Correspondence.

Calming the Waves with Oil.

To the Editor of the Scientific American:

In looking over some odd volumes of the *Penny Magazine,* an old London weekly, I came across a paragraph "On the effect of oil in stilling waves." This article is contained in the issue of May 28, 1842, a testimony of Sir Gilfred Lawson, "who served in the British army at the defense of Gibraltar. He relates that the fishermen of Gibraltar were accustomed to pour a little oil on the sea, in order to still its motions, that they might be enabled to see the oysters lying at its bottom; Sir Gilfred had often seen this done." . . . "Dr. Franklin was informed that many of the divers on the coast of Italy were accustomed to take a little oil in their mouths before they dived; when they had descended to a certain depth they allowed the escape of the oil, which, rising to the surface by virtue of its lightness, spread in a thin film, which smoothed the water rippies and allowed light to descend to a considerable depth. The fishermen of Lisbon, when about to return into the river, if they saw before them too great a surf upon the bar, were accustomed to empty a bottle or two of oil into the sea, to still the breakers."

Franklin thus narrates: "In 1757, being at sea in a fleet of ninety-six sail, bound against Louisbourg, I observed the wakes of two of the ships to be remarkably smooth, while all the others were ruffled by the wind, which blew fresh. Being puzzled with the differing appearance, I at last pointed it out to our captain, and asked him the meaning of it. 'The cooks,' said he, 'have, I suppose, been just emptying their greasy water through the scuppers, which has greased the sides of those ships a little!' and this answer he gave me with an air of some little contempt, as to a person ignorant of what everybody knew. In my own mind I at first slighted this solution, though I was not able to think of another."

Franklin did not drop this subject, but conversed with "maritime men" on the matter, and found that most of them knew of it. He made some experiments on Clapham pond, but found that if applied upon the leeward side of the pond, where the waves were largest, the oil was driven upon the shore. But on dropping a teaspoonful of oil on the windward side, it produced a "sudden calm over a space of several yards," until it gradually made the pond of perhaps half an acre, "as smooth as looking glass." He explains it thus: "I imagine that the wind blowing over water thus covered with a film of oil cannot easily *catch* upon it, so as to raise the first wrinkles, but slides over it, and leaves it smooth as it finds it. It moves a little the oil, indeed, which, being between it and the water, serves it to slide with and prevents friction."

A. L. R.

Fort Wayne, April 2, 1884.

Substitutes for India Rubber and Gutta Percha.

The Swiss *Gewerbe-blatt* thus discusses the subject of a substitute for India rubber. In the first place, such a substitute must be cheaper than real India rubber. There are many kinds of material that fulfill this requirement. Sulphur is one of the things that is unattacked by acids, alkalies, and salts. Its great brittleness gives place to a softness, pliability, and elasticity similar to rubber if it is poured into cold water while melted. (It melts twice at different temperatures, and it is only after this second melting that it possesses this elasticity.) It remains soft enough to be moulded for several days, and these qualities it retains permanently if it is mixed with more or less linseed oil varnish before it is poured into water.

There is no doubt that sulphur is of importance in making artificial substitutes for India rubber, and no less so as a substitute for gutta percha. The first thing is to endeavor to discover some permanently elastic substance which shall destroy that crystalline structure which makes the sulphur brittle, and render it impossible for it to return to this condition.

Next after sulphur, alumina soap deserves consideration, for it is likewise a tenacious substance that can be stretched, and it undergoes many curious changes when melted with thick linseed varnish and resin. Zingler has, in fact, patented a composition of sulphur, copal, oil of turpentine, and albumen.

Although substitutes for gutta percha may be obtained with the aid of some of these substances, it will always be difficult to imitate the elasticity of India rubber, so that its substitutes will find use only where its elastic property does not come into prominence.—*Poly. Notizblatt.*

Artesian Wells on the New Jersey Coast.

Dr. George H. Cook, the New Jersey State Geologist, describes the successful opening of artesian wells, 400 feet deep, at Ocean Grove and Asbury Park last summer, and says the character of the sand and marl found in the boring is so well marked that it may be reasonably expected to yield water for the supply of all the towns and villages on the sea coast. The water is absolutely free from contamination with organic matters, and is soft enough for laundry purposes. The well at Ocean Grove is a flowing well, yielding 60,000 to 70,000 gallons daily; it is lined with six inch iron tube for 50 feet, the bore lower down not being tubed. The water has a temperature of 60° F., and contains 8·5 cubic inches of carbonic acid per gallon.

Siphonage of Traps by Capillary Attraction.

A correspondent of the *Hydraulic Plumber,* of New York, relates a story of his employment, some time ago, to investigate the causes of a foul smell in a certain bath room, where other plumbers had worked before him in vain. The pipes had been swabbed out; the closet, an old-fashioned pan apparatus, had been burned out, and disinfectants applied in vain. The wastes of bath and wash basin, according to the old practice, entered the water closet trap, but no sign of leakage could be discovered about this or the waste pipes. The new plumber, not knowing what else to look for, removed the closet and filled the trap with water. As soon as the agitation had ceased, he measured the depth of the water, and then left it to itself for twenty minutes. At the end of that time the water level had fallen half an inch. Twenty minutes later it had fallen still more, and in an hour the seal was so far broken as to allow a slight current of sewer air to enter the room. The plumber then left the room for two hours, locking the door and taking the key with him. When he returned the place was full of foul air, and on passing his hand under the bend of the trap he found a space of about an inch and a quarter between the surface of the water and the under side of the bend of the trap.

The next step was to cut away the crown of the trap, so as to expose the upper portion of the bend. An opening was made, 4 inches long and 3½ inches wide, but examination through this showed nothing out of the way until the trap was refilled, when a wet line was observed over the bend, which proved to follow the course of some hairs, twelve or fifteen in all, which had been caught, together with some lint and ravelings, in the slimy lining of the bend. By detaching the lower part of this collection from the walls, allowing it to hang down free in the outlet pipe, the water was observed to drip from the end at the rate of 70 or 80 drops a minute. The whole was then cleared away and the closet replaced, and no more trouble was experienced.

The plumber in question then made some very interesting experiments, to ascertain the amount of conducting substance necessary to cause the emptying of traps in this way, using a small beaker glass in place of a lead trap. He found that with five pieces of No. 80 spool cotton, about 7 inches long, hung over the edge of the beaker, the water level was lowered 3 inches in nineteen hours, and ½ inch in about fifteen minutes. With five long hairs the lowering amounted to 1 inch in ten hours, and 3 inches in about a day and a half. With five hairs and two threads, of the same size as before, the lowering in seven and one-half hours was 1½ inches. One piece of cotton twine lowered the water ¾ of an inch in four and one-half hours. Two pieces of twine drew over 1 inch of water in two hours, and 2 inches in less than four hours. A bit of cotton cloth, half an inch wide, siphoned over ¾ of an inch of water in an hour and a quarter. There was apparently no difference in the action, whether the threads were submerged or floated on the surface of the water.

In the sunshine the drying of the absorbent material was so rapid as sometimes to stop the capillary action, but in the shade it went on steadily, even when the beaker was placed in a strong current of warm air. As nothing is of more common occurrence in drain pipes than lint or hair, it seems likely that this observation will explain many cases of offensive odors in bath rooms and bed rooms not otherwise to be accounted for.

Siemens, Bessemer, and the German Patent System.

It is related that the late Sir William Siemens, who was born and educated in Germany, but made England his home after his twenty-fourth year, was principally moved to change his residence from the greater security afforded inventors by the English patent law. The English patent law was not then (1844) as liberal as it now is, but the advantages thereunder were greatly superior to those afforded in Germany, where great inventions had been often refused any protection, while inventors of small mechanical improvements were allowed patents for only a short period.

The early German policy was well illustrated in the manner of treating the Bessemer process. Before Sir Henry had taken the preliminary steps to obtain his German patent, Herr Krupp had entered into negotiations therefor, and agreed to pay £5,000 for the use of the invention. The inventor accordingly sent all his papers to Krupp, who in due course applied to the Prussian Government for a patent, and was told the invention was not a new one, but that Mr. Nasmyth had made the invention previously. Mr. Nasmyth denied this, and the Prussian officials of patents then said some one else had made the invention, and they would find out in a few days who it was. This excuse continued to be made during six weeks, during which the Commissioners promised from day to day to find a previous inventor, when they finally told Krupp: "If we do not find it to-morrow, we will grant your patent." This answer was then again repeated until a week of to-morrows had passed, when, as Krupp called the last time, he was shown an English blue book, containing the publication of the English patent, and the Commissioners said: "Now, seeing it is a publication in Prussia, we cannot grant you a patent by the law of Prussia." Of course, after this answer Herr Krupp had the use of the invention without any legal obligation to make any payment to the inventor.

The Old Trade Guilds in Germany.

The late Sir William Siemens, who was born in Hanover in 1823, and received his early education at Lubeck, has thus described the manner of "learning a trade" at that time in vogue:

"When a boy at school," he says, "I was living under the full vigor of the old guild system. In going through the streets of Lubeck I saw Carpenters' Arms, Tailors' Arms, Goldsmiths' Arms, and Blacksmiths' Arms. These were lodging houses where every journeyman belonging to that trade or craft had to stop if came into the town. In commencing his career, he had to be bound as an apprentice for three or four years; and the master, in taking an apprentice, had to enter into an engagement to teach him the art and mystery, which meant the science of his trade. Before the young man could leave his state of apprenticeship he had to pass a certain examination; he had to produce his *Gesellen-stück,* or journeyman piece of work, and if that was found satisfactory he was pronounced a journeyman. He had then to travel for four years from place to place, not being allowed to remain for longer than four months under any one master; he had to go from city to city, and thus pick up knowledge in the best way that could have been devised in those days. Then, after he had completed his time of travel, on coming back to his native city, he could not settle as a master in his trade until he had produced his *Meister-stück,* or master-piece. These master-pieces in the trade were frequently works of art in every sense of the word. They were, in blacksmithy, for instance, the most splendid pieces of armory; in every trade, and in clocks above all others, great skill was displayed in their production. These were examined by the Guild Masters' Committee, and upon approval were exposed at the Armsof the Trade for a certain time, after which the journeyman was pronounced a master; he was then allowed to marry, provided he had made choice of a young woman of unimpeachable character. These rules would hardly suit the taste of the present day, but still there was a great deal of good in those old guild practices." This system was abolished in Germany in 1869, but the stimulus it afforded to excellence of workmanship appeared to have made an early and lasting impression on his mind.

Rusting of Iron and Steel.

M. Gruner has lately published in *La Metallurgie,* the results of a year's researches into the comparative oxidizability of cast iron, steel, and soft iron, under the influences of moist air, sea water, and acidulated water. Having done justice to the earlier labors of Mr. Robert Mallet, of Dublin, and Messrs. Phillips and Parker, of London, he explains the arrangements made to secure a perfectly fair trial. The following results were obtained. The experiments with moist air are still proceeding; but so far, it was found that in twenty days the steel plates lost from 3 gram. to 4 gram. for every two square decimeters of surface. Chrome steel rusted more, and tungstated steel less, than the ordinary carbureted steel. Cast iron lost only about half as much as the steel, and spiegeleisen less than gray iron. Sea water dissolves iron rapidly, and acts upon it more powerfully than on steel, most powerfully of all upon spiegeleisen. In nine days the steel plates with 2 square decimeters of surface lost from 1 gram. to 2 gram., while the Bessemer metal lost 3·5 gram., phosphorized iron 5 gram., and spiegeleisen 7 gram. Tempered steel was less affected than the same steel twice annealed, soft steel less than chrome steel, and tungstated steel less than the ordinary steel with the same proportion of carbon. It is evident from these experiments that manganese sheets ought not to be used on the hull of a vessel. Acidulated water dissolves cast iron much more rapidly than steel but not spiegeleisen.

A New Fire Tank.

Several large fires in the lower part of New York city have demonstrated that the supply of water from the hydrants is insufficient for the purpose. To overcome this evil one of the Fire Commissioners has invented an apparatus which seems to be well adapted to its work, where circumstances require and conditions permit its use. The device consists of a large tank, mounted on wheels, which is supplied with water pumped from fireboats situated in the river. In the trial the tank was placed a mile away from the boat, and the two were connected by hose. The pumps of the fireboat threw water into the tank without trouble, and the fire engines drew from the tank as successfully as from a hydrant.

The Patent Bills Analyzed by "Puck."

"The Register" in *Puck* dissects the patent bills now before Congress, and draws the following apt conclusions and illustrations: "If these bills go through, the next edition of Webster's Dictionary ought to define 'Legislation' as 'robbery by representatives.' Suppose a bill were introduced to shorten the term of all railroad company charters to five years—a melodious outcry there would be, wouldn't there? But rob the inventor of a patent car wheel of twelve years' profit on his invention, and you find only six men in the House of Representatives to see the iniquity of the proceeding—six out of one hundred and twenty voting. Truly, the age of pure reason has not dawned yet; and there is not so vast a distance between prehistoric man and the dude as the dude's shirt collar would imply."

Borax Lake.

In speaking, recently, of boracic acid and its possible sources of origin, we mentioned the Sulphur Bank on the northern side of Clear Lake, in California. South of this, at a distance of less than a mile, is another spot which displays an immense outpouring of boracic acid, though here the emission has been only in times long past, and the acid has all entered into combination with soda, as the name above given indicates.

Borax Lake is very insignificant in its appearance, but fifteen years ago it completely revolutionized the borax trade of the United States, though of that we do not propose to speak to-day. It seems absurd to give the title of lake to it, for it is only a large pool of shallow water, with muddy shores and bottom, and without either inlet or outlet. The length of this oval "mud hole" varies with the season. At the close of the dry season the water has sometimes, though not commonly, entirely evaporated, leaving only a space of mud incrusted with salts, while after an extremely wet season the water is five or six feet deep in the middle, with a length of a mile and a half. This water, even in its most diluted condition, is intensely alkaline, its strength, of course, increasing with the progress of the summer's evaporation.

It is separated from the Sulphur Bank by a ridge somewhat over six hundred feet in height, and the two localities have apparently no relations, the one with the other. The ridge is composed of volcanic materials, scoriæ, obsidian, pumice, etc., and is continued in horseshoe form around three sides of the lake, leaving the southeastern end open.

There is no evidence of a crater having ever existed here, and yet the water plainly occupies a cup-like cavity of unknown depth, for the bottom is filled with an exceedingly smooth and plastic mud, which has been bored to the extent of thirty feet without reaching its lower limit or finding any change in its character, and explorations show that it steadily deepens from the shore toward the center. When the depth of the water is four feet, which may be reckoned a fair average, and which gives a length of about three-quarters of a mile, it holds in solution 18·75 grains of salts to the fluid ounce. These are salts of soda, in the following proportions: Sod. carbon., 0·618; sod. chlorid., 0·204; sod. bibor., 0·178. Each gallon of the water, therefore, holds about a quarter of a pound of borax.

This amount, however, is of small consequence in comparison with that which lies in crystals below in the mud. The change from water to mud is very gradual, the upper portion being semi-fluid. In this part no crystals are to be found. At the depth of perhaps a foot, when it has acquired sufficient consistency to be called liquid mud, the fingers in rubbing it can detect what feels like very fine "grit." This, when washed clean, shows under the microscope, of course, its true nature, and every particle is seen to be a most exquisitely beautiful crystal of pure borax. Going still deeper, the "grit" becomes "sand," for the crystals have become larger and are manifest to the eye, without assistance. As the mud becomes firmer the crystals become larger, being at the depth of two feet a quarter to half an inch long.

At the depth of three to four feet the mud suddenly changes its character. Above this it has been of a grayish-brown, some of it inclining to reddish, which ceases abruptly, being replaced by a firm, tenacious blue clay, the plane of distinction being as sharply marked as that of a course of brick upon stone. In this upper mud the crystals had been gradually increasing in size as the depth increased, until in its lower part they were from an inch and a half to two inches long. Every crystal was distinct and perfect in itself, and—a most wonderful feature—though often lying in contact, they were not adherent.

This last item is very difficult of explanation. We have in unnumbered instances seen them as the mud was removed lying in "layers" or "pockets," from one to ten pounds of separate crystals of the borax lying in one mass, as clean and free from mud as though they had been washed, and as loose and distinct as pebbles on a beach. Each crystal had its own existence. These "layers" were never uniform, and were scattered without apparent order, the adjacent mud often showing no crystals whatever.

When the "blue clay" is reached all this ceases, and crystals of a new style commence. Each one lies by itself, in a firm matrix, from which it can be picked out like a bullet from its mould. They have an individual appearance *sui generis*, so that it is easy to distinguish even the smallest of them from the largest of those in the mud above. But their chief feature is their size. We have taken out many of them which weighed more than a pound each, and a "blue clay" crystal of less than a quarter of a pound seldom occurs. But they cease about as abruptly as they commence, for they are confined absolutely to the upper two feet in thickness of the clay. Abundant examinations have shown that below that no crystals of any sort exist. The mud however continues to be of the same look and quality to the greatest depth reached (thirty feet), and though showing no crystals it holds everywhere a uniform amount of the salts of soda, being sixteen per cent. of its entire weight when dried. The proportions vary somewhat from those of the water above: Sod. carbon, 0·554; sod. chlorid., 0·164; sod. bibor., 0·282. We will show at another time the manner of obtaining the crystals. It was done in sections of four feet square, and we have often seen 900 pounds taken from that extent of the mud; and from the imperfection of the manipulation a large amount, certainly not less than a hundred pounds, escaped back into the lake.

We pass all other points at the present time, barely to consider the enormous quantity of boracic acid which we have here represented. Taking the data just given, the borax held in the water, the tangible crystals down to their lower limit in the upper part of the "blue clay," and the amount contained in the clay below that down only to the distance of which we have knowledge, it is perfectly safe to say that Borax Lake held, and holds now, not less than 9,400,000 pounds of borax to the acre of surface. The ground so rich in crystals does not extend over all the area, but at least twenty-five acres (and this is far within the reality) will come up to our estimate, and we have thus clearly over 200,000,000 pounds there existing.

The mode of its formation we will see later, but whence could this boracic acid have come? Here is a cavity like a crater, though its volcano is not apparent. Admit that the cup was filled with mud rich in soda and that jets of boracic acid were injected below. The space occupied by the jets was manifestly quite restricted, for the acid did not in its full force reach laterally even to the crater's border, and yet they came strong enough and long enough to combine with the soda to the amount we have given. But the *amount* of work done is the least surprising part, as we will see.

The Walled Lakes of Iowa.

The questions whether the so-called "walled lakes of Iowa" are the work of some extinct race or are natural formations, have periodically appeared for discussion. In his "Geology of Iowa," Prof. Charles A. White presents as a theory that in the shallow portions of the lakes the ice along the shores freezes fast to everything upon the bottom, whether sand, gravel, bowlders, or mud, and the expansive power of the water in freezing is exerted upon them, acting from the center of the lake in all directions toward its circumference. By this means whatever substances are frozen into the ice are pushed up upon the shores as far as the expansive force is exerted, and there left as the ice melts in the spring. By this means embankments have been formed, varying from 2 to 10 feet in width and from 5 to 20 or 30 feet across. The ice, during long ages, has brought these materials together in this manner, having in some instances moved large bowlders and piled them up with other materials.

In corroboration of this, a writer in the *Sun* states that he has "seen the ice piled up on the shores of Walled Lake, in Wright County, pushed up along these embankments, and containing earthy materials of which the walls are made. Occasionally these walls were found along the old margin of some dried-up prairie slough, proving the existence of an open shallow lake in some time past."

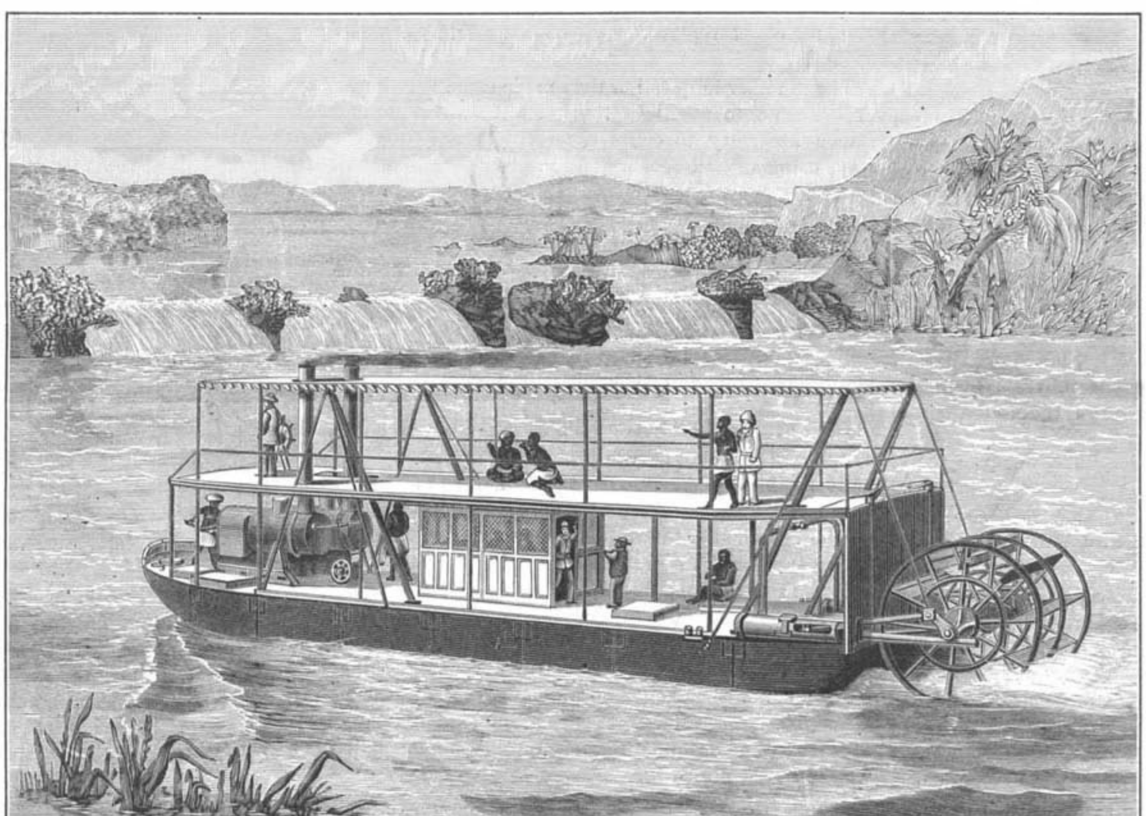
American Car Wheels.

"There are more than 10,000,000 iron car wheels in use on American railroads," said the master mechanic of one of the trunk lines, "and it requires about 525 pounds of pig iron to make one wheel. About 1,250,000 wheels are worn out every year, and the same number of new ones must be made to take their places. The iron men are called upon for only a small proportion of the 312,500 tons of material required for these new wheels, however, for nearly 290,000 tons are supplied by the worn out wheels themselves. Formerly, the life of a car wheel was estimated at eight years, but the reduction of the railroads generally to the standard gauge, and the improvements in loading and unloading facilities, have materially decreased the length of service that a wheel may be depended on to perform. The uniformity in gauge keeps cars in more continuous use, while the decrease in time of loading and unloading enables them to be put to more active service even where they are run only on short local routes.

"These figures do not include the wheels on palace coaches and the better class of passenger coaches. The wheels on that grade of rolling stock are for the most part what are known as paper wheels. That is, the wheel is made with steel rim or flange and iron center or hub, but the filling or web between hub and rim is composed of sheets of paper cemented together. They are as serviceable as the wheels of solid iron, and combine lightness with strength—a great desideratum where speed and economy in motive power are of paramount importance."

THE SECTIONAL STEAMER LE STANLEY.

A river run was lately made in the Thames with a small vessel of peculiar construction, and for a purpose which may some day single it out as one of the steamers with an epoch-making history. Le Stanley is the name given to this small steamer, in honor of the celebrated African explorer. She has been built near London, under the inspection of Monsieur Delcourt, Chief Engineer of the Belgian Government, for L'Association Internationale, of Brussels, of which the King of the Belgians is the head. It is an association having for its object the opening up to commerce and civilization of the unknown regions of Africa, said to be wholly without political aim, and what it is doing must therefore be looked upon as for the universal good. Mr. Stanley, who is engaged establishing numerous stations, is the head of the expedition in Africa; the little steamer is to assist him in his operations, especially in the district of the Congo and its tributaries; and some idea of the magnitude of an expedition of this kind may be formed when it is stated that no less than 500 natives have already been engaged to accompany the steamer and assist in its transport overland. About the middle of last year the Belgian authorities placed themselves in communication with Messrs. Yarrow & Co., with a view to build a thoroughly serviceable steamer of exceptionally shallow draught and able to steam in places where there is not water sufficient for vessels constructed in the usual way. The main point, however, was to design something that could be easily transported overland, so as to pass by and avoid the numerous rapids and cataracts which render navigation impossible. With these requirements before them Messrs. Yarrow & Co. have constructed the present steamer; it consists of six galvanized steel square-shaped pontoons, 18 feet long by 8½ feet wide by 4 feet deep; these sections, each of which is watertight and therefore floatable, are placed side by side; to these are added a bow piece and a stern piece, making together a hull 70 feet long by 18 feet beam. By means which we shall describe at more length at another time these sections can be readily united and disunited, and this can be done afloat. On the bow division are placed two boilers, and on the stern division the engines, which are designed for a working pressure of 140 pounds per square inch, and have cylinders 10½ inches in diameter by 2½ feet stroke, which, by means of a crank on each side, drive a paddlewheel situated aft, well clear of the stern. The engines are each made up on a steel tube as a frame. The strain due to these weights being concentrated at the extreme ends of the boat is taken by a system of light steel tie rods above, secured to tubular king posts; the effect of this system is at all times to throw a compression on the hull, thereby tending to keep the various sections together in close contact and free from alternating strains. Above the vessel, and completely covering it, is a wooden awning deck, which in an African climate is very necessary to protect the passengers and crew from the sun. The boilers are made with very capacious grates, and



STERN WHEEL SECTIONAL STEAMBOAT, LE STANLEY FOR AFRICA.