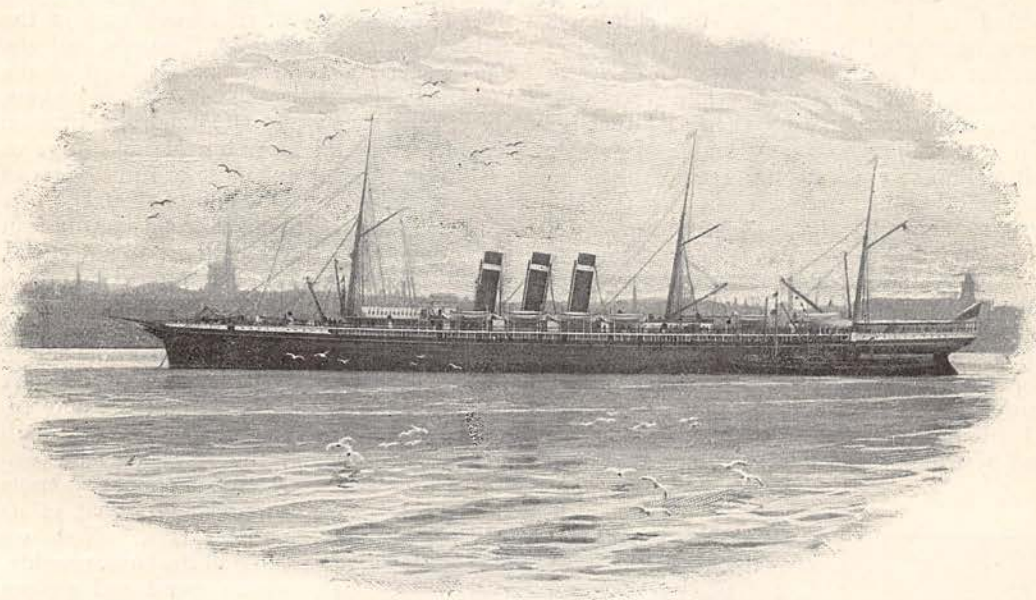
THE ATLANTIC GREYHOUND OF THE FUTURE.

BY J. H. BILES, DESIGNER OF THE *PARIS* AND THE *NEW YORK*.

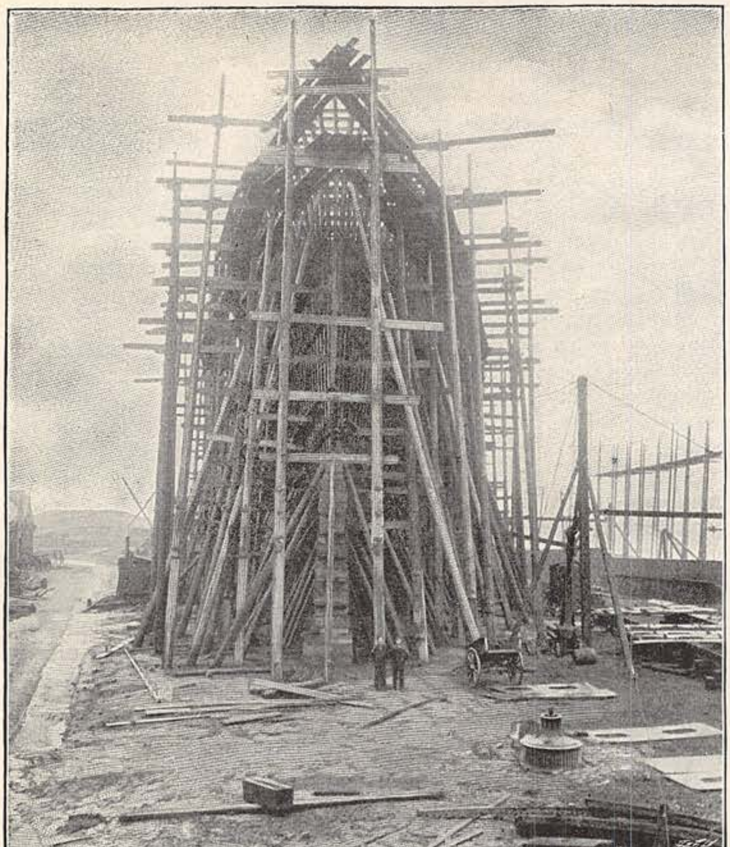


SS. *PARIS*.
(From a photograph by Frith & Co., Reigate.)

WE are always looking to the future and trying to see what it is to bring us. It may be the near future, or it may be the far-away one, but the future is ever in our thoughts. Now, I have to look into the future to see what kind of Atlantic greyhound, as the modern Atlantic liner is called, it is likely to bring us. Suppose that you had heard that a new continent had been discovered, in which there were people who had in their own way, and in a different way from ours, made ships and trains and all manner of wonderful inventions. And suppose that someone told us that one of their ships was coming to see us, but had told us nothing about what kind of ship it was, or of what material it was constructed, or how it was propelled. Now, what would you think of me if I offered to describe that ship to you before I had seen it? I don't want to hear your answer, for I am afraid it would not be pleasant; but this is the task which the editor has set me. I can only draw on a limited imagination for information on this subject, and not on any storehouse of fact, but will try to avoid putting anything forward which is not possible.

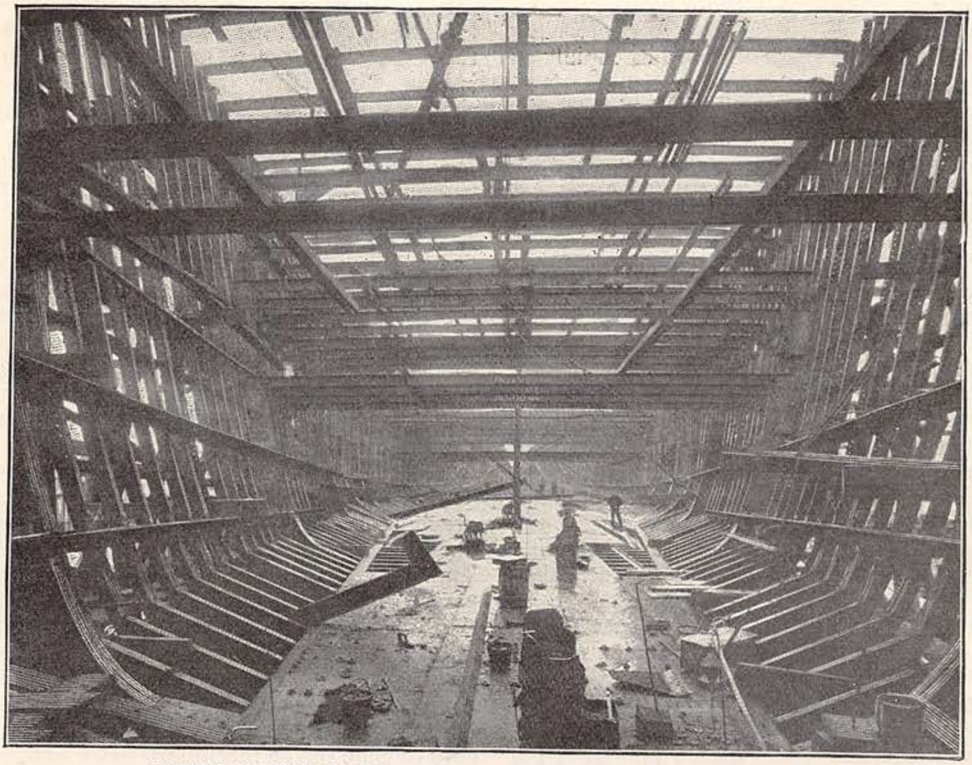
Before taking a leap into the dark future, let us look back a little to see the road upon which we have come. It is only in the lifetime of men now living that steamships have regularly crossed the Atlantic. By the word "regularly" I mean that the vessels did their work as a matter of regular routine work, and not as a mere toy boat would do it. These vessels at first travelled at a speed of eight or nine knots. Some of you may not be quite familiar with the meaning of the term "knot" as applied to speed of ships. In the days gone by, when a sailor wanted to find out how fast his ship was sailing or steaming, he took a reel of cord or line, to the end of which was attached a three-cornered flat board. This board was let go over the stern of the ship, and as there was nothing to pull the board through the water but the line on the reel, as soon as the reel was allowed to revolve, the speed at which the line ran off the reel was the speed of the ship, nearly. Now on this cord were knots so spaced that the number of knots which ran off the reel in a given time measured the speed of the ship. The given time was that required to run all the sand from one end of a glass to the other. It was called an hour-glass, but it ran itself out in much less than an hour. So when a sailor wanted to know how fast his ship was going, he started his log-reel and hour-glass together and counted the number of knots which ran off the reel while the sand was running out, and he then said that his ship was sailing so many knots. In order that all knots should mean the same, the hour-glass and distances between knots on the line were so arranged that every knot ran off —corresponded to a speed of one nautical mile 6,080 feet—in that time. We now know what is meant by a speed of eight knots. It is a speed of eight times 6,080 feet per hour. This explanation is rather a long way from the subject of the Atlantic greyhound of the future.

I will not take you step by step along the road by which speed has been increased from 8 knots of the first liners to $21\frac{3}{4}$ of the present. At the beginning of the ten years, 1850-60, the Cunard Company had a ship of $11\frac{1}{2}$ knots. At the end of these ten years they had a 13-knot ship. At the end of the next ten years, 1870, the greyhound of the Atlantic was the *City of Brussels*, and she had a speed of $14\frac{1}{2}$ knots. The end of the next ten years leaves the *Arizona*, a 16-knot vessel in possession of the "shortest time on record," and the next ten years brings us within the memory of most of the readers of this MAGAZINE. At the end of 1889, the *City of Paris*, now of the well-known American line, broke the record with a 20-knot speed, which she subsequently improved upon to nearly 21 knots. To-day the record is held by the Cunard steamships, *Campania* and *Lucania*, with a record of $21\frac{3}{4}$ knots speed. Thus we have in the successive decades, advances of $3\frac{1}{2}$, $1\frac{1}{2}$, $1\frac{1}{2}$, $1\frac{1}{2}$, and 4 knots respectively. We are half way through another decade, and the speed may be considered as about two knots in advance of that of its earlier days. Now we have all the facts, roughly, about speed, and we can all take our turn at prophesying, according to our fears or hopes, our whims or our wishes. If we take the average advance in speed over the last five completed decades we shall see that it is $2\frac{1}{2}$ knots per ten years. We have already got nearly all the $2\frac{1}{2}$ of the present decade in the *Campania*, so that viewing the matter in this way we have not much advance to look for before the century ends. But speed is not a thing that grows like a boy, so that we cannot measure its advance by the lapse of time only. Increase of speed generally means increased price of ships, and it also means increase of money paid per week to run the ship, and these are things which are apt to stop the growth of speed.



BOW FRAMING OF *CAMPANIA* AND KEEL PLATING OF *LUCANIA*, DEC. 31, 1891.
(*From a photograph by T. & R. Annan & Son, Glasgow.*)

The sea raises great objections to increase of speed. This you may best



MIDSHIP FRAMING OF THE *CAMPANIA*, AS SEEN FROM BOW, DEC. 31, 1891.
(*From a photograph by T. & R. Annan & Son, Glasgow.*)

appreciate if I state here the great increase in power required to drive the present-day ships at their 22-knot speed, compared with the 8-knot ships of fifty years ago. Engineers measure power by a unit which is called a horse-power; but horses vary in strength. If you could find a horse which could lift just 33,000 pounds through a foot in a minute, it would have just the power necessary to be a measurer of the engineer's horse-power. Now, in the 8-knot ships the power was equal to 700 times that of your particular horse, while in the *Campania* and *Lucania* the power is equal to about 30,000, more than forty times as much. So you see how much more objection the sea has to a 22-knot speed than to one of 8 knots. Of course, the ships which have so much more power have to be bigger, but not so much bigger as they would have had to be had there not been a constant improvement in engines and boilers, which has enabled engineers to get so much more horse-power in the same space and for the same weight than used to be got, and also to get this horse-power for so much less weight of coal. To give you some idea of this difference, I will tell you of two cases during the decade of 1880-90.

The first Cunard steamship completed in that decade had machinery of one-half the power of that of the *Paris*, which was completed in 1889. If we say the weight of her machinery is represented by 2,000, that of the *Paris* would have been 4,000, unless some improvement had been made. But the *Paris's* is represented by only 2,800. These figures may be taken approximately to be tons, so that there was actually about 1,200 tons less weight than would have been had no improvements been made, for double the power of the older ship. Then as to coal burned. For every four pounds burned in the older ship only three are required in the *Paris* to produce the same power. The *Paris* burns about 2,400 tons in crossing the Atlantic. She would have had to burn 3,200 tons, unless improvements had been made. Here then we see that to produce the power which is in the *Paris* on the old lines of only fifteen years ago, would have involved 1,200 tons more for machinery and 800 tons for coal, or 2,000 tons more in all. This weight is much more than the weight of the whole of the cargo of the *Paris*, so that without the engineers' improvements the poor *Paris* would have had to go without cargo, and the public would have lost the advantage of having many important articles carried as rapidly as they now are.

These matters affect speed principally, but they also affect the money-making capability of a ship. It is not desirable to enter into this question on this occasion, but it must never be forgotten in considering any steamboat question, that everybody wants to make both ends meet and likes to have a little over, and if, in any proposed ship of the future the impossibility of doing this is evident, there can be no *real* future for this proposed ship.

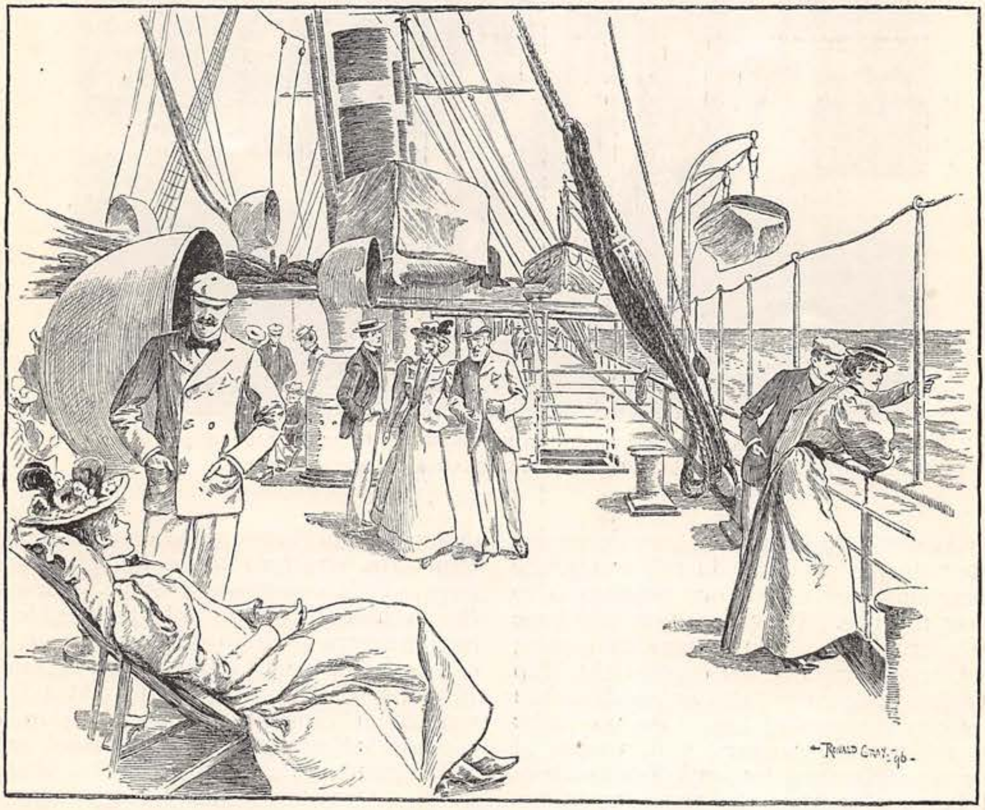
But there is much more than speed to take into account. Safety is the first consideration. Only a few months since we had the heart-rending story of the loss of the *Elbe*, an Atlantic greyhound. Such a loss should not take place in the greyhound of the future. We know how to subdivide a ship so that she cannot be sunk by a blow from another ship. The thing is quite possible and practicable, and in a large part has been done in ships already built. Warships are liable in a sea-fight to have holes made in their sides by collision with the enemy, or by shots or shells from his guns. If a warship were only divided as our passenger ships generally are, she would have a very short life in a sea-fight. But because it is certain that if she fights, holes will be knocked in her and water will get into the ship, it is provided that the ship shall be in as many separate compartments as possible, so that the water which may get in shall extend as little as possible.

So much for keeping afloat with a hole knocked through the ship's side. There are other dangers. The shore is a hard place for the ship to knock against, and it is better to make sure of keeping away from it rather than to try and make a ship able to hit it without danger. There are two chances of going ashore. One is in a fog when the captain has mistaken his position. This happened to the Inman liner *City of Chicago* not far from Queenstown. The captain, a very capable sailor, mistook his position, and drove his ship ashore right under a high cliff. The passengers stepped from the bows of the steamer almost on to the cliffs, and scaled them without much difficulty. No ship is free from this danger, nor will be as long as it is human to err. There may in the future be some means of dissipating a fog at sea, but the chance of such a discovery being made is not great. It is, however, the unexpected that is most likely to happen, and when our natural philosophers fully understand what condition of the atmosphere really causes fog, it may be possible by the electrical power in a ship to dispel it for a short distance from the ship. The other chance of going ashore is by a breakdown of machinery near the shore. This chance becomes smaller every day. Every accident that takes place to machinery is a lesson which teaches something, and as the years go on the number of accidents tends to decrease.

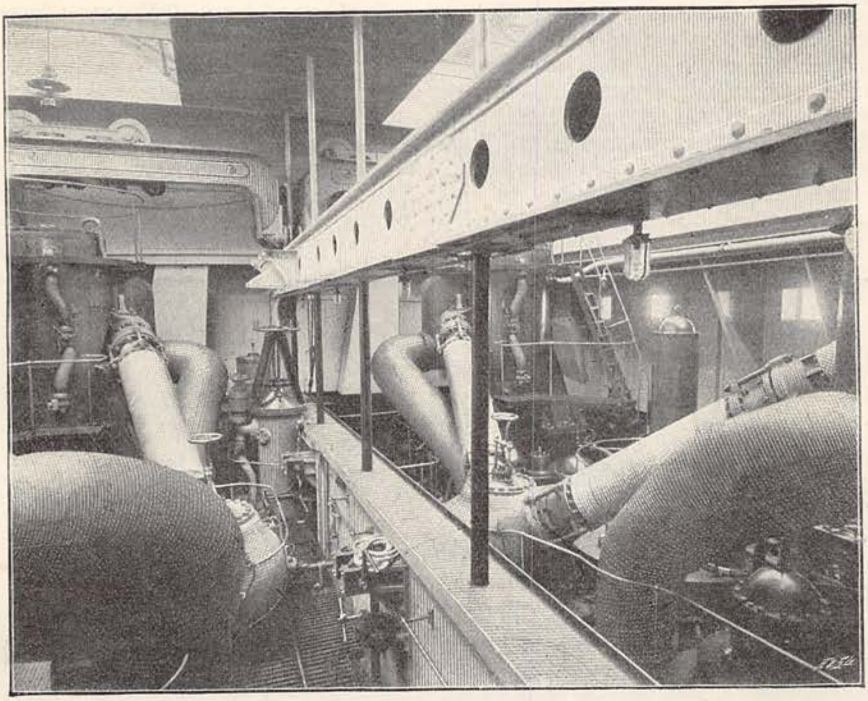
The other dangers peculiar to the sea are fire, and foundering. The former is very small, and will be smaller when the greater subdivision already mentioned is effected. The latter is the smallest of all the dangers, even in the greyhounds of to-day. We may say that the greatest danger of the sea is collision, and it may be reduced by greater subdivision, and that in any case the danger is really very small in a greyhound at sea.

Having provided for safety in your future greyhound by multiplication of compartments and separate sets of machinery, you may now begin to look out for comfort. Let us compare the space we have available at sea with that on land—I mean in a ship and not outside of it. Take the *Paris*, for example. She has four decks; they would be called flats, or storeys, on land. Two of these flats extend the whole length of the ship, and two only outside of the machinery space, which is 150 feet long. We have then two flats 175 yards long, and two 125 yards long, or, in all, 600 yards length of flat, varying in width from 63 feet to nothing. Now this vessel carries about 1,500 people, so that there are from two to three passengers per yard of length of the flat or deck occupied. You may each one compare this with the size of the house you happen to live in, and you will see that there is very much less space available for all purposes than you have in your home. We must remember that in a ship this space includes everything. The promenade deck is the pleasure ground of the ship, and on the upper deck is the street for the steerage passengers and crew to air themselves upon. All this is included in the space we have already measured. But yet a trip in one of these greyhounds is very enjoyable if the state of the sea is not too much for the passenger's capabilities of resisting sea-sickness. But none would object to more space in their private cabins, and in the future greyhound more will be found. You will most likely say, How is such an arrangement possible with the greater subdivision which you ask for? Inasmuch as the subdivision of the vessel is wanted more below the water than above, it is easy to see that we can have large spaces in the passenger quarters, which are some distance above the water, and small ones in the spaces below. With this enlarged space for accommodation we shall have room for shops, so that many things which you have forgotten to bring may be bought upon the voyage. You may not be able to get the morning papers, but you may be able to get news from the shore by some means of communication, so that on a voyage you will not be cut off altogether from the world. This, however, is not for the engineer at present to speak upon without telling you that such means of communication exist only in his imagination.

So far we have talked of comfort as a matter of accommodation, but if you had a greyhound all for your own especial use, and had it fitted up by some good fairy in a way to meet every possible whim or wish, you might be very uncomfortable unless seasickness could be prevented. So far there has been no means devised or adopted for completely stopping or doing away with the motions of a ship at sea, which cause such unpleasant feelings. How can a ship be made perfectly steady at sea? We must first see what it is that makes a ship jump up and down and roll from side to side. In smooth water this does not happen, but only when the surface of the sea becomes uneven and wavy. Every floating vessel occupies in the water a volume which has this relation to the weight of the vessel—viz. that the weight of the same volume of water is the same as the weight of the vessel. If we put some more weight on the vessel it sinks into the water and occupies an increased volume, which has the same relation to the increased weight of the vessel that the original weight has to the original volume. If, instead of putting an increased weight on board, we were to suddenly increase the volume of water occupied by the vessel by piling up waves round the sides of the vessel, we should have destroyed this equality, and we should have an occupied volume corresponding or belonging to a greater weight of vessel. Not having the greater weight ready to put in the vessel to keep her from moving up, she will try and rise, and if the waves remain long enough in



ON THE PROMENADE DECK OF THE *PARIS*.

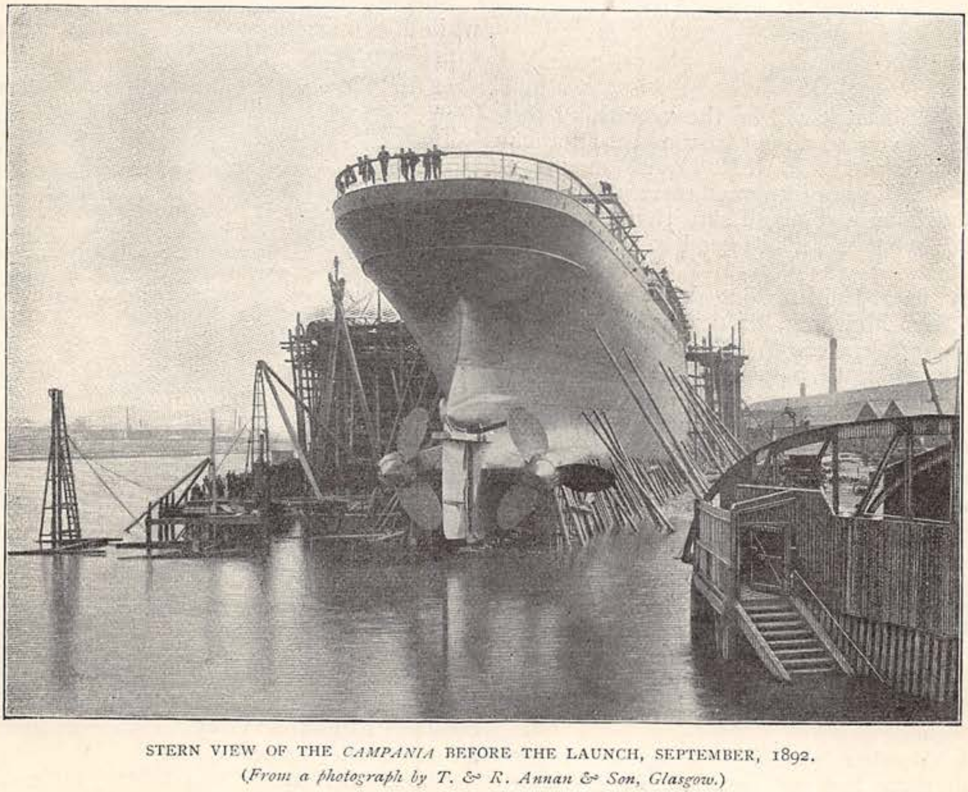


VIEW OF THE UPPER PART OF THE ENGINE-ROOM OF THE *CAMPANIA*.
(*From a photograph by T. & R. Annan & Son, Glasgow.*)

a position to keep the volume occupied greater than it would be in still water, she will certainly rise. Now our problem is to prevent this rise. We cannot very well hope to prevent the wind from blowing and causing waves, so we must try to make the ship move up and down as little as possible when the waves are passing her. One way is to have the vessel of so very small volume at the water surface and for some distance above and below this, that the waves could not increase the volume occupied by her very much. A submerged vessel would not rise or fall much even if near the surface, so that if we could get a vessel which is nearly submerged, we should have one free from the objectionable up and down movement. This kind of vessel would not be very comfortable for those who can stand the sea, so that it would be necessary to have above this, and well out of the water, a kind of second vessel, upon whose deck the passengers could promenade and the captain navigate the vessel. Such a vessel might lack certain other necessary qualities, such as power to remain upright, and a large quantity of weight would be necessary in the bottom of the vessel to give her the necessary stability. Now, weight is the thing which the ship designer is always trying to do without. He wants the structure to be as light—*i.e.* to have as little weight—as possible. He wants the machinery to be as light as possible ; in fact, the more the ship designer can get out of a pound of weight the better he is pleased. If, therefore, it is necessary to add a lot of weight in order to make the ship less "jumpy" at sea, something else must suffer, unless things are made so light that there is no more *room* in a ship for anything else. This state of affairs is very likely to come in the future.

Aluminium is one-third of the weight of steel, and at present is about one-half of its strength. When the chemists and metallurgists have succeeded in making aluminium, or one of its alloys consisting almost wholly of aluminium, of the same strength as steel, we can then look for a saving of one-half the weight of the steel structure of a modern vessel. In a ship like the *Paris* this would mean 2,500 to 3,000 tons, irrespective of any saving in the machinery. This saving is about equal to the whole weight of the machinery, but it would be very difficult to find room for twice the amount of machinery that there is now in the *Paris*. If we believe that room can be found for twice the power, we should find difficulty in getting room for nearly twice the amount of coal. It will, therefore, be necessary to find means of stowing machinery and fuel more closely than it is at present stowed. In 1881 an engine of 4,000 horse-power occupied 30,000 cubic feet. To-day the same power can be got from two sets of engines occupying 4,000 cubic feet. In the case of the *Paris*, her engines of 20,000 horse-power occupy 100,000 cubic feet, so that if we could put five sets of the 4,000 horse-power engines of to-day into the *Paris* they would only occupy one-fifth of the space of the *Paris's*. It is, therefore, possible to reduce the proportionate amount of space required for engines by adopting other types as they become adapted for large ship work. If we could double the power of the engines in the *Paris*, and could provide the necessary fuel to carry her across the Atlantic without adding anything to her total weight, we could increase her speed nearly one-fifth, or reduce her time by more than a day.

The fuel at present used is coal. If we could convert coal into a liquid, it would be very much easier to get on board ship and to stow away in the ship. At present coal has to be put on board in baskets or barrows by manual labour, and when on board has to be lifted by the firemen with shovels and thrown into the fire. If we could put it on board in a liquid form it would go through pipes to its place of storage in the ship, and be drawn from this place and forced through other pipes into the fires by a steam pump. This would make available at once spaces in the ship which at present are useless for carrying coal, and would get over one of the difficulties of finding *room* for the extra coal required if we want extra speed. Now you have a large supply of coal in a liquid form, which is known as petroleum. When the price of this liquid fuel is low enough to admit of its being profitably used, it will then take the place of coal, with many advantages. One of these is that very much less weight of fuel is required to obtain the same result. For weight-saving and consequent high speed of the future everything points to the adoption of this kind of fuel. We have already obtained nearly thirty knots per hour in small vessels carrying a small supply of fuel. In the future we may reasonably expect to attain this speed in the Atlantic greyhound, and it will then be possible to reach Europe in four days. Some of us will some day leave New York, spend nearly a week in Europe, and be back again in New York within the fortnight.



STERN VIEW OF THE *CAMPANIA* BEFORE THE LAUNCH, SEPTEMBER, 1892.
(From a photograph by T. & R. Annan & Son, Glasgow.)