MAKING AND LAYING AN ATLANTIC CABLE.

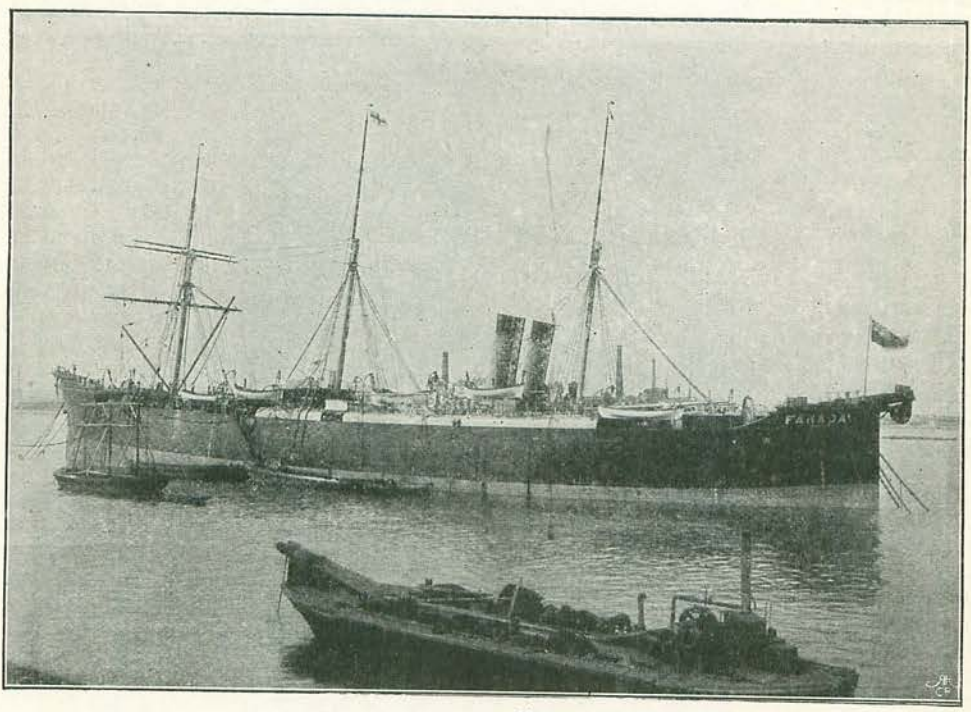
By Roland Belfort.

Illustrated from Photographs by Messrs. Angove.

IT is really doubtful whether we properly realise the magnitude of the work accomplished, mainly by the British, in the establishment of submarine telegraph communication—the materialisation of Shakspeare's famous "girdle round the earth in forty minutes." This great work has been executed amid comparative indifference; important extensions are constantly being made without attracting the slightest attention. And yet what a terrible calamity it would be for the Press, commerce, diplomacy, and, indeed, the world generally, should certain omnipotent cable kings decree the sudden and universal severance of this spinal cord of civilisation!

There is no corner of the world into which these hardy pioneers have not made their pacific, scientific raid, developing international communications, disseminating intelligence, expediting the world's commerce, and completing that vital chain which may ultimately bind the world in the bonds of peace. Is it not a significant fact that since the establishment of this admirable system England has not been involved in any serious conflict, although ominous war-clouds have frequently gathered? In their dispersion the cable has always played a prominent part.

When, in 1851, Brett laid his Dover-Calais cable, he scarcely anticipated that within forty years every point of the globe would be placed in permanent intercommunication. With what surprise would he contemplate the latest telegraphic map intersected by 1300 cables, aggregating 162,000 knots, and varying in length from 1 to 2700 knots. He who experienced such difficulty in raising his modest capital would marvel at the £45,000,000 invested, the vast army of men and the fleet of forty-one ships now employed in cable work.



THE CABLE STEAMER "FARADAY."

A recent interview with Mr. Alexander Siemens, director of the famous firm of Siemens Brothers & Co., so long identified with submarine telegraphy, and a visit to their cable works, furnished me with many interesting details concerning this cosmopolitan enterprise.

Messrs. Siemens have laid seven out of the twelve existing Atlantic cables: one for the "Direct" Company, one for a French company, two for Jay Gould, and three for Mr. Mackay, the Silver King. Jay Gould acted with characteristic boldness. One day he cabled to Messrs. Siemens—

"Cable estimate for making and laying two Atlantic cables."

The firm immediately quoted their price, the amount considerably exceeding £1,000,000!

"Accept offer. Will buy *Faraday*," instantly responded the Napoleon of finance.

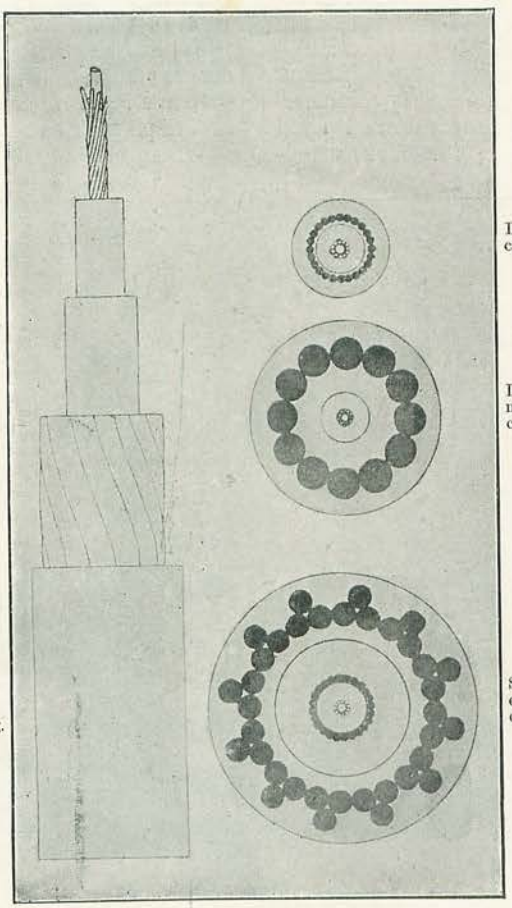
But, alas! there are many things that even a millionaire cannot buy, among these being the *Faraday*. However, Jay Gould, restraining his acquisitive ardour, cabled—

"Make and lay two cables. £50,000 deposited at your bankers."

The cables were promptly made and laid.

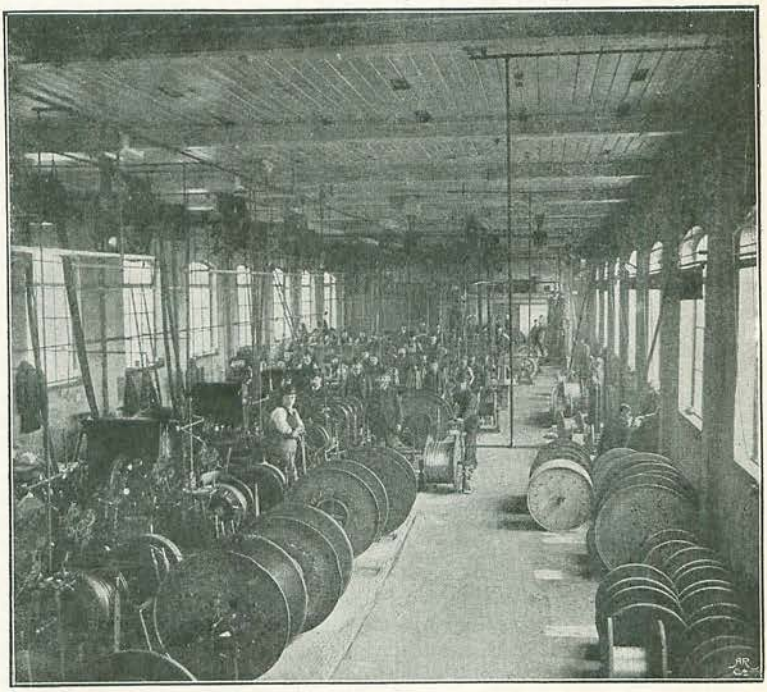
Immediately on receiving the purchaser's order the contractors prepare for mutual signature a printed agreement minutely specifying, among many other things, the price, length, weight, quality, landing-places, ocean routes and date of completion of the proposed cables. All preliminary arrangements having been completed, the scene of this interesting commercial drama changes from Westminster to Woolwich.

Messrs. Siemens' headquarters are at 12 Queen Anne's Gate—an old-world mansion with long passages, lofty, domed recesses and spacious apartments, many of which, overlooking the sylvan, verdant expanse of St. James's Park, seem far removed from the storm and stress of our feverish London life. In striking contrast are their Woolwich works, consisting of a long line of brick buildings of varying heights and severe aspect, dominated by an immense chimney-shaft, whose smoke intensifies the hazy atmosphere so characteristic of these riparian regions. A dreary expanse of waste land, bordered by humble cottages, faces the works. On the other side flows the turgid Thames, with its long lines of dingy wharves and malodorous factories, and its constant stream of bustling river traffic.



Accompanied by Messrs. Siemens' representative, who kindly pilots me through this industrial labyrinth, I sign the visitors' book, which contains the autographs of many distinguished people. The establishment covers eight acres and often employs a staff of three thousand men—submarine cable-making being only one of the numerous electrical enterprises conducted here. The works are intersected by avenues and streets like a small town. I observe a light railway, an electric tramway; telephonic, fire-alarm and electric-light wires run above and under ground. On every hand are immense buildings filled with

ponderous engines, steam-hammers, cranes and every description of machinery. The air literally throbs with the nervous vibrations of an endless series of whirring wheels and bobbins, revolving shafts and flashing belts, all driven by tiny motors supplied with electric current from a central station. There are smithies with glowing forges, huge storehouses, testing-rooms with a bright array of shining instruments, vast show-rooms, general offices with an army of busy clerks, carpenters' shops, timber-yards, piles of wire, big boilers, colossal, red-faced, rotund buoys, and a thousand other objects bewildering in their diversity. The greatest activity reigns everywhere; vigilant overseers supervise both men and machinery, for here accidents positively must not happen! This scene of disciplined industrial activity causes me to reflect on the talent amounting to genius required to organise and control from Westminster this dual mechanical and human force and extract therefrom such admirable results. Every man seems to fit into his place as perfectly as the cog-wheels fit into the machinery. In fact, men and machinery almost seem to form but one, so homogeneous is their joint action.



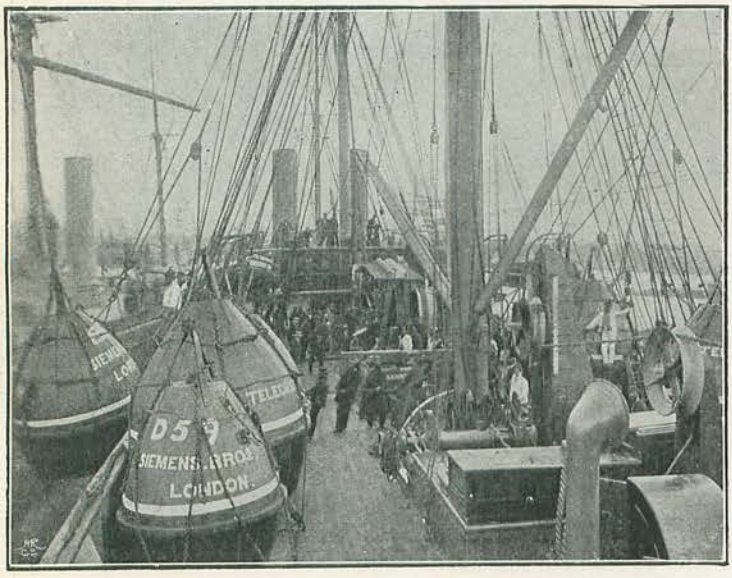
WIRE-STRANDING MACHINERY.

After this general survey we enter the cable factory, our first visit being to the storehouses, containing enormous stocks of material. For instance, the latest "commercial" Atlantic cable made here was 2201 knots long and absorbed—copper wire, 495 tons; gutta-percha, 315 tons; jute yarn, 575 tons; steel wire, 3000 tons; compound and tar, 1075 tons; total, 5460 tons. This cable was ordered, made, laid and worked within seven months. Ten machines, working night and day, averaged 55 knots of cable every twenty-four hours. And this is not the first time such a feat has been performed by Messrs. Siemens, who have twenty years' experience, a staff of electrical, mechanical and nautical experts, and extensive works equipped with the latest apparatus and machinery known to science—invented, in many cases, by members of the firm. Otherwise it could not be done.

For laying near the coast in shallow water, where the cable is buffeted by the waves and chafes on the rocks, it is made heavy, thick and strong. For the depths of mid-ocean it is of lighter make, lesser depths necessitating a suitable intermediate size. These three types are known as "shore end," "deep sea," and "intermediate." In each case the core, hereafter described, is uniform throughout.

All material is carefully tested before use, so that the operations of testing and verification equal the sum of actual work performed. Each coil of wire is tested as to its weight, size and purity. Compound, gutta-percha, india-rubber must be purified and otherwise manipulated before use. Every knot of cable is tested twice: first by the contractors' electricians, then by those representing the purchasing company. An Atlantic cable contains about 1300 joints, each one being carefully tested, numbered, labelled and registered. Every operation, simple or complex, is so carefully checked that a flaw becomes a practical impossibility. Hence the enviable reputation enjoyed by the firm.

The initial process in cable-making is the stranding of the twelve copper wires composing the conductor. This is effected by an ingenious arrangement of revolving discs with bobbins of copper wire, which act like gigantic spinning-jennies. The wires thus stranded are covered with a thin layer of compound, to ensure the perfect adhesion of the gutta-percha which is then applied. When this is cold the core is wound on drums, taken to the tank-houses, submerged in water and tested electrically to make certain that the gutta-percha covering is flawless. As a fault in a core may ruin a cable, this test is obviously of paramount importance. In order to test its capacity for resisting the enormous pressure of the water when submerged, the cable is now subjected to hydraulic pressure averaging four tons to the square inch. Then the embryo cable is transferred to the cable shop, where it is covered with yarn, laid on helically by a process similar to that used for stranding the wires. The short lengths are now jointed and tested, and form one long cable. This is transferred to the principal machine shop — the home of "Jumbo," probably the largest cable-spinning machine extant, by which sixty-four sheathing wires can be simultaneously applied. Many similar but smaller machines occupy adjacent positions. The manner in which the wires are manipulated and securely wound round the cable is as ingenious as it is striking. The cable passes through the hollow axle of an immense circular frame carrying bobbins filled with steel wire. This frame, rapidly revolving, lays the wires round the cable, the jute yarn acting as a buffer between the gutta-percha and the heavy wire. The same machine applies a layer of compound, followed by one of jute. Then come a second layer of compound and a second layer of jute, the latter being applied in the reverse direction to the first. The application of a third layer of compound completes the cable. It is then coiled away in immense circular tanks filled with water, and is regularly tested until it reaches its final resting-place beneath the waters. Accidents apart, it should last sixty years or more.



CABLE MACHINERY ON THE "FARADAY."

During shipment the *Faraday* is moored near the works, and the cable travels from tanks to ship over guide-pulleys mounted on tall floating frames. In the ship's tanks are men who carefully arrange the cable in coils, whitewash being used to prevent these sticking. Very curious is this scene: the immense sea-serpent gliding into the tank with a wriggling, ceaseless motion; the shadowy tank; the ghostly forms of the men, looking like uncanny witches muttering dark incantations and performing mysterious rites inside a colossal caldron.

The *Faraday* was designed by Sir William Siemens, who, dissatisfied with existing cable-ships, determined to design one himself. Although a novice in naval architecture, he evolved a ship pronounced by cable experts to be a model. About 5000 tons register, 360 feet long, and 36 feet deep, she is one of the two largest cable-ships afloat. Three enormous tanks, each capable of holding a fair-sized villa, accommodate 1700 knots of cable. They are so built as to add materially to her structural strength. She has such novel features as double bows and funnels *abreast*, manœuvres rapidly, and turns in her own length.

During an expedition she carries 180 men. The work is divided into three departments,

with separate chiefs and staffs, who, however, always work in perfect harmony. The cable-laying, picking-up, and other engineering operations are superintended by Mr. John Brittle, C.E., a cool, quiet, resourceful man, familiar with every phase of cable work. Captain Le Fanu, an experienced officer, navigates the ship; while the electrical department is controlled by Mr. Frank Jacob, an electrician of uncommon scientific attainments. The supreme command is generally assumed by Mr. Alexander Siemens, a past president of the Institution of Electrical Engineers, and a recognised authority on everything relating to submarine telegraphy.

The *Faraday* is a floating town rather than an ordinary ship. Her decks are crowded with machinery: paying-out and picking-up gear, huge buoys, grapnels, chains, sounding apparatus, donkey-engines, cranes and derricks. Both bows are fitted with large projecting iron pulleys called "sheaves," which keep the cable clear of the ship during operations. These sheaves are enclosed in a railed gangway, which serves as a look-out station for officers and men. Throughout the ship are distributed smithies, carpenters' shop, electric-light house, ice-house, doctor's surgery, photographic studio, steward's store-rooms, butcher's shop, bake-house and an immense kitchen. Along the decks are penned the live stock—poultry, sheep, cattle, all tenderly nurtured by the butchers until the hour for slaughter arrives. A spacious testing-room is fitted with electrical apparatus of every description. Comfortable messing and sleeping accommodation is provided for each category of men. The saloons and state-rooms occupied by the chiefs and principal officers of the expedition are luxurious, and fitted with all the latest space-saving notions. Bath-rooms, buffet, and cosy writing-rooms complete the installation. Throughout the ship glows the electric light, which also provides powerful search-lights for night work. Strict discipline is maintained; every man has a defined duty, which he performs with cheerful alacrity. Well paid, well treated, having perfect confidence in their chiefs, all hands work with a pluck and enthusiasm which the most formidable obstacles cannot resist. The ship may be in a fog, a gale, surrounded by ice-bergs or rolling and pitching in a terrible manner, delicate electrical experiments, smart engineering and navigating feats are performed with as much precision and regularity as they could be in harbour.

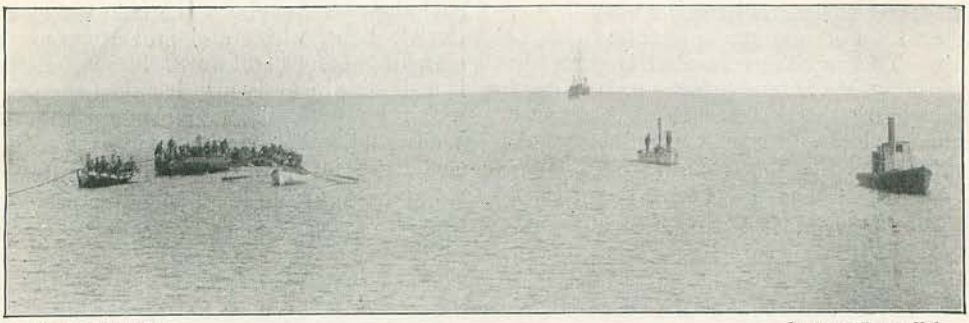
From a photo by] [*Angove, Canso, N.S.*

CARRYING THE CABLE ON SHORE.

In an Atlantic expedition the *Faraday* commences by laying about 150 miles of cable from the Irish coast westward. The landing of shore ends is an interesting operation, in which boats, buoys, rafts and steam-launches play a prominent part. In stormy weather exciting events sometimes occur. Near the shore, brawny cable hands jump into the water, resolutely seize the cable, and haul it by main strength along a trench into the cable hut. The ocean end is attached to an immense buoy, which

remains at the mercy of the waves whilst the ship crosses the "pond" to lay 400 knots from the Nova Scotian coast across the great banks of Newfoundland. Buoying this she returns to ship the deep-sea section—1650 miles.

The *Faraday's* departure creates considerable excitement. With her go the good wishes of thousands connected with Siemens'. The adjacent wharves are crowded with people, and as she slowly leaves her moorings hats and handkerchiefs are waved, and "Good-bye!" is shouted by mothers, sweethearts, wives, children. Responsive cries are heard from the ship. Finally the leviathan disappears; many sympathetic spectators retire to some tavern, there to honour the toast: *Bon voyage*.



From a photo by] [*Angove, Canso, N.S.*

HAULING THE CABLE TO SHORE.

On her second voyage the ship makes for the end buoyed off the Irish coast, "clearing for action" during her run down Channel. On arrival fog may prevail, but calculations by dead reckoning reveal the vicinity of the buoys. When fog prevents operations the ship lies to until it lifts. Then they pick up the buoys—an easy matter under favourable circumstances. But stormy weather sometimes causes cable and buoy to part company. The ocean bed must then be raked with a grapnel to recover the lost cable—an arduous task not exempt from risk and even danger.

If the buoy be found in position the sea may be rough or the ship rolling heavily, but a lifeboat manned by sturdy fellows wearing cork jackets is rapidly lowered. The tiny craft pitches and tosses on the angry, white-capped waves in a terrific manner. But these men, smart, plucky, gallantly pull for the dancing buoy. Watching their opportunity they attach thereto a steadying rope, one of them springs on the buoy with simian agility; attaching strong ropes, he hops back into the boat—sometimes into the sea—and both buoy and cable are hauled on board. The boat with its drenched crew returns to the ship; the two ends of the cable are tested and spliced, the *Faraday's* prow pointed westward, paying out commences. Night and day watches are organised in every department; every man is at his post; wonderful animation reigns everywhere. The ship forges ahead at seven knots an hour; the cable shoots up from the tank. Gliding over certain pulleys it winds around a swiftly-revolving drum, fitted with weighted breaks destined to control and check the speed of paying out. Then diving under the wheel of a dynamometer, which indicates the strain on the cable, it passes over the stern sheaves, dips into the sea, and finally disappears. Cable-laying necessitates constant attention, resourcefulness, engineering skill, and familiarity with the ocean bed. A cable laid too slack causes waste and sometimes dangerous "kinks"; if too tight it remains suspended between the peaks of submarine mountains, exposed to fracture by its own weight.

From a photo by] [*Angove, Canso, N.S.*

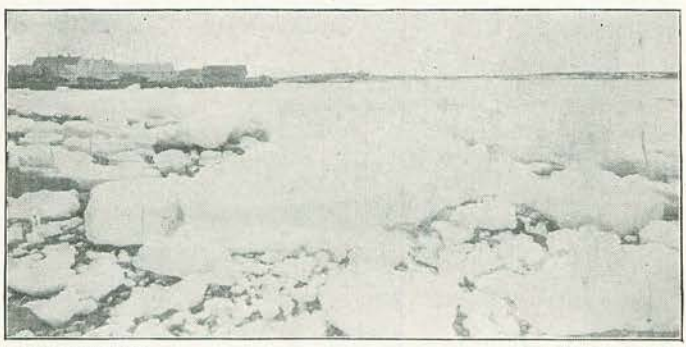
LANDING THE CABLE.

In the tanks are stationed men to facilitate the cable's exit and prevent accidents. On deck, whatever the weather, the contractors' and purchasing company's engineers supervise all operations, minutely recording everything that transpires for future reference. The electricians are equally vigilant, testing and recording all results. The navigating and engine-room staffs are on the alert. During the night work continues by electric light. A brilliant cresset at the mast-head announces to passing ships that a cable steamer is at work.

Occasionally some mishap occurs. An excited electrician rushes out of the testing-room shouting, "Stop her!"—communication with the shore has ceased. The telegraph-bell clangs, the engines cease to throb, the breaks arrest the drum, the cable is secured. The leviathan drifts like a log on the ocean. Very impressive is this sudden stillness succeeding the previous uproar. The chiefs immediately assemble; the cable is tested. Sometimes it is a false alarm; at others a slight fault is discovered. According to circumstances, the faulty portion of the cable is hauled back on board and repaired, or the end is buoyed and the ship steams back to pick up and repair the damaged section. The buoyed cable is then recovered and operations are resumed. But such accidents are rare; the work generally runs on smoothly, even in stormy weather. Day by day the cable is laid over hill and valley, gorge and crevice, and along immense undulating table-lands. The depths vary, according to the configuration of the ocean bed, from 300 feet to 3½ miles.

During the entire expedition the electricians, maintaining constant communication with the shore, are kept informed of passing events. The birth of Prince Edward of York was thus communicated. Mr. Alexander Siemens flashed congratulations, and the Duke of York sent a gracious response to this unique message from the sea.

Finally, about the tenth day out, the ship reaches the vicinity of the buoyed end. In these latitudes fogs and icebergs are frequently encountered. The cable is cut and buoyed, and the ship lies to until the fog disappears, when the buoys are sought for and picked up. To the shore end is spliced sufficient cable to meet the ocean end, which is brought on board and tested. Then the final splice is made—a critical operation. Amid wild excitement the retaining ropes are severed by mighty axes, and the cable gently drops into the sea. After being tested from shore to shore, congratulatory messages circulate; the *Faraday* returns home. But the expedition is not *quite* finished; for thirty days the contractors are responsible for the cable. Should it break even at the twenty-third hour of the thirtieth day they must repair it at their own expense. With what anxious care are the final tests taken! If quite satisfied, the purchasing company's representative informs his chief: "Cable perfect." It is then officially accepted from the contractors.



From a photo by] [*Angove, Canso, N.S.*

ICEBERGS IN CANSO HARBOUR.

The expedition usually terminates with a banquet given by the firm; congratulatory speeches and sparkling champagne kindle professional enthusiasm and promote general gaiety. The chief thanks one and all for their hearty co-operation, reminiscences are exchanged, toasts are duly honoured. These festivities efface the souvenir of the dangers and hardships encountered whilst battling with the elements in "the roaring forties."