THE RESISTANCE AND SPEED OF STEAMSHIPS.

The seventh of the series of lectures in connection with the Naval and Marine Engineering Exhibition was delivered on the 4th inst., in the Corporation Galleries by Mr. Frank P. Purvis, Leven Shipyard, Dumbarton, his subject being "The Resistance and Speed of Steamships." Mr. Purvis gave a sketch of the theories and discoveries of Beaufoy, the late Prof. Rankine, and Scott Russell, regarding the resistance of ships. He also gave an interesting account of the experiments made at Torquay by the late Mr. Froude. In conclusion he said: It has been suggested by several, and among them Mr. Pearce in the opening lecture of this series, that private ship-builders should establish an experimental tank similar to the one at Torquay. Such a suggestion is of the highest value, and well worthy of being carried into practice. If it had not been for the experiments made at Amsterdam by Dr. Tideman, supplemented as they subsequently were by the further experiments upon Lochlomond, how could any one responsible for the speed of the "Livadia," how could Mr. Pearce have been certain about the speed which that remarkable vessel attained? In this respect, in the matter of attaining and for exceeding her predicted speed, she was indeed a triumph. They knew what huge strides had been made in recent years in the direction of length. In the rooms below were models of the "Iberia," the "Arizona," the "City of Berlin," and the "Servia," ranging in length from 449 ft. to 515 ft.; while, not represented in the collection, but at present under construction at Barrow, is the "City of Rome," a ship which will have a length of 546 ft., or within 125 ft. of the length of the "Great Eastern." After detailing the results of the elaborate calculations, by which, with tolerable certainty, we can build a ship to travel at a given speed, Mr. Purvis said: In determining the foregoing, length is the dimension which in all cases has first been deduced, breadth and draught then following to make up the required displacement. It will be readily seen that the dimensions noted in these tables differ very largely from those of actual ships, both in the absolute length of ship, and also in the ratio of length to breadth. Compare, for instance, the dimensions of the 10,000 ton ship, intended to go 18 knots, with the dimensions of the "Servia," and the contrast will appear very marked. He believed the "Servia," was to have a load displacement of some 10,000 tons; in which case the length figure in the table would have to be some 20 ft. greater than it is, leaving a difference still of nearly 60 ft. between the figure and the length of the actual ship. The much greater breadth and the greater draught of the ship in the table are, it is true, decidedly open to objection, the former because it would involve extra weight of material if the ship were built to fulfil Lloyd's requirements, the latter because few ports would admit of the ship's entry. He did not attempt to answer these objections further than by saying that both Lloyd's rules and the depths of water in ports were intended to meet the requirements of ships as they were at present built, and not as they may be required to be built in the future. The author ventured to predict that when matters of speed have been more thoroughly investigated ships of very different dimensions from those at present in fashion will come to be built; ships, too, in which the breadth bears a much higher ratio to the length. Of late years much has been done on the Clyde towards getting careful data connected with speed. Mr. William Denny strongly advocated and himself adopted the plan of trying the ships built by his firm at several speeds (four or five in number), ranging between the lowest and the highest that the engines are possible of maintaining, two runs being in every case made for each speed, one with and the other against the tide. Previously one speed with each ship had to suffice, the data obtained from it—although now acknowledged to be inadequate—being all that was available for future use. Mr. Denny's plan has now been adopted by several other builders on the river.

Mining, Metallurgy, Mineralogy

UNDERGROUND SURVEYING.

Although several improvements have been made during the past few years in the construction of the theodolite and dial, and these instruments are now considered perfect for all practical purposes, there are, however, other instruments which the mining engineer and surveyor must use, and the much greater accuracy which is now necessary in making mining plans, to prevent encroachment and consequent litigation, makes it desirable to use the best instruments for securing precision. One of the defects of the present system of surveying is the method of transmitting a mark from the center of the dial to the roof of the tunnel or drift. The usual practice is to hold the line and plumb-bob with one hand above the instrument, and after getting the center the hand is removed to allow the mark to be made on the roof with the other hand. This method is too much dependent on guesswork, and for accurate operations, say, in the case where two headings have to meet, surveyors, although it sometimes entails a large amount of extra work, prefer to go over the whole distance again rather than rely on a mark made in this way. To overcome these difficulties, an English mining engineer, Mr. W. E. Garforth, of Normanton, has designed an arrangement of adjustable plumb-bob and holder, which we illustrate in the accompanying drawings, taken from the *Engineer*.

From this it will be seen that Mr. Garforth's new instrument, which is very ingenious and extremely neat in design, consists of a small brass box plate—with projections to prevent slipping when placed against the roof of the mine—on the under side of which the rack, *C*, is arranged to move backwards and forwards the projecting arm, which can likewise be worked at right angles by the second rack, *D*. By means of these motions the string connected with the plumb-bob can be moved to any required position by the wheels *A* and *B*, which, although placed on one hollow spindle, work independently of each other. At the extremity of the arm a duplex center or gimball motion—similar to that in use for suspending a ship's compass—is arranged to hold the rod, *R*, through which a string passes, to which is attached the plumb-bob which causes the rod, *R*, to hang in a perfectly vertical line whatever the inclination of the roof of the mine. The movable slide, *T*, which is bored to fit the rod, *R*, when lifted upwards either by a spring or by hand, as preferred, is consequently obliged to move in a perpendicular line. An adjustable screw cap, in which is placed the chalk or needle, is fitted to the upper end of the slide. The plumb-bob, *L*, is arranged with a lock nut, *H*, so as to allow the string between the instrument and the roof to be lengthened or shortened as required, and to obtain greater accuracy the plumb-bob has a long, adjustable, coarse-threaded screw, *K*, to enable the point of the plumb-bob to be brought in the closest contact with the glass of the instrument.

Now, assuming it is required to transmit a mark, the "dial center" is placed against the roof of the mine, the string adjusted first by the lock nut, *H*, and afterwards by the screw, *K*, the screws *A* and *B*, are then worked until the plumb-bob hangs exactly above the center of the dial, when the slide—which, for the reasons already explained, is caused to hang vertical—is next moved upwards, and the center mark made in the roof. To obtain even greater accuracy, and when the mark has to be made on timber, the screw, *M*, can be attached to the movable slide, and instead of a chalk mark a loose needle can be pressed and left in the plug or timber.

Mr. Garforth's "dial center" will, without doubt, prove a most useful adjunct to the dial, and a means of saving considerable time in setting out lines is now almost daily required, especially in those collieries where an extensive system of chain or rope haulage is at work, and where straight roads are found to work so much more advantageously, as compared with crooked roads. The plumb-bob used by itself will prove of service to architects and engineers, as there is often a loss of time in having to lengthen or shorten the line, which is so quickly adjusted by the arrangement shown.—*Mining and Scientific Press.*

ELECTRIC-METALLURGY.—SILVER PLATING.

For electro-silver plating the double salt of silver and potassium cyanide is almost universally employed. The baths are used either hot or cold. The latter method is generally adopted for articles which require great solidity. The hot process is used for small articles, and is preferable for steel, iron, zinc, lead and tin, which have been previously electro-coppered. The hot baths are generally kept in enamelled cast-iron kettles, and the articles are either suspended or moved constantly about in them. A somewhat energetic current is needed, especially when the articles are moved about in order to operate rapidly. A grey or black deposit indicates too strong a current, and when the surface becomes covered with bubbles of gas the same thing is indicated. The anodes are plates of silver or heavy silver foil. The wooden tanks for the cold baths are similar to those used in plating with copper and nickel, but should be very thoroughly coated on the inside with guttapercha.