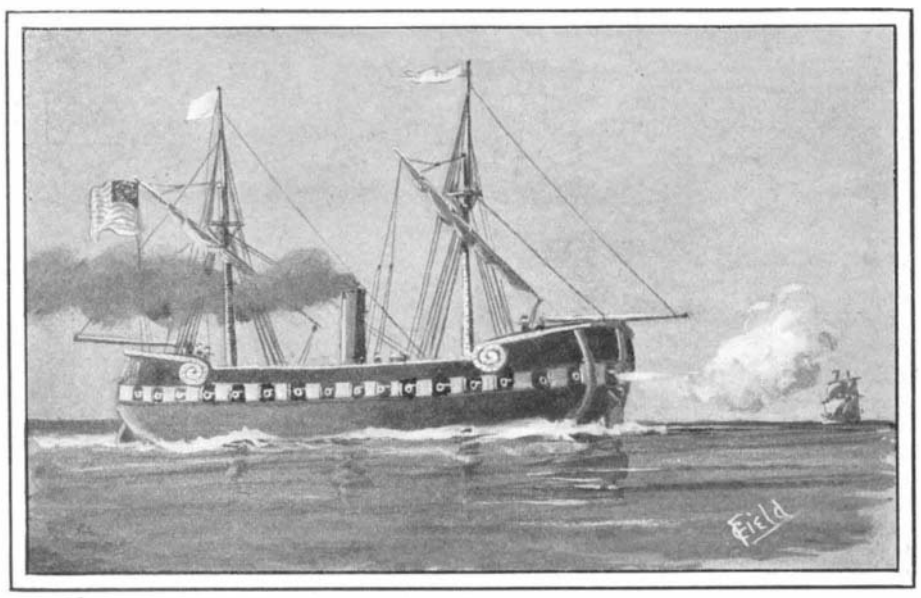
EARLY ARMORCLADS.

BY MAJOR C. FIELD, GLENMORE, ENGLAND.

Although armorclad ships are generally considered to date only from the middle of the last century, armor, in the general and extended use of the word, has been used for the protection of ships for hundreds, nay thousands, of years. Not, of course, nickel-steel or even iron armor, but a protective covering of various materials; for as the warriors of the past wore steel, iron, brass, leather, and even quilted cotton armor, so have ships been protected by a variety of different substances. The modern word "cuirass," which we apply solely to body armor as worn by the Life Guards, and which is of French derivation, is used also in France for the armor of a battleship and reminds one at once that armor was originally made of leather or "cuir."



FULTON'S "DEMOLOGOS," OF 1815. THE FIRST STEAM WAR VESSEL.

As with men so with ships. The ships of the ancient Greeks and Romans were often fortified with a thick fence of hides, which served to repel the missiles of their enemies and afford protection to their own crews. Hides, possibly brass and iron, and certainly thick timber, entered into the construction of the turrets and towers with which the fighting ships of ancient and medieval times were fitted, especially when used for harbor defense, as in the Venetian turret ship of the ninth century here illustrated. Felt made an early appearance as a defensive armor on shipboard, as we find that in a sea fight off Palermo in 1071 between the Normans and Saracens, the former hung their galleys with this material by way of a defensive cuirass. The Norman knights had probably adopted this device from their enemies, for felt had been used for some time for this purpose on board the huge "dromons" of the Saracens. These, the "battleships" of those days in the Mediterranean, usually rowed fifty oars a side, each oar being manned by two men, so that here we have a couple of hundred seamen accounted for at once. When the soldiers, sail trimmers, and artificers who worked the war engines and siphons for Greek fire are added, it is evident that the crew must have been very large, and have required a ship of considerable dimensions. These great warships were armored with woolen cloth soaked in vinegar to render it fireproof, and hung with mantlets of red and yellow felt, so that their cuirass was not only useful, but ornamental as well. At this period, and for many hundreds of years later, additional protection was afforded to those on deck by the ranging of the bucklers and shields of the warriors on board along the gunwales. Later, in the fifteenth and sixteenth centuries, special "pavesades" or bulwarks were provided in lieu, composed of large oblong shields supplied for the purpose. In addition to felt, the time-honored leather armor also entered into the defensive panoply of the "dromons," and in the war of the Sicilian Vespers, Pedro III. of Aragon, who commenced his reign in 1276, covered two of the largest ships of his fleet with leather before sending it against Charles of Anjou.

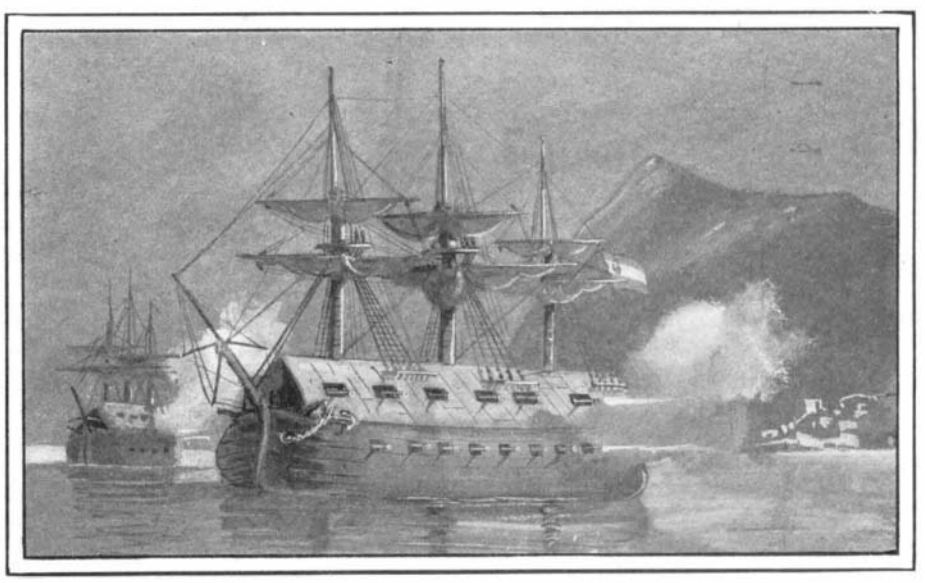
These, by the way, were not the first "leather-clads." We have already seen that leather, probably in the form of rawhides, formed a portion of the armor of the Saracen dromons, while Conrad of Montferrat, at the siege of Tyre in 1187, either invented or at all events caused a special class of leather-protected vessels to be built, which were called "barbotes" or "duckbacks." They would now probably be called "turtlebacks." They would appear to have been small craft covered with a strong leather-protected domed roof, through portholes or openings in which the archers and crossbowmen could fire without exposing themselves. They proved very effective against the Saracens, and in 1218 the entrance of the Nile was forced by seventy of these little armorclads.

But in the meantime the Saracens seem to have "gone one better" in the evolution of armor protection, for it is said that the "Great Dromon"—whose capture by Richard Lion-Heart is still commemorated by the stars and crescent in the arms of our greatest naval port—was equipped with leaden armor. This was in 1191, and probably lead was occasionally used for protective purposes throughout the next two or three centuries, although there is no record of any ship so protected until 1530.

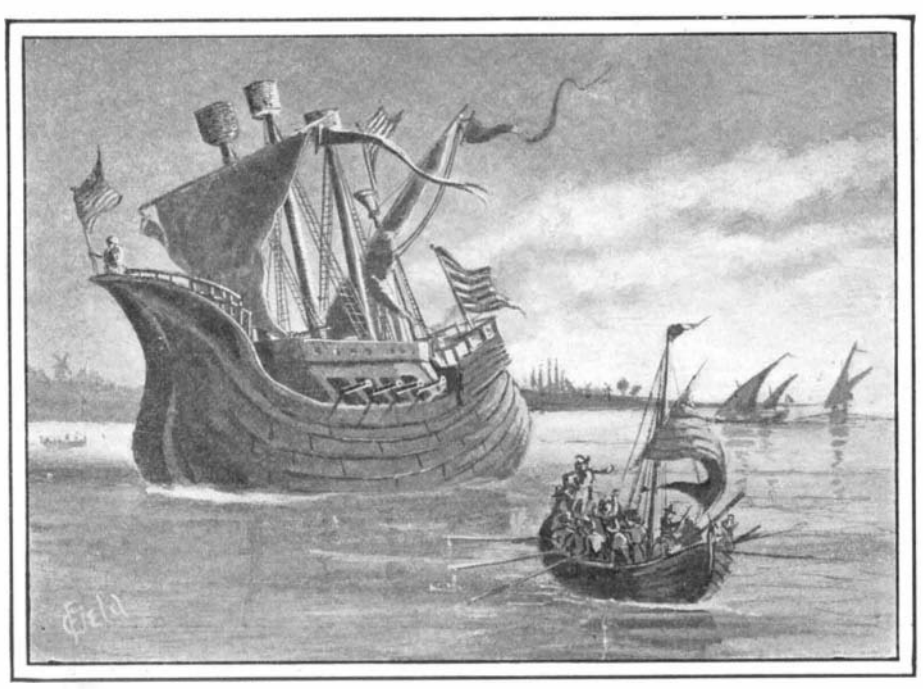
In this year the Knights of St. John, those sworn opponents of the Turk, built one or perhaps two "lead-clads." At any rate, one account says that they built such a ship in this year at Malta, while another describes a ship of this kind called the "Santa Anna," launched at Nice in the same year. The "Santa Anna's" leaden armor plates were attached to her sides by bolts of brass, and it was claimed for her that she could "resist the artillery of a whole army," and at the same time could sail or row as fast as any of her unarmored contemporaries. She was a big ship, with six decks, a reception saloon, a chapel, a specially constructed powder magazine, and a bakery. She was present at the taking of Tunis in 1535, and played an important part in its capture.

Lead, it may be remarked in passing, was not infrequently used at this period for sheathing ships under water, in the same way that copper is still found so useful. Thus the French ship "Grande-Françoise," launched in 1527, one of the largest and most famous ships of her day, was sheathed with lead from her keel to the first wale above her waterline.

According to a short paragraph in Hayden's Dictionary of Dates, "Chain netting of iron was suspended to the sides of men-of-war, which were also strengthened by plates in the time of Henry VIII. and Elizabeth." No authority is quoted, nor is the material of the "plates" specified. The assertion seems a little difficult to believe, because Sir William Monson in his famous Naval Tracts, in one of which he specially deals with protective devices, does not mention either of these systems; and as he served at sea in the reign of Elizabeth, he could hardly fail to be acquainted with them if in general use. What he suggests is "a device made with a plank of elm, because it does not shiver like oak. This plank is musket-proof, and removed with trucks from one part of the ship to the other, which is a good safeguard for small shot. In my opinion I prefer the coiling of cables on deck, and keeping most of the men within them." Again, in his proposals for a class of ship to be superior to all others afloat, he says: "All parts of the ship shall be made musket-proof for the safety of the men. Low by the water and without-board they shall be fortified with packs of wool, that no shot shall pierce them." Here we have a prototype of our modern waterline belt at once. The Spaniards attempted to protect their galleons of the Invincible Armada by building their sides four or five feet thick, but the heavy English guns "lashed them through and through." But now at last we arrive at a real armored ship in the present-day acceptation of the word. Not only an armorclad, but a real ironclad. This was constructed in Antwerp in 1585, with a view of breaking through the lines of the Spanish army under Alexander of Parma, which was at that time closely investing the city. It was a large flat-bottomed craft, with a central casemate or battery built of thick balks of timber and plated with iron. It was intended to be, and very likely was impenetrable to any artillery that the Spaniards could bring against it; and in hopeful anticipation that their ironclad ship would raise the siege and put an end to hostilities, the men of Antwerp christened her the "Finis Belli." In addition to a heavy battery of guns, the "Finis Belli" carried a large body of musketeers, some of whom were stationed aloft in her four fighting tops, while the rest were well protected by the loopholed bulwarks on the upper deck. Unluckily for the besieged Dutchmen, she ran aground before she had effected anything at all, and fell into the hands of the Spaniards, who nicknamed her the "Caranjamula," or as we should say, "Bogey." They contrived to get her afloat, and brought her down to the camp of Alexander of Parma, where she became a great attraction to the sightseers of the period. As for the Dutchmen in the doomed city, they henceforward only referred to their fruitless experiment as the "Perditæ Expensæ," or "Wasted Money." Ten years previous to this, others of the Dutch patriots had built a somewhat similar contrivance, which very possibly was also armored. This was the "Ark of Delft," a twin vessel supporting a floating fortress, which was propelled by three hand-worked paddle-wheels placed between the two hulls.



THE SPANISH FLOATING BATTERIES BEFORE GIBRALTAR.



THE FIRST IRONCLAD, THE "FINIS BELLI," AGROUND AND ABANDONED BY THE DUTCH.

It is a curious but well-known fact that if we go to the far East, we can find a parallel to almost any western invention. It is therefore not astonishing to find that the Japanese possessed a paddle-propelled armorclad in the year 1600. This quaint craft, like the old leathercad "barbotes" of the twelfth century, was turtle-backed, with ports for firing from. She was covered with iron and copper plates fitted together like the cells of a honeycomb, mounted ten guns, and like the "Ark of Delft," was moved by a central paddle-wheel. Though there is no record of any more iron-

clad ships before the nineteenth century, our own navy at any rate used various devices to protect its ships in the eighteenth. According to a French writer, the sailors of his country were astonished at the perfection to which the English had attained in this direction. "Old cables," he writes, "held in place by pieces of iron barricaded the whole length of the bulwarks; mantlets of old rope hung over the ship's sides to diminish the shock of our cannon balls, and, beneath a thick rope netting stretched from poop to bowsprit, the English fought under shelter, maneuvering without ceasing out of musket range, so as to riddle our detachments of fusileers with their cannon shot. So we lost two hundred men for every thirty of the English put out of action."

This system of armoring was, however, soon adopted by the French, as in Lescallier's "Vocabulaire des Termes de Marine Anglois et François," published in 1777, we find the following:

"'Blinder un vaisseau,' to cover the ship's side with fenders of old cables to preserve her from an enemy's shot, when employed to defend a harbor, etc."

The Spaniards endeavored to improve on this, and in 1782 hoped great things from the celebrated floating batteries employed at the great siege of Gibraltar by the Duke de Crillon.

"The floating batteries used at Gibraltar," says a contemporary account, "were mounted on ships of the line cut down to a particular size. On the top they were defended by a covering made of cordage and wet hides." This was not the complete protection that was originally intended by the Chevalier d'Arcon, their constructor, according to another account of the same date as the above, which states that "The covering was to have been laid over with strong sheets of copper, and by this means the red-hot balls, the bombs, and other destructive implements, would have slid off." A "Journal from on Board the 'Victory,'" from 8th to 21st October, 1782, gives further particulars of the protection of the Spanish batteries as follows: "Ten ships of war of different rates were appropriated, rendered bomb-proof, and fitted with wonderful precaution, having a sloped roof and the sides seven feet thick with cork, wet sand, etc., and having channels which by means of pumps were kept continually full of water. How all this was in vain is a matter of history; but the following succinct account of the end of the floating batteries, published in the Gazette de France of September 27, 1782, is worth quoting:

"14th (Sept.) In the morning we lost everything excepting our honor. The floating batteries, which were believed to be proof against the balls and bombs, were found to be entirely insufficient. In a moment the whole were set on fire. The fire raged prodigiously, particularly in that one in which was the Prince of Nassau. By a miracle it happened that he was neither killed, wounded, burnt, nor drowned. Never did the bravery of two nations ever shine with so much advantage as in this unfortunate attack. About noon all the floating batteries were blown up or sunk; the loss of the besiegers was about 1,200 or 1,500 men. The red-hot balls and bombs did execution in all parts."

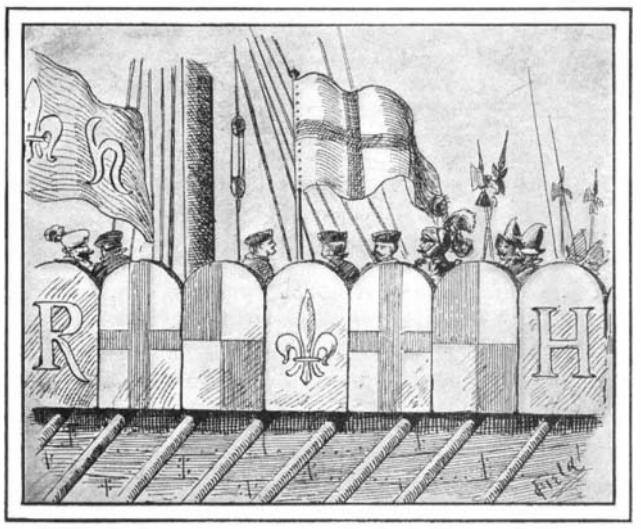
The fate of these experimental armorclads offered no inducement to the naval constructors of the day to make further researches in the direction of protection, so that till comparatively recent times we find our sailors depending only on their "wooden walls" to resist the projectiles of the enemy. The oaken sides of the British ships, we may note in passing, were often exceptionally stout and difficult to penetrate.

In the fight between the "Glatton," 56-gun ship, and four French frigates, a brig, and a cutter, mounting 220 guns between them, their 12 and 24 pounders failed to penetrate her sides, and she beat them all off with great loss at the cost of one officer and one man wounded.

But the Americans, from the very commencement of their existence as a nation, set themselves to make improvements in naval warfare. David Bushnell constructed a practical submarine boat in 1773. Torpedoes were used by him and others in the war with this country, and for the purpose of towing these contrivances alongside our ships, they invented and built in 1814 a paddle-propelled turtle-backed boat lying very low in the water and covered with "half-inch iron plates, not to be injured by shot."

About the same period the celebrated inventor Robert Fulton, who had already constructed one or two submarine boats and various classes of torpedoes, built a steam frigate which he called the "Demologos," or "Voice of the People," but which is sometimes known as the "Fulton I." This, the first steam warship ever constructed, had her sides no less than 13 feet thick of alternate layers of oak and ash wood, a thickness absolutely impenetrable by any gun then afloat. In 1829 this vessel was blown up by accident, and was succeeded in the American navy by the "Fulton II.," a ship which appears to have been protected by some kind of iron armor.

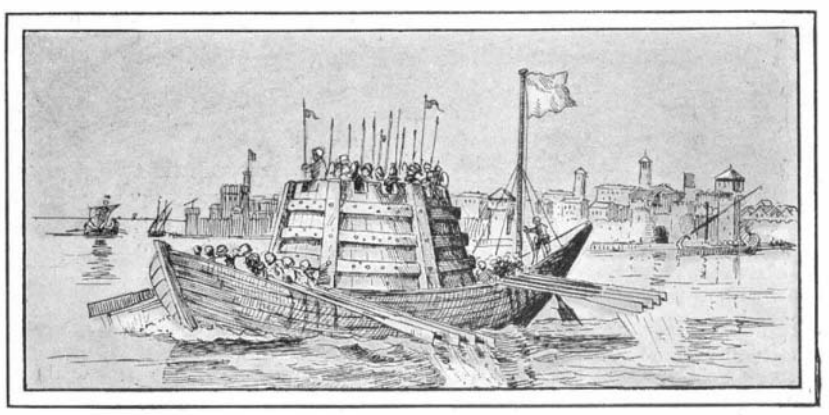
Various proposals were made to use iron plating to protect the sides of ships of war from this time forward, but until the French constructed a number of



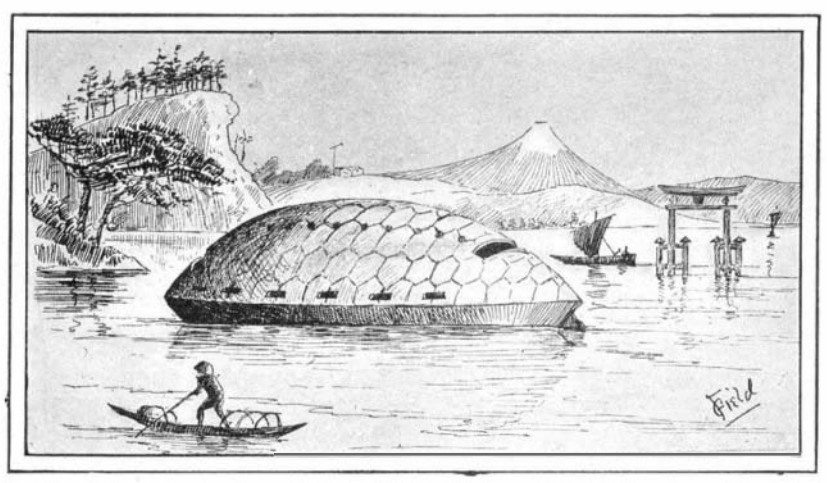
AN ENGLISH GALLEY OF THE TIME OF HENRY VIII.

armor-plated batteries for use in the Crimean war, nothing practical came of the suggestions of inventors. Their success at the bombardment of Kinburn demonstrated the value of armor plating. England at once followed suit with others of the same kind, some of which are still doing duty as hulks. Then came the French "La Gloire," the British "Warrior," the ironclads and monitors of the American war, and thenceforward the steady evolution of the armored fighting ship, which has provided us with the majestic battleships of the present day.

Thomas A. Edison's fifty-eighth birthday and the twenty-fifth anniversary of the invention of the incandescent electric lamp were celebrated at a banquet given to the inventor at the Waldorf-Astoria Hotel, New York. Although it is too soon to estimate at its true worth the debt which modern civilization owes to the inventions of Mr. Edison, still we are able to judge something of their usefulness. Of all his inventions, perhaps, the incandescent electric lamp has been fraught with the greatest utility to mankind, and has found the widest application of any of his numerous contrivances. As we have pointed out more than once in these columns, the lamp is the result of unflagging pertinacity in experimental work on the part of Edison—a pertinacity which has always distinguished his methods as an inventor.



TURRET SHIP USED IN THE DEFENSE OF VENICE. NINTH CENTURY.



A SEVENTEENTH CENTURY JAPANESE ARMORCLAD.

New Electric Inventions and Experiments.

Railway engine.—Experiments have recently been conducted on the 1-meter gage line connecting St. Georges de Commiers and La Mure, in the Department of Isère, with a 500-horsepower electric engine, using a continuous current at 2,400 volts. This engine, constructed by the Geneva works, weighs 50 tons, is 12½ meters (41 feet) long, and admits a speed of 22½ kilometers (14 miles) per hour, with a load of 110 tons, over the stretch of line rising on an average of 0.0275 meter per meter (1.08 inches per 39.37 inches) and with curves of 100 meters (328 feet) in radius. The electric power required is supplied by the hydro-electric plant operated by the Drac torrent. The line is worked on the three-wire overhead system, the current being delivered by means of a top-head trolley.

Suppression of synchronizing.—A method of reducing or entirely suppressing the synchronizing or equalizing currents which flow between single and multiphase alternators is described in a patent recently secured by a Bohemian inventor. In the arrangement employed for securing these ends, the alternators are connected to the primary windings of a pair of transformers placed between the alternators, and of which the secondary windings are connected together. The windings are arranged so that normally the magnetic effects of the currents in the primary and secondary windings balance each other. In the case of a larger number of alternators a corresponding number of transformers is used, all the secondary windings being connected together in series. For three-phase machines, three-phase three-core transformers are employed, and in each case the primary windings of the transformer and the armature windings of the generator have a common neutral point.

Regulating consumption of energy.—A Viennese invention provides a method of, and means for, automatically regulating the consumption of energy in a system of electric traction. The current is supplied by a compound-wound generator, of which one field winding is in connection with a separate exciter, while the other is in series with the mains leading to the motor. These two windings are arranged in such a manner that they act in opposition, so that the voltage of the generator is varied automatically in a contrary sense to the main current, which avoids the necessity for employing starting resistance in the main motor. The motor field may be separately excited by a battery with a reversing switch and rheostat for adjusting the strength of the field as required. In applying the invention to electric railways, independent generators are employed for supplying the separate leads of a number of line sections, on each of which not more than one train is running at the same time.—Oliver J. D. Hughes.

Improvements in Lord Kelvin's Compass and Sounding Machine.

Several improvements in the design and construction of Lord Kelvin's patent compass and sounding machine have just been introduced. In the newest form of the compass the illumination is effected from below, and either oil lamps or electric light may be used. The bottom of the compass bowl is in the form of a strong, thick lens, through which the light is refracted on the card. The intensity of the light may be varied at the pleasure of the observer, and this is found to be exceedingly useful in taking bearings of stars or other faint lights. A new antivibrational suspension has been designed, which insures great steadiness in the card; and a new form of helmet, with rifle sights, facilitates very considerably the work of taking bearings. With the new helmet navigators are able to take bearings of lights and stars by night with the same ease and convenience as bearings of the sun are now taken by day. The new form of sounding machine has been constructed of a height which has been found, from practical experience, to be the most suitable for the work of winding in the line. In addition to this great advantage, the new machine has an improved form of brake action, and a further advantage is that the working parts of the machine are all in sight and can be easily removed if necessary.

Reports from St. Michael, B. C., are to the effect that the well-preserved body of a mammoth has been found by Indians in a glacier near that point. Charles Ranner, a hotel proprietor at Skagway, has organized an expedition to investigate the report. An effort will be made to exhibit the find at the World's Fair. The body is said to be 20 feet high and the tusks more than a foot thick. The only other complete specimen ever obtained is now in St. Petersburg.