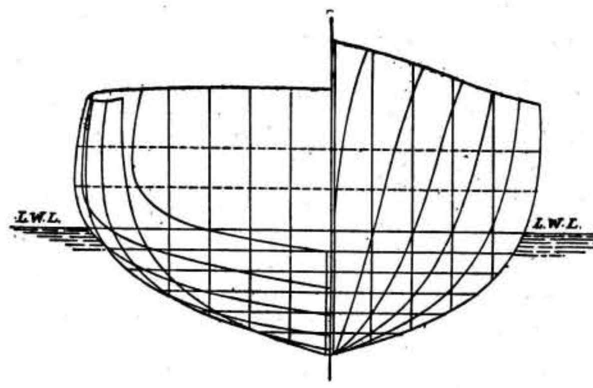
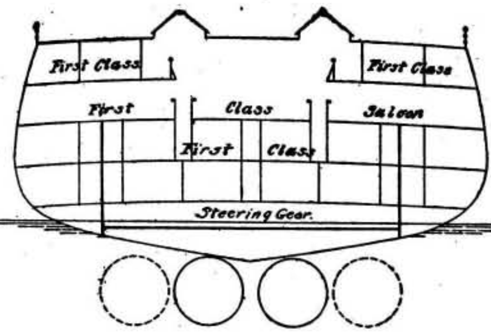
FAST STEAMERS BUILT ON "TETRAHEDRAL" LINES.

BY OTTO KRETSCHMER.

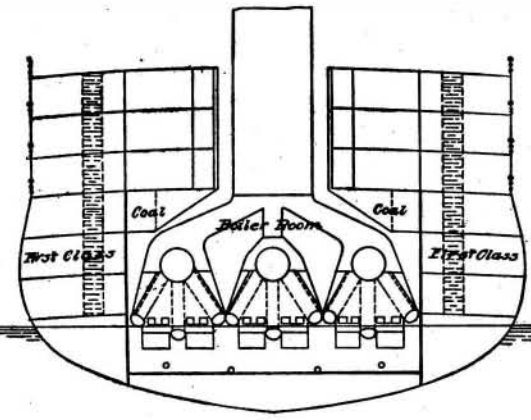
The performance of the steamer "Lusitania" of the Cunard Line has caused the subject of the 25-knot express steamers to become acute again, and the question arises whether, with a lower displacement and correspondingly lower engine power, greater success cannot be obtained. A solution of this question is not merely technically important. Above all, the shipbuilders and the large steamship companies are vitally



The sections change from a sharp V at the bow to a flat U at the stern.

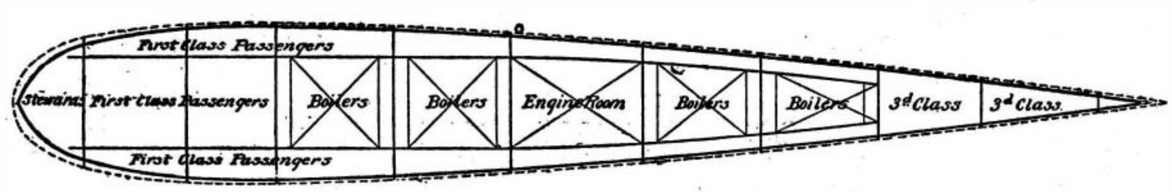


Cross-section showing passenger accommodations in after portion of vessel.



Cross-section through after boiler room.

interested, for economic reasons, in arriving at a solution of the question; for it would enable them to invest less money in this field of transatlantic passenger transportation than is at present required when such a giant boat has to be constructed. If it should become technically possible to construct for the same sum as is now sunk into one of these vessels, two of them, this would signify an economic success which would cause an unprecedented revolution in the domain of international service, by reducing the price of the trips, increasing the number of voyages, and finally shortening the length of the passage.



Deck plan showing motive power in center and passenger accommodations at side of ship.

What means to employ to bring about this revolution is the first consideration that arises for discussion.

In regard to the engine, a radical change cannot be expected; for in the piston engine probably the greatest possible perfection has been reached. The steam turbine is just entering upon its further development; but even here it may be predicted almost with certainty, that any considerable reduction of the displacement of these vessels cannot result therefrom. Hence the only thing that remains is to try to modify the shape of the submerged part of the vessel, and to ascertain, if only theoretically at first, whether this will lead to the end desired.

Large area of waterline plane, with slight resultant displacement, is adapted in itself to produce great velocity with little engine power. The ordinary construction of the vessel expressed in the "beam," or mathematically in the parallelopipedon or the hexahedron, which is their fundamental form, prohibits taking the means indicated on account of various objections which would preclude their employment. It is the shape of a fish. Hence of an animal which moves in a medium, the water, like the bird in the air, and not at the border of two media, water and air, like the ship.

Such a ship construction will be best adapted to fulfill the requirement mentioned above, viz., large area of waterline plane with sufficient resultant displacement. The best prototype from the animal kingdom for this purpose is the swan, which when swimming dives down the deepest in the front, with sharp entering lines of its front body and full, round, spoon-like lines of its hind body. The geometrical fundamental form for a similarly shaped ship construction is certainly afforded in the tetrahedron.

This construction or model has long been accepted as the best for high-speed motor boats, and it has given high speed with comparatively small displacement. In this branch, viz., that of building small vessels, it has been adopted almost exclusively as the most successful, most convenient, most seaworthy as well as the simplest and easiest-to-handle design or construction. It is interesting to note, in the case of the duck, which may also be considered an animal representative of the tetrahedron, how it dips down in the front and lifts itself up in the back when desiring to swim quicker.

The fast steamer of the Cunard Line, "Lusitania," according to the information at hand, possesses the following dimensions:

Length between perpendiculars	790	feet
Beam	88	feet
Draft	37½	feet
Displacement	45,000	tons

The engine power is said to amount to 65,000 horse-power, but is probably 72,000 horse-power. The speed obtained on a trial of 1,200 miles was 25.4 knots per hour.

The fundamental form of the submerged hull of the "Lusitania" is the parallelopidedon.

A fast steamer designed on the tetrahedral lines possessing

Length between perpendiculars	656.0 feet
Beam	78.7 feet
Draft	24.6 feet
Displacement	16,800 tons

showed at the model towing tank tests in the Admiralty Basin at St. Petersburg the following results:

Speed 16.3	knots, actual horse-power,	4,150
Speed 19.6	knots, actual horse-power,	7,450
Speed 22.8	knots, actual horse-power,	13,120
Speed 25.0	knots, actual horse-power,	19,000
Speed, 26.03	knots, actual horse-power,	22,500
Speed, 29.7	knots, actual horse-power,	37,900

For the tertahedral construction we may assume that the proportion of the actual horse-power to the indicated horse-power lies between 0.7 and 0.8, unless the actual horse-power ascertained in the basin should, as is very probable, as with torpedo boats, be equal to the indicated horse-power actually developed later on.

On the basis of these model towing tests two express (high-speed) steamer types have been designed by the author, which have furnished the following dimensions with computation of the weight-groups given below which constitute the displacement.

Project I, for a speed of 26.5 knots but probably 30 knots—

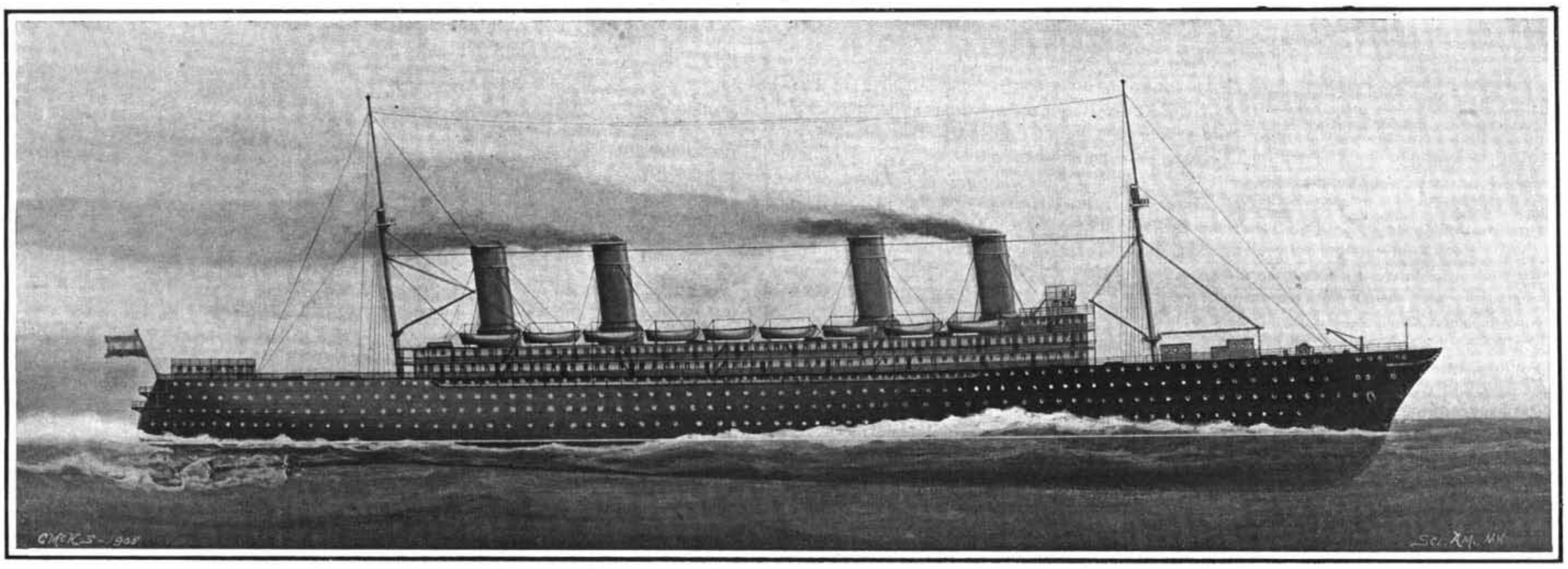
Length between perpendiculars	754.0 feet
Beam	98.4 feet
Draft with half the coal	24.6 feet
Displacement with half the coal	18,700 tons
Horse-power	40,000

Weights.

Hull, with fixtures	11,000 tons
Boiler rooms	1,980 tons
Engine rooms	950 tons
Water for the boilers	100 tons
Reserve inventory	250 tons
Four propellers	16 tons
Shafts, etc	204 tons
Coal, one-half	2,500 tons
Equipment	1,000 tons
Passengers, with effects	500 tons
Cargo	200 tons
	18,700 tons

Project II, for a speed of 25 knots—

Length between perpendiculars	656.0 feet
Beam	78.7 feet
Draft with half the fuel	24.6 feet
Displacement with half the fuel	14,400 tons
Horse-power	20,000



Future steamship improvement may come in altered lines of the submerged portion. The ocean liner here shown is modeled on the general lines of the modern motor boat.

PROPOSED FAST STEAMERS BUILT ON "TETRAHEDRAL" LINES

Weights.

Hull, with fixtures	9,600 tons
Boiler rooms	960 tons
Engine rooms	480 tons
Water for the boilers	50 tons
Reserve inventory	150 tons
Four propellers	14 tons
Shafts, etc.	180 tons
Coal, one-half	1,500 tons
Equipment	800 tons
Passengers, with effects	500 tons
Cargo	200 tons

For the operation Richard Schulz turbines and Yarrow boilers with very slight forced draft are intended. In the normal displacement for both projects one-half the fuel has been put down because in this construction it will not be necessary upon consumption of the fuel to gradually take in more and more water ballast to maintain the stability, as has always been necessary heretofore.

Mr. Stuyvesant, of St. Louis, as well as Admiral Fournier of the French navy, also hold that the tetrahedral form for ships offers the least resistance and that it is the most perfect construction in order to obtain great, and the greatest, speed. The latter has presented to the Académie des Sciences, through M. Bertier, chief constructor of the French navy, a paper on "Carène à grandes vitesses" in which he likewise furnishes the theoretical proof for the above views.

A NEW AND INTERESTING MOTOR CYCLE.

BY ARTHUR H. J. KEANE, M.J.I.

The "Max" motor cycle (Claude Johnson's patent) is a light and comfortable machine of the "runabout" type, intended for short-distance work at moderate speed, absolute safety for the rider being assured. In the ordinary pattern no seat is provided, the rider adopting a standing position on footplates which are within a few inches of the ground. In this position the rider has perfect control over the machine. There is none of that feeling of fatigue and ennui generally experienced after a run on the ordinary type of motor cycle. This cycle will easily maintain a speed of fifteen miles an hour (maximum). It will climb a hill of 1 in 6 grade at a velocity of ten miles per hour. It is inexpensive both in the consumption of fuel and in maintenance. It occupies very little space, and the footplates fold up to form a stand for the machine when at rest. As the total weight is small, and the center of gravity low, it can be handled with minimum effort, and all tendency to side-slip is avoided.

The latest model of the machine is fitted with a special 1¾-horse-power engine with a back gear, so that a large belt pulley may be used, and Sims magneto ignition. The frame is arranged with a continuous curved tube to carry the engine, these being intended to replace the holding lugs used in the former models. The wheels are 18 inches in diameter, and are fitted with 18 x 2-inch tires of the type mentioned above. The fuel tank has a capacity of about 1⅛ gallons, or approximately enough for a 100-mile run. The control is effected almost entirely by means of a throttle and thumb switch, exhaust valve, lifter, front rim brake and drum brake on the engine—all controlled from the handle-bar. The weight of the machine complete is only 85 pounds. The wheel base is 39 inches, the length over all 58 inches, the total height 38 inches, while the handle bars are 18 inches wide.

A NOVEL SYSTEM OF CONCRETE CONSTRUCTION.

(*Concluded from page* 472.)

to give the material time to solidify, when preparations for lifting the wall to its permanent position were made. This was a comparatively simple task, most of the power being furnished by a 5-horse-power engine. It was connected by belting with the shaft under the platform operating the jack screws, and slowly the wall was tilted into position. The platform supports were so placed that the foot of the wall swung to its position on the foundation at precisely the right line and when the wall had assumed a vertical position, every line was plumb. Five or six wood props braced to the window frames held the wall in position and the platform was taken away from the back and swung about for the construction of the next wall, at right angles to the first. This operation was repeated until all the walls were up. The reinforcing rods were set to protrude at the edges of the walls, and when all the walls were in position, the rods interlocked at the corners of the structure. They were twisted together, and an 8-inch board, the only false work used in the construction, was placed inside the corner. Here concrete was poured in, a joint made on the outside corner and the two walls thus bound together.

As the photographs show, the mess hall is two stories in height and presents the appearance of massive construction, yet each wall was molded and set in place in less than three days' actual working time, although they have a height of 26 feet. The interior construction was also of the same material, and here again a plan original with the engineer in charge, Mr. R. H. Aiken, was followed. Columns 8 inches square and 10 feet 8 inches long were used in connection with girders 15 feet in length and 8 by 12 inches in thickness. Their reinforcement consisted of 16 ¼-inch steel rods to each member. Upon these girders were placed the floor slabs 3 feet wide and 2½ inches thick. Those of the first floor are reinforced with ¼-inch twisted bars, both ways, 6 inches apart; the second floor slabs have similar reinforcement, 4 inches apart. The slabs were molded in the following manner: On a bed of sand four cylinders were set, having holes to receive the steel rods that protruded about 6 inches on all sides of the finished slab. The concrete was poured in very wet, and tamped but little. Ten minutes after the first slab was molded, a sheet of heavy paper was spread on it, a new form placed on top and a second slab rested over the first. When the slabs were completed they were left to solidify and did not have to be handled again until placed in the floor.

In the floor, the reinforcing bars of the slabs interweave at all sides. A board was placed under each joint and concrete poured in, forming a perfecting bond. In this, as in all similar cases on this work, the hard concrete was thoroughly wet before the cement mortar for the joint was applied. With the joint, each slab is 42 inches wide. After the slabs were laid, they were moistened and a top coat of concrete spread over the entire floor, bringing the thickness up to 6 inches. This has been termed the unit system of construction, but another method adopted was to mold the supports on the ground, then set them in place according to the plan sometimes followed in setting steel columns. By the method described no delay ensued in construction and no party of workmen was obliged to wait upon others engaged on the building.

THE "MAX" MOTOR CYCLE.

How far this system can be employed in building construction is an interesting question. Apparently it could be utilized in wall formations of much larger dimensions than those described, provided the adjustable framework for supporting the wall is of sufficient strength to give equal resistance to all portions of the load while being raised. As the lifting capacity of the jack can be increased to meet any weight which may be placed upon it and the mechanical power can be suited to all the requirements it would seem as if concrete buildings of much larger dimensions could be literally molded upon the ground even to the ornaments of the exterior and much of the interior framework, for if a wall is too large to be cast, so to speak, in one section it can be formed in parts and then raised upon its permanent site.

Where this plan of erection can be successfully accomplished without affecting the strength of wall or putting undue stress on the work it possesses many advantages that are apparent—not merely in time saving but in labor saving, also in curtailing the space usually required in building operations so valuable in large cities. In the erection of a frame, brick or stone structure much of the time required is to "lay up" the walls piece by piece. All of the material must be elevated and transferred to the workmen. This represents far more time than that employed in the actual labor on the undertaking, while expense of conveying material is a large item of the contract. It is also evident that a wall or other portion of a structure can be completed more thoroughly when on the ground than from the aerial scaffold, since it is more accessible and far more men can work upon it to advantage, while each can accomplish more than he can by the ordinary process.

The practicability of "molding" a building on the ground, then raising and assembling the completed structure, is admitted by United States engineers who have examined the work at Camp Perry with the view of employing the method in military service and have given it their official approval. Col. O. B. Parsons, State engineer of Ohio, gives his opinion as follows:

"As regards the construction, I would say that I am convinced that it is both practical and economical inasmuch as it does away with an untold waste of lumber and admits of a much stronger wall being built with less material. Practically all the lumber that is used is the planks on which the walls are molded, and they are used over and over without being cut or nailed. In constructing a wall in this way the mixture does not separate as while being poured from the top of a building and there is also a great advantage in finishing, as one man will finish more than a half dozen will on a scaffold, do better work, and there is no trouble in bonding, as the surface is put on before the other material is dry."

At Camp Perry this plan of erection is being employed in another interesting way. A wall for supporting rifle targets was included in the plans. It is also formed of concrete but all of it is composed on the ground in sections, no less than 130 feet in length. These are, of course, molded upon framework located at the site of the wall, which is ten feet high and six inches thick. Consequently when a part of the barrier is set in place it is necessary to lift all this mass of concrete at one time, but the system of jacks supporting the adjustable framework has been efficient for the purpose, showing that the Aiken method is adapted to construction on a large scale.

A $500 Prize for a Simple Explanation of the Fourth Dimension.

A friend of the SCIENTIFIC AMERICAN, who desires to remain unknown, has paid into the hands of the publishers the sum of $500, which is to be awarded as a prize for the best popular explanation of the Fourth Dimension, the object being to set forth in an essay the meaning of the term so that the ordinary lay reader can understand it.

Competitors for the prize must comply with the following conditions:

1. No essay must be longer than 2,500 words.
2. The essays must be written as simply, lucidly, and non-technically as possible.
3. Each essay must be typewritten and identified with a pseudonym. The essay must be inclosed in a plain sealed envelope, bearing only the pseudonym. With the essay should be sent a second plain sealed envelope, also labeled with the pseudonym, and containing the name and address of the competitor. Both these envelopes should be sent to "Fourth Dimension Editor, SCIENTIFIC AMERICAN, 361 Broadway, New York, N. Y."
4. All essays must be in the office of the SCIENTIFIC AMERICAN by April 1, 1909.
5. The Editor of the SCIENTIFIC AMERICAN will retain the small sealed envelope containing the address of the competitor and forward the essays to a Board of Judges, who will select the prize-winning essay.
6. As soon as the Board of Judges have agreed upon the winning essay, they will notify the Editor, who will open the envelope bearing the proper pseudonym and containing the competitor's true name. The competitor will be notified by the Editor that he has won the prize, and his essay will be published in the SCIENTIFIC AMERICAN.
7. The Editor reserves the right to publish in the columns of the SCIENTIFIC AMERICAN or the SCIENTIFIC AMERICAN SUPPLEMENT three or four of the more meritorious essays, which in the opinion of the judges are worthy of honorable mention.

The judges who will award the prize will be three in number, and all will be eminent American mathematicians. The names of the judges will be announced in a later issue of this journal.

To Our Subscribers.

We are at the close of another year—the sixty-third of the SCIENTIFIC AMERICAN'S life. Since the subscription of many a subscriber expires, it will not be amiss to call attention to the fact that the sending of the paper will be discontinued if the subscription be not renewed. In order to avoid any interruption in the receipt of the paper, subscriptions should be renewed before the publication of the first issue of the new year. To those who are not familiar with the SUPPLEMENT, a word may not be out of place. The SUPPLEMENT contains articles too long for insertion in the SCIENTIFIC AMERICAN, as well as translations from foreign periodicals, the information contained in which would otherwise be inaccessible. By taking the SCIENTIFIC AMERICAN and SUPPLEMENT the subscriber receives the benefit of a reduction in the subscription price.