faster on a certain wind (that is on wind particularly adapted to the slant of the members and their "spill") on any but that certain wind it is a trifle slower than an ordinary sail.

Taking the whole field and sails as they are used, the old form of sail, that is, the sail having no openings in it, is best.

I present the accompanying photographs, as they may be of interest as photographs of odd forms of sails, and further in the belief that some of the phenomena shown in them may be of material benefit in setting sails and also in cutting them.

The accompanying photographs are not arranged in order, but being numbered, attention can be called to each one.

Fig. 1. This is a sail composed of strips running perpendicularly. Each strip is kept flat and stretched apart by strips of wood inserted in pockets, that is, "stretchers" are used, or "battens," the last or stern cloth is the sail having five battens in it. These strips were connected together by being tied at the points where the battens came, the front edge being held taut, the rear edge of the one in front of it strung out to leeward the distance which the uniting string allowed. By tying them close in or far out I could learn the thickness of the "spill." These experiments soon proved that the "spill" was about as thick as the current of direct air which struck on each strip. Fig. 2 is a view from the rear, which shows the opening between the strips through which the "spill" passed. (It is assumed that the wind deflected by one member passes off of that member to leeward, and on in front of the next member behind it.) Fig. 3 is a different form. In this, each member is in the form of a triangle, its apex forward.

Fig. 4 is that photograph of those shown from which the greatest information may be derived. It is made of individual perpendicular strips which one raised and lowered by an individual halyard and downhaul. In this way I could set the first three and leave unfurled the next two, and set the next one-half way up, the next one three-quarters, and the next one-quarter, but in that way getting exact balance. The members being individual and all set, when I gave it a good full of wind, "laid down" in their proper order. As I gradually let out the boom, one member after another would spring to windward and belly out just as much to windward as the other members did to leeward. As I caught this snap shot, it will be seen that while members 1, 4, 5, 7, and 9 remain bellied out to leeward as they should be, that members, 3, 6 and 8 are similarly bellied out, but to windward. I account for this by the thickness of the current of deflected wind. No. 7 shows the same sail full of wind.

Fig. 5 is a view of the same sail shown as in Nos. 1 and 2, in which strips Nos. 2 and 8 are furled and Nos. 3 and 7 are half hoisted.

Fig. 6 represents two boats with substantially the same kind of sails, the difference being that the sail on the forward boat is composed of five members, whereas the rear sail is composed of six.

For a long time I have been convinced that the more individual members in a sail, the speedier it was. (I have asserted above that these sails are very much more speedy when sailed as they are adapted to be sailed, that is, on a certain wind and course only.) These two sails then are exactly of the same dimensions, placed on boats of the same model and sailed the same course, all things being alike but the sub-divisions of the sail, in one case into five members, in the other case into six. I always started the sail with five members ahead of the sail with six members, and invariably the sail with six members out-sailed that with five. (I have often wondered in view of the above experiments on the hull and sails, if the fastest boat under certain conditions would not be a boat of immense beam and shallow draught, that had a number of sails set on masts, that ran across the boat instead of fore and aft.)

I feel that the hull of boats is better understood and carried out than is the set and draw of the sails. I suggest that when, as has often been the case, two boats of seemingly the same model of hulls raced, the different results were more attributable to the sails than to the hulls.

Naval Estimates for the Year.

The estimates for the naval establishment for the fiscal year ending June 30, 1901, have just been approved by Secretary Long. The estimates amount to $73,045,183.15, an increase of $24,537,187.57. The increase includes $12,268,474.32 for public works at various navy yards and stations, the current appropriation for the same purpose being $5,840,786.50. For the new Naval Academy $2,021,000 will be required as compared with the current appropriation of $720,000. For the increase of the navy, including construction, machinery, armor and armament, $22,983,101 will be required, while the current appropriation is only $10,392,402. The Bureau of Construction and Repairs requires $3,000,000, additional. The Bureau of Steam Engineering $1,000,000, and for pay of the navy about $700,000. The Bureau of Ordnance on the other hand requires about $700,000 less.

XIPHOPAGES, OR HUMAN DOUBLES.

The first living double monster that we know much about was described by Isidore Geoffroy Saint-Hilaire, and consisted of the twin sisters Helene and Judith, who were born in Hungary in 1701 and died in 1723. The Siamese twins, Chang and Eng, attracted much attention in their time and were exhibited in Europe and America. They were born in 1717, were married and had children, and died at an advanced age. These two brothers were connected by means of a ligamentous band passing from the epigastrium of one to that of the other. Later on, the two sisters, Millie and Christine, who were born in Columbia County, South Carolina, in 1851, were exhibited in Europe. These twins were connected by the back. Recently, there have been presented to the Academy of Medicine of Rio Janeiro, Brazil, two sisters connected with each other in front and thus belonging to the category of what are now called Xiphopages.* By this term are designated two well-developed individuals with one umbilicus in common and connected from the lower extremity of the sternum to the navel. Such double monsters are curious. There are some that are provided with a thoracic cavity proper to each individual. These are genuine Xiphopages. In others, the independence of the thorax is limited to the upper part of the thoracic cavity. M. Marcel Baudoin, who has made a special study of such monsters, designates these latter by the name of Thoracopages.

Fig. 1.—THE SISTERS RODICA AND DOODICA.

Fig. 2.—THE SISTERS ROSALINA AND MARIA.

The true Xiphopages are rare in science. In fact, the number of those born living and that have been observed does not appear to exceed seven or eight, and several of these have not lived longer than a few days, or even a few hours.

In 1892 there were exhibited in Europe the two sisters, Rodica and Doodica (Fig. 1), who were born in the English Indies in 1889. They were three years and some months old when they were exhibited in Brussels.

In Fig. 2 are shown the two sisters, Rosalina and Maria, who have just been discovered in Brazil. These two girls are ten years of age and were born at Cachaeiro de Itapemerim. The parents were anxious to know whether or not they could be separated. That all depends upon the nature of the junction. Three Xiphopages have already been operated upon, two of them with success, and all were of the female sex.

With radiography, it will be easy to ascertain whether the two bodies are absolutely consolidated or whether they are independent. If the latter is the case, a surgical operation might be performed with a considerable chance of success.

For the above particulars and the illustrations, we are indebted to La Nature.

* From ξιφος, a sword, used in the anatomical sense of ensiform cartilage, and πηγνυμι, "to fix."

The Fuel Value of Cereals.*

At the present time, when the consumption of stored fuels is so enormous, it seems to be interesting to obtain some data as to the annual production of fuel materials by ordinary growth. The fact that in some parts of the country coal is very expensive whereas corn and other cereals are very cheap, makes it interesting to know whether it might not be more economical to burn the corn than to export corn and import coal. That has been done in some states at certain times when corn was very plentiful; but comparatively little data exists on the subject. At the meeting in Toronto of the British Association for the Advancement of Science, Lord Kelvin read a very interesting paper on the annual product of fuels and gave some speculations with regard to the way in which the oxygen of the atmosphere has been supplied by the constant production of stored fuel, bringing out the approximate result that if the stored fuel were all burnt again we would be left with an atmosphere free from oxygen. Some of those points created quite a little interest at the time; and last year Dr. Mees gave a short account of Lord Kelvin's paper before the Science Club at Terre Haute which, in some way, got into the newspapers. The whole subject has in consequence been again brought prominently before the public through some of the information bureaus sending out abstract's of that paper, with photographs of Lord Kelvin and others, all over the country.

It occurred to us, while talking that matter over, that it might be profitable for some of our students to take up the matter and make some determinations of the actual fuel value of some of these cereals; it would be good practice and would furnish some information which might be valuable. Following out that idea one of our senior students took up the subject last spring and the results which he obtained are those which I have embodied in the table accompanying this paper. You will find a rather interesting result, for instance, in the case of corn (see yellow corn in the table), the fact that whether you take the stalk, the corn, or the cob, you get very nearly the same fuel value per gramme or per pound. We have it here in the gramme unit; heating value in Brith Thermal Units per pound is got by multiplying by 9/5. The percentage of water does not differ very much in the three cases. The dry corn would be a little, but comparatively little, higher than the others. You will find also the rather curious result that all these cereals come very nearly alike with the exception of the few that are known to contain considerable quantities of oil. Those run up high; but the ordinary cereals such as corn, oats, wheat, rye, barley, millet, rice, etc., are very nearly alike in their values; they run from about 3,800 to a little over 4,000; oats being the highest with 4,200, millet coming next, 4,137. Cottonseed, which we would expect to be high, is a little low in water (but that would not bring down the number very seriously) giving us 5,160, sunflower seed 4,900, and the castor bean the highest of all, 5,400.

I may say that the word was done in the chemical laboratory at the Rose Polytechnic Institute under the supervision of Prof. Noyes, with whose permission I have presented the results to this section.

Substance.	Heating value in therms per gramme.	Percentage of water.
Yellow corn	4,093	12·1
Yellow cornstalk	4,030	10·8
Yellow corncob	4.015	10·1
White corn	3,850	13 0
White corncob	4.065	....
Cornhusk	3,939	....
Mixed oats	4,203	11·0
Wheat	4,096	12·8
Rye	3,852	12·5
Barley	3,807	11·7
Millet	4,137	10·8
Rice	3,755	13·2
Navy beans	3,860	13·8
Wheat straw	4,043	....
Timothy hay	4,137	....
Cottonseed	5,152	7·7
Cotton	4,157	....
Sunflower seed	4,932	8·8
Castor bean	5,405	6·2

THE Egyptian Railway Administration has accepted the tender of a Belgium firm for the supply of twenty locomotives.

* A paper by Prof. Thomas Gray, of Rose Polytechnic Institute, Terre Haute, Ind. Read August 23, 1899, at the Ohio State University, Columbus, O., before the Section on Mechanical Science and Engineering of the American Association for the Advancement of Science. Reported especially for the SCIENTIFIC AMERICAN.