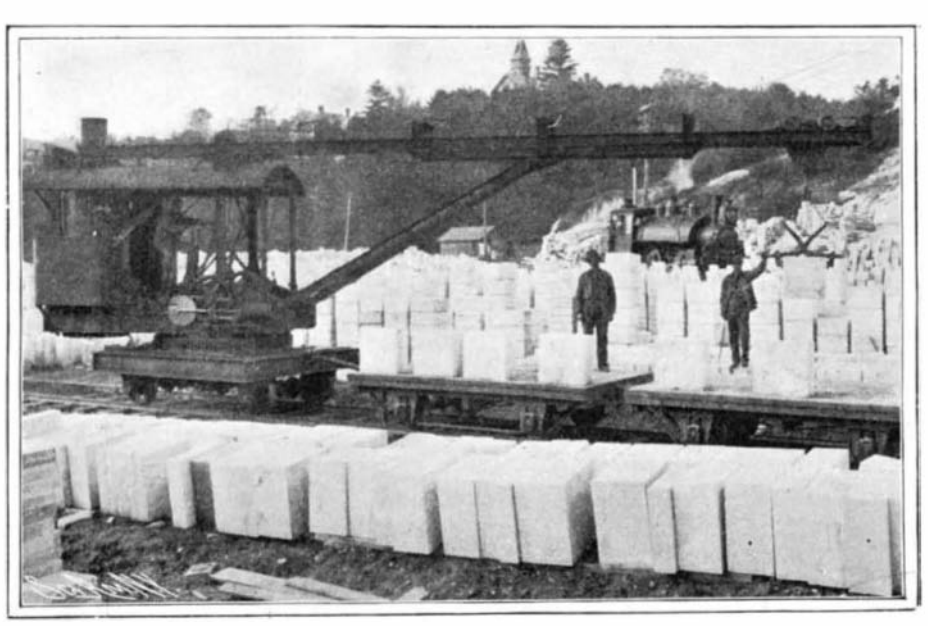
The marble industry of Vermont is interesting, not only on account of its magnitude, but its comparatively recent inception, although located in one of the oldest of the United States. It forms a striking illustration of the fact that New England has natural resources which are just beginning to be appreciated. Yet as early as 1792 it was known that deposits of marble existed in the State named, and a few blocks were taken from surface beds early in the present century.

The extent of operations in Rutland County, where the most extensive quarries have thus far been opened, indicates, however, that this resource is one of the most important not only in New England, but in the United States, and that the supply is of very large proportions. One of the most interesting features connected with the deposits is that they vary to such an extent in color and quality. The ordinary white marble used for buildings is found in abundance, but in addition a variety of the grayish-white tint for which Greece is so noted has been obtained, as well as layers with black, blue, red, and greenish hues. While much of this deposit is of one color, other beds are so blended that marbles representing a combination of tints in mottled and striped patterns are worked as well. Several of the kinds which have been secured bear a striking resemblance to the famous Pentelic marbles, of which some of the most noted structures in Greece were built while a variety which is very similar to the statuary marbles of Italy, on account of its translucent quality, is being obtained and utilized for statuary. By reason of the extent and variety of the marbles thus far obtained, Rutland County has also been called the Carrara of America; but geologists who have studied the formation, are of the opinion that the deposit is of far greater proportions than the Italian beds referred to.

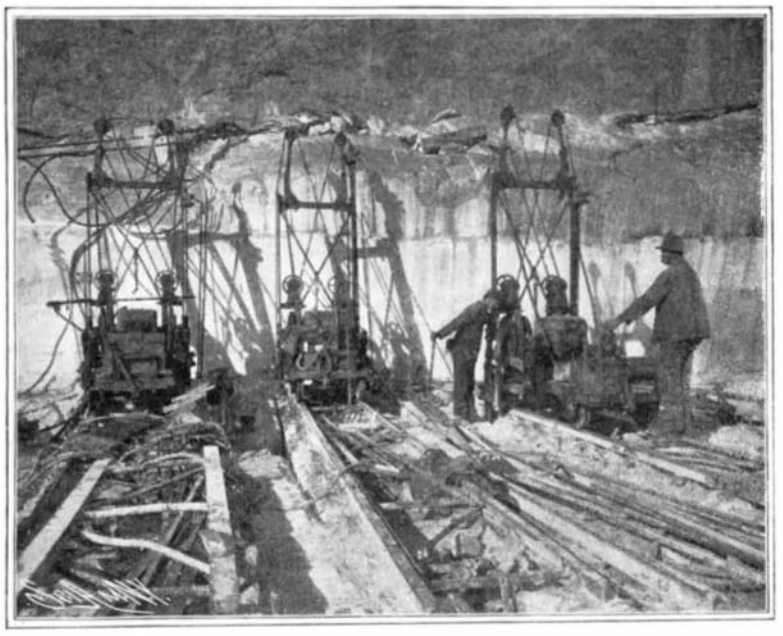
Although, as already intimated, the industry is comparatively new, it has progressed so rapidly that some of the quarries in the vicinity of West Rutland are of unusual dimensions. One has been excavated to a depth of nearly 300 feet, and at the bottom is nearly 2,000 feet in length. From it has been taken an enormous quantity of material for buildings alone, but the beds are of such size that even at the depth mentioned, marble of such a high grade has been secured that it was profitable to work it. An examination of the strata as revealed by the walls of these quarries shows that several varieties both in color and composition may be found in proximity with each other, the deposits occurring in regular layers separated by a natural cement, which occurs in partitions of varying thickness. The layers of marble range in width from a few inches to over ten feet, and consequently blocks of very large size can be secured for foundations, obelisks, and for other purposes where massiveness is required. As may be



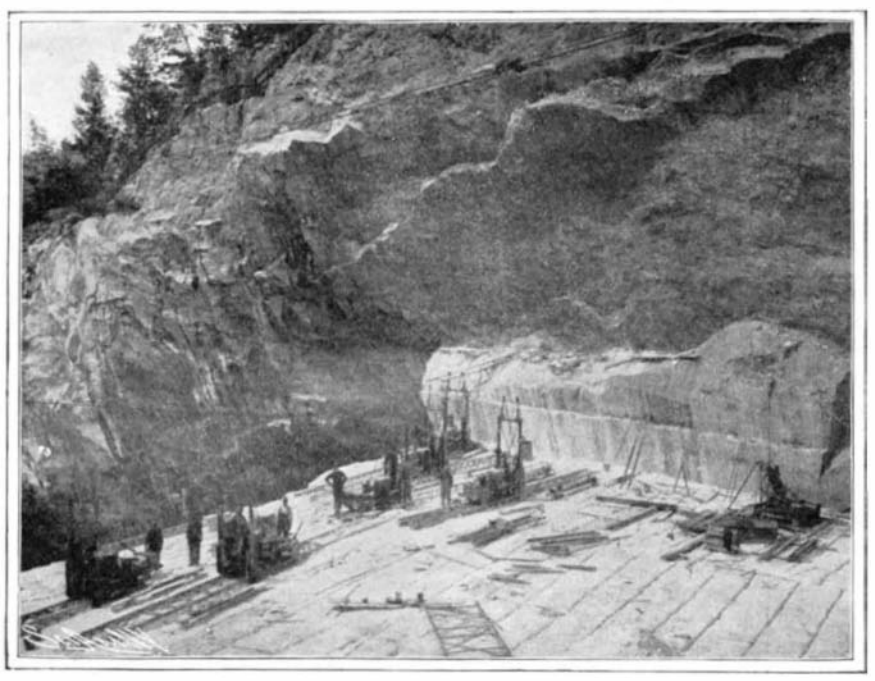
A Vermont Marble Quarry 200 Feet Deep.



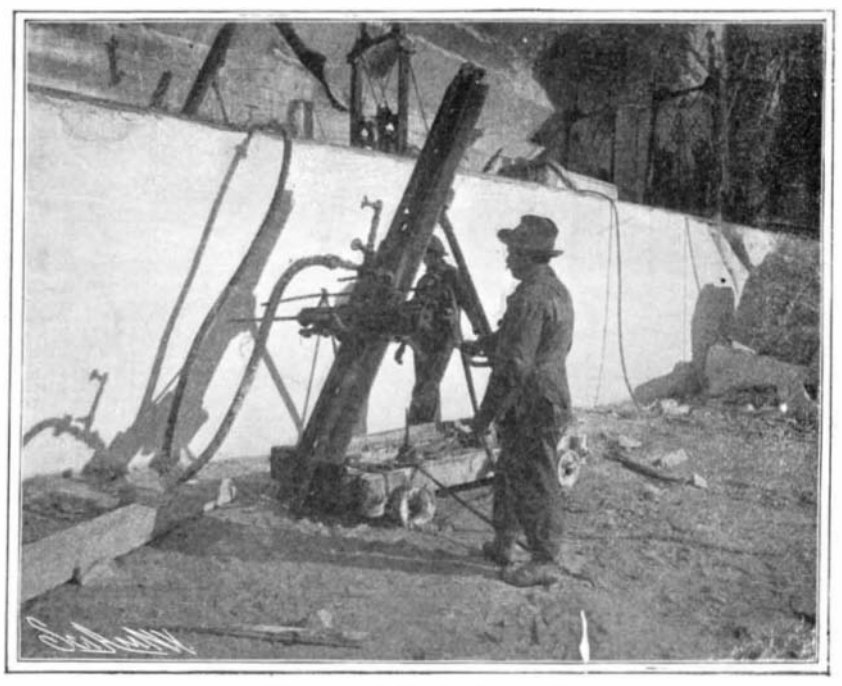
One of the Locomotive Cranes in Use at the American Carrara.



Channeling Machine at Work, Showing Vertical and Horizontal Cuts.



Quarry at Proctor with Gang of Electric Channeling Machines.



Type of Steam Drill Used in Quarrying.

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imagined, in securing the marble from the beds, some very interesting machinery is employed. In the quarries of the Vermont Marble Company, at Proctor and West Rutland, are installed what are termed channeling machines, which are operated by both steam and electric power. One of this type is known as the Sullivan channeler, after the inventor. It travels back and forth on a track which is pinned to the solid rock, making a ridge or channel which averages one and one-fourth inches in width and ranges from four to ten feet in depth. This incision is made parallel with the rails of the channeler track, but a few inches to one side. The machine cuts but one channel at a time, and in its operation is somewhat similar to the ordinary steam drill, with this exception, that the rotary motion is avoided. In order to cut the channel evenly, no less than five drills are assembled, each having a separate bit. They are so fastened together that they act as a single tool, but having five bits. Three of the bits are adjusted directly across the channel, while two are at an angle of 45 degrees. They are clamped into a head which forms a part of the piston rod connected with the steam cylinder, so that the power acts directly on the drills through the piston. The five bits combined really constitute a drill, which would be about seven-eighths of an inch by seven inches in dimensions. The movement of the channeler on the track is controlled by a separate engine, which is geared to the trucks. The capacity of the machine depends, of course, largely upon the hardness of the formation, but frequently one hundred feet of channel will be cut in a day.

Another type of cutting machine is known as the Wardwell, and can be operated either by steam or electric power as desired. It is also moved back and forth on a track, but makes a channel on each side of the track and parallel with it. In this apparatus the drills are also arranged in clamps in groups of five, the up and down stroke of the drills being obtained through a double system of levers connected with a crankpin on the crankshaft of the engine. Between the levers is a system of springs, also between the lower lever and the frame, and the motion of the machine along the track is secured by connecting the crankshaft of the engine with the trucks through a system of gears. With this type of the channeler there is a constant relation between the speed of the machine and the strokes of the drill. When electricity is used in place of steam power, a connection is made between the electric motor and the shaft by means of bevel gears. The Wardwell cutter is of special advantage for up and down or vertical work, where the channel can be made at fixed distances apart, but the Sullivan is generally used where the layers are of widths which vary considerably. In addition to these machines independent drills are used for what the quarryman calls "gadding," and where it can be employed with more economy than the channeler.

It is perhaps unnecessary to say that the use of explosives in connection with marble quarrying is practically impossible, since so much of the material would be shattered that the process would be attended with such waste as to be by far too expensive. Therefore a large number of the channeling machines referred to are installed. For elevating the blocks to the surface, powerful boom derricks are used, similar to many of those employed in the construction of large office buildings, the motive power being furnished by steam engines. For transferring the blocks from the quarry openings to the yards and marble "mills" as they are termed, several varieties of cranes are used, in which both steam and electricity are employed. The locomotive cranes are very valuable in connection with the industry, those at Proctor being provided with a horizontal jib or arm of unusual dimensions. It is built of steel girders, and is so massively constructed that it will handle loads of several tons without difficulty. The most powerful crane employed by the Proctor company is of the Whiting pattern. As the photograph shows, it is electrically driven, having a bridge available for use, of no less than 160 feet, with an overhang on each side of the legs of 50 feet, the distance between the legs being 60 feet. The crane travels on a track, and the loads are handled by two trolleys mounted on a bridge, each of 25 tons capacity. By means of an equalizing bar the trolleys can be connected and used in moving a single load, making the maximum capacity of the crane 50 tons. Material can be lifted to a height of 35 feet. This apparatus is principally used for loading trains, the cars being hauled beneath it, and the blocks quickly swung into position. In connection with the mills a crane of 10 tons capacity is used, which is called a half-gantry, from the fact that one leg moves upon a rail at the edge of the loading platform, while the truck at the other end of the crane travels on a rail which is attached to the mill building. This arrangement affords a clear passageway in the center, so that the material can be carried in an overhang, and facilitates the loading of cars.

At the Vermont quarries much of the marble is fashioned into tombstones, statuary, and other forms in the mills, which have been erected in some instances immediately over the beds. In the work of cutting the blocks pneumatic chisels are now extensively used. For cutting the slabs into suitable sizes sand-saws are used almost entirely. The saws are made of soft iron but without teeth, sand being substituted for the latter. Operated by steam power the iron blades move back and forth, forcing the particles of sand against the material, and thus cutting it. The sand is applied to the marble in a stream of water which is continually poured upon the surface. The process is somewhat lengthy, for from four to five hours are required to cut through a single foot, but the number of saws give this portion of the works a large capacity. It might be added that all of the sand used is brought a distance of several miles entirely by mechanical power and on its way is carried to a considerable altitude over a mountain by means of an endless cable carrying a line of buckets, which are automatically unloaded.

The recent date at which this industry was undertaken on an extensive scale can be appreciated, when it is stated that in 1870 the census reports show that the total valuation of marble obtained from the Green Mountains of Vermont was but $130,000. At present one company alone extracts material yearly to the value of $2,500,000. Over three thousand hands are employed in all of the quarries and mills, while the total investment of capital represents nearly $5,000,000; the value of the marble for buildings, statuary, monuments, and other purposes sent yearly from this district being nearly as much as the total investment.

THE START OF THE BALTIC FLEET.

The long-heralded setting out of the Russian Armada for the Far East has been signalized, at the very outset, by a fleet engagement, which is destined to rank as unique in naval history. We cannot recall another instance in which an admiral starting to the relief of a beleaguered and far-distant fortress, was so fortunate as to strike the first telling blow in home waters, and sweep through the enemy's lines, delivering his broadsides without the loss of a single man, or so much as the scratching of the war paint on his own battleships and cruisers.

The collision occurred at night and in thick weather. Warned by the fate of the Port Arthur fleet, Admiral Rojestvensky and his staff were keeping a strict lookout for torpedo attack, when suddenly they were confronted by a numerous fleet of suspicious-looking craft, filled with uncouth men, some of whom were wielding sharp knives, while others were seen in the very act of hauling and pulling on objects that were floating in the sea. Here, then, was the enemy, caught in the very act of sowing mines in the path of his Majesty's battleships. Despite the sudden peril that thus confronted it, the traditions of the Russian navy were nobly maintained. There was no panic—merely a sharp word of command—and the united broadsides of four of the very latest and most powerful battleships of the day opened with telling effect. After twenty minutes of spirited and accurate firing, in which the greatest self-possession was shown by all ranks, the admiral, seeing that the enemy made no reply, steamed to the southward, leaving behind him two fishermen killed, several wounded, and one fishing boat sent to the bottom. It is generally agreed that naval history, ancient or modern, fails to furnish a parallel, either in brevity or effectiveness, to this Battle of the North Sea.

Its effect upon the spirits of the beleaguered garrison at Port Arthur must prove to be highly stimulating; and there can be little doubt that such an astute admiral as Togo will make a mental note of the keen-eyed vigilance, dashing courage, and deadly efficiency shown thus early in its career by the Baltic fleet.

As regards the material of which the fleet is composed, although it includes four battleships which we consider to be, in some respects, the best in the world, the fleet as a whole is composed of so many different types, that it is totally lacking in that homogeneity which tacticians of the modern school consider to be of prime importance to the effectiveness of a fleet. The most important element is, of course, the four recently-completed battleships of the "Borodino" class, ships that are very similar to the "Czarevitch," now sheltering, badly crippled, under the protecting wing of a neutral port. They embody, however, certain improvements over that ship. The vessels are the "Borodino," "Orel," "Imperator Alexander III.," and "Suvaroff." They carry four 12-inch and twelve 6-inch guns, besides a numerous battery of smaller rapid-fire pieces. The belt of Krupp steel varies from 9 inches amidships to 4½ inches at the ends. The heavy guns are protected by 11 and 10 inches of armor, and the six turrets that contain the twelve 6-inch guns in pairs, carry six inches of armor. Theoretically, these ships are unsinkable by gun fire at ordinary battle ranges. In addition to the protective deck at the waterline, which is 4 inches thick, they have an upper protective deck, 2 inches in thickness, and the space between them is entirely filled with coal. Moreover, two vertical bulkheads of 4-inch armor extend throughout the ship at about 8 or 10 feet from the side. Compared with the latest battleship designs of other navies, the secondary battery of 6-inch guns is too light for its purpose. Our own "Connecticut" carries secondary batteries of 7 and 8-inch guns, the "Lord Nelson" of the British navy carries ten 9.2-inch guns in its secondary battery, while the latest Japanese carry four 10-inch guns.

The battleship "Osliabia" is practically a sister ship to the "Peresviet" and "Pobieda," now imprisoned at Port Arthur. She was half way on her voyage out to the Far East at the outbreak of the war, and was recalled because of the early naval ascendency gained by Japan. She is distinguished by an abnormally high freeboard of about 30 feet, and she would, of course, present a lofty target to the enemy. She is armed with four 45-caliber 10-inch guns and eleven 45-caliber 6-inch guns, besides forty-six smaller pieces. Her belt, which extends almost to the ends, is of 9-inch Harvey nickel-steel, with a shorter 5-inch belt above it, extending for a third of the length amidships. The 6-inch guns are carried in casemates protected by 5 inches of armor. The 10-inch gun is a powerful piece, but not by any means a match for the 12-inch wire-wound guns of the Japanese. The "Osliabia" carries two submerged and four above-water torpedo tubes. On trial she made a speed of 18.3 knots. The other two battleships are comparatively obsolete vessels, that could only find a place in a "scratch" squadron, such as this; the "Sissoi Veliky," built in 1894, is a ship of 9,000 tons and 16 knots speed. She carries four 35-caliber 12-inch guns of low velocity and six 45-caliber 6-inch rapid-fire guns. Her half-dozen torpedo tubes are carried above water. She has a partial belt of 16-inch Creusot armor, a deck 3 inches thick on the slopes, and 5 inches of protection to her 6-inch guns. The "Navarin," built in 1891, is a vessel of 10,000 tons and 16 knots. She carries four 12-inch guns of the same pattern as those on the "Sissoi Veliky," and eight 45-caliber 6-inch pieces. Her 16-inch waterline belt and her 12-inch turrets are protected by the old compound iron and steel armor, whose resisting power is very small against modern artillery. Moreover, she is a ship of low freeboard and limited coal supply. It is quite a question whether the crack battleships of the Baltic squadron would not be better off without these two old and inefficient "armorclads."

Of the cruisers, two, the "Admiral Nakhimoff," of 8.000 tons and 18½ knots, and the "Dmitri Donskoi," of 5,880 tons and 15.5 knots, are old armored cruisers. The former was launched in 1885, and the latter in 1883. The "Admiral Nakhimoff" was reconstructed in 1899, but she still carries the soft compound armor, as does the "Donskoi" also. The "Nakhimoff" is armed with eight 6-inch and ten 4.7-inch, and the "Donskoi" with six 6-inch and ten 4.7-inch guns, of modern type. These two obsolete craft can never hope to stand up against the modern powerful armored cruisers of Japan, like the "Asama."

The fleet also includes six protected cruisers, whose presence in the Far East can have only an indirect effect in raising the siege at Port Arthur. Their province will be to act the part played by the Vladivostock cruisers before they were put out of commission by Admiral Kamimura's squadron, namely, that of raiding the Japanese transports and merchant vessels. In this, because of their high speed, they can, undoubtedly, prove very troublesome to the Japanese by distracting the attention of the blockading fleets at Port Arthur and Vladivostock, and by constituting a menace to the Japanese communications by sea. The fleet consists of the "Aurora," of 6,630 tons and 20 knots, carrying eight 6-inch guns, sister to the "Pallada" and "Diana," now confined in Port Arthur; the "Oleg," of 6,250 tons and 23 knots, carrying twelve 6-inch guns, a new vessel of the "Bogatyr" type (the "Bogatyr" went on the rocks at Vladivostock, was floated, and is now repairing at that port); the "Jemtchug" and "Izumrud," of 3,200 tons and 22½ knots speed, carrying six 4.7-inch guns, sisters to the "Boyarin," sunk by a mine at Port Arthur or Dalny; the "Svietlana," of 3,900 tons and 21½ knots speed, carrying six 6-inch 45-caliber guns, besides the "Almaz," of 3,000 tons and 25 knots speed, carrying six 4.7-inch guns, a sister vessel to the "Novik," of which we heard so much during the earlier Port Arthur operations.

The fleet is proceeding to the Far East in two divisions, the smaller vessels, including the torpedo boats, going by the Suez Canal and Indian Ocean, and the larger vessels going by way of the Cape of Good Hope. What will be the fate of the squadron? We must confess that, in view of its auspicious start, it is impossible to predict with any semblance of certainty just what it may do. But one thing is certain—if it should succeed in navigating the 17,000 miles that separate it from the Far East, and should then meet and demolish the well-seasoned ships and crews of Togo and Kamimura, raise the siege of Port Arthur, and transfer the command of the sea from the flag of Japan to that of Russia, it will have accomplished a feat that seems, even with the Battle of the North Sea fresh in our minds, altogether beyond human possibility.