these coils come near a piece of metal, the inductive disturbance which its presence creates will upset the existing balance, and the telephone, before silent or nearly so, will give out distinctly audible sounds, owing to the predominance of the induced currents in the secondary, S^1, over those in the secondary, S.

The idea of applying the balance to the detection of metals has been worked out by Captain McEvoy, who has reduced it to a thoroughly practical form. This

Fig. 5.—ELECTRICAL ORE FINDER.

actual apparatus is illustrated in Fig. 7, where A is a portable case containing the adjustable coils, P S, and the interrupter, I; B is a voltaic battery of two cells, which may be replaced by a small magneto-electric machine giving alternating currents; T is the telephone in the secondary circuit; C is an insulated cable conveying the wires connecting up the two pairs of coils; and D is the detecting or exploring case containing the two secondary coils, S^1 P^1. The coils, P S, inside the box, A, are separated by a layer of soft India rubber, and an ivory screw passes through both coils and the rubber washer between. An ebonite head to the screw is adjusted by hand so as to press the coils together or let them further apart by regulating the pressure between them and the India rubber. The simple device adjusts the balance of induction and reduces the telephone to silence.

The interrupter is a special device which consists of a small iron reed or tongue kept in vibration by a small double-poled electro-magnet, thereby interrupting the current a certain number of times per second, so as to give out a definite note which is easily recognizable in the telephone.

A switch, E, at the box turns the current from the battery on and off the interrupter at a moment's notice. The telephone is the ordinary speaking receiver of Bell.

The cable, C, is insulated with India rubber having its pores filled up with ozokerit or black earth wax forced in under pressure and when in a hot fluid state. It is further protected with an outer braided sheathing, and is fitted to the box, A, by an ingenious socket, which in an instant establishes connection between the corresponding primaries and secondaries, and locks them together. The detecting case, D, is made of wood soaked with paraffin wax. It is watertight, and contains two exploring coils, S P, Fig. 6. When it is lowered into the water by the cable, C, and moved about, or dragged over the bottom, the instant it comes against a piece of metal, such as a torpedo case, a chain, or a submarine cable, it disturbs the balance, and the note, heard in the telephone very faintly until now, becomes unmistakably loud and clear. It is, indeed, somewhat surprising to find so marked an effect.

If there is any objection to this instrument, it is that a body of metal lying in the plane of the coil will not affect it.

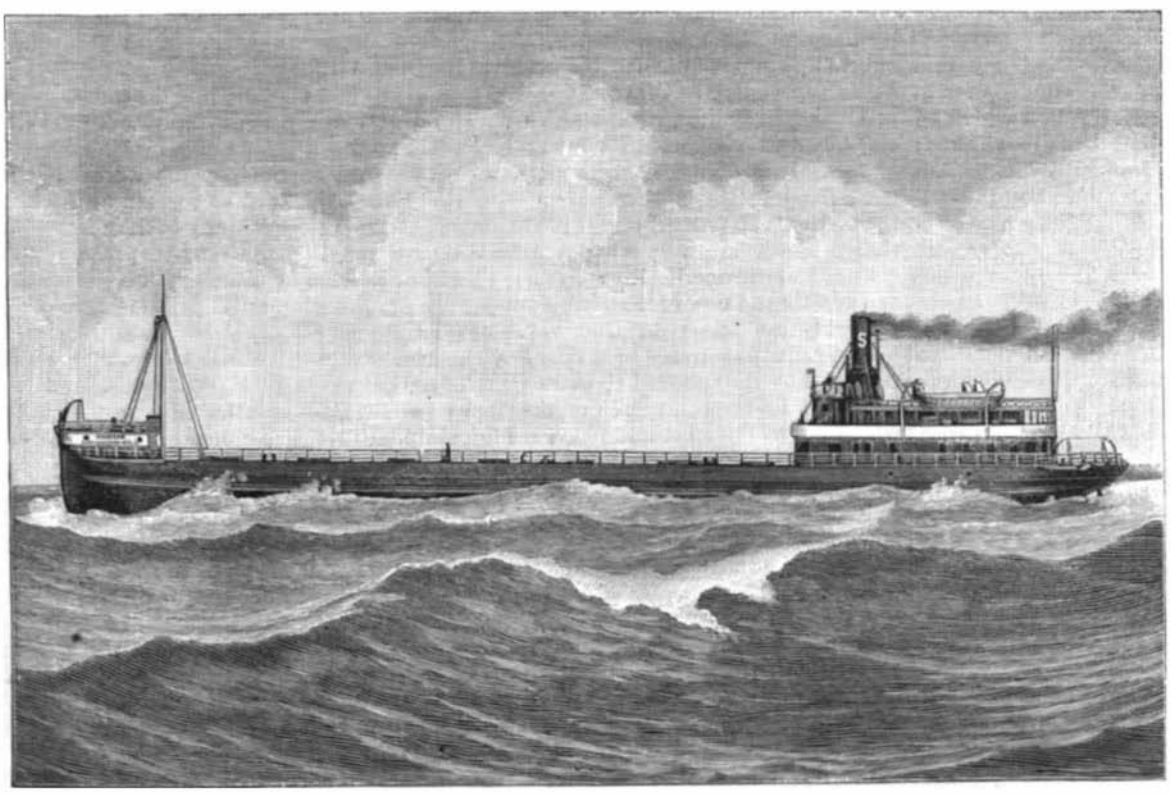
Pertinacious John Nash.

When a pupil in Sir Robert Taylor's office, John Nash had an early opportunity of bringing himself into notice. Sir Robert, on one occasion, putting before his clerks some plans to which certain alterations were needed in an unusually short space of time, was annoyed at being told that it was impossible to do what he required. This being overheard by young Nash, he ventured to ask if he might undertake the task which had been declined by his superiors. Sir Robert, struck by the earnest manner of the boy, granted his request. Nash immediately went to his room, procured paper and candles, and, sitting up all night, labored incessantly at the drawings, and by the time appointed appeared before Sir Robert with the plans completed. As another illustration of Nash's perseverance in after life, and his determination never to be overcome by seeming difficulties, it is told that on one occasion, having to go to some out-of-the-way place in Wales, he disdained the accustomed road, which was circuitous, and resolved to seek a more direct path to his object. Setting out on foot, he encountered many hedges, ditches, and fences, most of which he passed, but not without difficulty. At last meeting with a locked gate, awkwardly framed and inconvenient to mount, he was seen to retrace his steps several hundred yards, make a sudden run and attempt to vault over the gate. Failing in this, again and again he put forth his strength, and nearly accomplished his aim; at last stripping himself of his coat and waistcoat, by a longer run and a desperate spring he succeeded in clearing the barrier. He was then seen to climb deliberately over the gate, retrace his course, put on his clothes, and proceed quietly on his way.—*The Architect.*

THE STEEL STEAMER CHOCTAW.

The builders of vessels for the freight business on the great northern lakes are sharply competing with each other in the building of the most economical and efficient craft for the enormous transportation service now being done, and which is growing with marvelous rapidity. The ability of a vessel to carry an extra 100 or more tons of cargo, the efficiency of its engines in comparison with its coal consumption, its average rate of speed and freedom from liability to any sort of accident likely to interfere with the daily performance of its full work, are all carefully considered in the making of contracts for the new freight steamers now being built for the lake trade. This is necessary because there is so much competition in the carrying business that the smallest differences in the efficiency of the vessels often mark the line between a profitable or a losing business for the owner of a vessel, and on this account the builders are constantly making improvements in the steamers they are now turning out for this work.

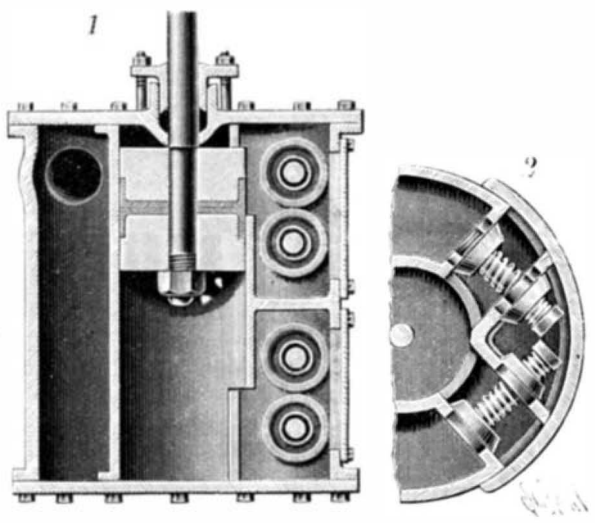
The accompanying illustration of the new steel steamer Choctaw, built by the Cleveland Shipbuilding Co. for the Lake Superior Iron Co., represents one of the latest models of this class of vessels. She is 266 feet long on the water line, 38 feet beam, and her moulded depth is 22 feet 4 inches. She will carry 2,683 net tons of fuel and cargo on a draught of 15 feet, her speed, light, being 13 miles an hour, and 12 miles an hour when loaded. Her engines are triple expansion, with cylinders 17, 29, and 47 inches, respectively, and a stroke, common, of 36 inches. She has two boilers, each 11 feet in diameter and 12 feet long.



THE STEEL STEAMER CHOCTAW.

AN IMPROVED FIRE ENGINE PUMP.

The illustration represents a double-acting fire engine pump in which the valves and interior mechanism are arranged to be more conveniently accessible than they have been with previous forms of construction, thus facilitating the repairing or replacing of the valves whenever necessary, and lessening the expense of keeping the engine in order. The improvement has been patented by Mr. T. S. La France, of 508 Spaulding St., Elmira, N. Y. Fig. 1 is a vertical section, and Fig. 2 a horizontal section, showing a portion of the section and delivery valves, on the line of the side inlets for receiving water from either side of the engine. Both the pump barrel and casing are closed at top and bottom, neither end requiring to be opened, nor the back of the casing, the barrel, or its plunger needing to be removed, in order to get at the valves. All the valves, both inlet and outlet, are in the front portion of the casing, as shown in Fig. 2, and running vertically from top to bottom in this front portion are partitions, joined midway of their height by a horizontal dividing partition, forming upper and lower inlet valve chambers, while between these two sets of inlet chambers are upper and lower outlet valve chambers. The plunger is made with upper and lower solid heads, holding reverse cup-shaped leather or flexible packings between them. In the front of the pump casing are openings of sufficient size to take in or expose all of the valves, these openings being covered by removable separate lids, whereby access may be readily had to either or both the upper and lower sets of inlet and outlet valves. By this arrangement of the valves and valve chambers the pump barrel and its outer casing may be cast in a single piece if desired.



LA FRANCE'S FIRE ENGINE PUMP.

Costa Rica.

Although Costa Rica is only about half the size of New York State, its list of birds numbers 730 species. It is a country of forests and of all sorts of climates, from the torrid sea coast to that found at an elevation of 11,500 feet, the top of the volcano Irazu, where ice forms.

The trees are not deciduous, although their leaves fall in part during the dry season, which extends from October to May. At the end of the rainy season, many North American migrants appear, and as the dry season advances they retreat to the coast region, and are not seen again till another year. Bird life is more abundant during the wet season, for the reason that fruit and insects abound at that period. The breeding season nearly corresponds with that of the United States.

Near San Jose, at an elevation of 5,000 feet, are what are called "the prairies," about five miles square. They become flooded to the depth of about an inch from September to February, and on them are found a number of species of water fowl and waders.—*George K. Cherrie.*