

Correspondence.

Tripler's Surplusage.

To the Editor of the SCIENTIFIC AMERICAN:

In answer to the criticisms that have appeared in your valuable journal of my theory of Tripler's surplusage, I would beg to say that I now fully admit the fallacy of my first argument, but inasmuch as it appears that I had a wrong conception of Tripler's process, it does not necessarily follow that surplusage itself is an impossibility.

I must again repeat that I am not contending for the possibility of a creation of force when I speak of the possibility of surplusage, but simply insist that by means of liquid air it may be possible that Tripler has discovered a new way of utilizing a natural force. The man who invented the first waterwheel and Tripler may possibly be placed in the same category. It appears now that Tripler produces his surplusage, if he produces it at all, not directly by the heat of the sun, as he originally claimed, but by the pressure of the atmosphere.

I can anticipate the shout of derision that will follow such an apparently unscientific proposition. It will be immediately said that my own original criticism of the impossibility of gaining a surplus by using the heat of the atmosphere to expand when one must again condense against the same heat applies equally against using the pressure of the atmosphere, inasmuch as this pressure can only be utilized by creation of a vacuum, and the creation of this vacuum would cost as much energy as would be gained by its use. With a perfect frictionless machine, and given a vacuum to start with, the force of the air rushing into the receiver would just furnish the energy required to pump out the air and create an equal vacuum in another receiver of same size and in same temperature, etc. However, Tripler does not "pump out" air to form his vacuum, but he "liquefies" part of it and utilizes the pressure of the incoming air, rushing in to replace it, to furnish him the power for the liquefaction.

It may be said that the greatest pressure alone will not liquefy air, and certainly not 15 pounds per square inch, which is all the pressure of the atmosphere will furnish under best conditions. However, we start out with the assumption that the temperature within Tripler's receiver or liquefier has already been reduced to say 290 degrees or more below zero with the liquid air sent into it previously produced in another liquefier by the energy of the steam engine. Now, air liquefies without pressure at -312° , and hence at a temperature approximating -312° , say -290° , it may be considered that a pressure of less than 15 pounds is sufficient for liquefaction. The point now is to determine whether the incoming of fresh air at 70° above zero will tend to increase the temperature within the liquefier more than the liquefaction of part, say one-twentieth, of this fresh air tends to decrease it. The incoming air furnishes a positive energy toward liquefaction by its pressure and a negative energy against liquefaction from its heat. If the positive energy exceeds the negative, then a surplusage is created, and liquid air will be produced free of cost.

H. GAYLORD WILSHIRE.

Los Angeles, July 10, 1899.

FAULTY FEATURES IN OUR PROPOSED SHEATHED AND COPPERED CRUISERS.

By an Act of Congress, approved March 3, 1899, appropriations were made for the construction of six sheathed and coppered cruisers of about 2,500 tons trial displacement. In accordance with the Act, the Board on Construction has recommended the building of six vessels, whose particulars, as given in the accompanying table, show that the new ships are to have a full load displacement of 3,500 tons, that they are to be of the unprotected type, that they are to carry 700 tons of coal, and that the speed is to be $16\frac{1}{2}$ knots.

The only satisfactory method of judging of the merit of a proposed type of warship is to compare it with ships of a similar size and class which represent contemporary practice among the navies of the world.

The displacement of a warship, whether it be 3,500 tons or 15,000 tons, represents the working capital of the naval architect. In designing his vessel, he apportions so much of this weight to armor, so much to armament, so much to motive power, so much to coal, and so forth. If he wishes to increase any particular element, it will be done at the expense of the others. If he uses up his displacement in providing a powerful battery and heavy armor, he must reduce the coal capacity or the speed, or perhaps both, and if the ship, furthermore, is crammed with engines and boilers in the effort to produce phenomenal speed, either the armor or the battery or both must suffer. The ideal warship is that which combines armament, coal endurance, speed, and protection in such well adjusted proportions that she is formidable in all the elements of fighting power without the sacrifice of any essential feature of first-class construction.

There is no branch of engineering in which there is

less pretense than in warship building. The interests at stake are so vital, involving in some instances—notably in the case of Great Britain—the very existence of the nation, that every country is aiming to produce the very best results under the appropriations that are voted for naval purposes. Designers watch each other closely, and borrow each others' ideas to an extent that has no parallel in other branches of constructive work. Hence, in any such tabular comparison of ships as that which accompanies this article, we can easily and surely detect the general drift of expert opinion as to the best type of ship to meet the present conditions of naval warfare.

We greatly regret to state it as our opinion that, ton for ton, the proposed United States cruisers are the least efficient ships of the whole seven, an opinion which must be shared by any one who makes a careful study of the figures as here laid down. Not only are the new cruisers in proportion to their size greatly inferior to the U. S. S. "Montgomery," a vessel that was designed over ten years ago, but with their lack of a complete protective deck and their low speed they are a positive reversal to the "Atlanta" and "Boston," ships which represent our earliest efforts at steel warship building, made over fifteen years ago.

It is no reply to these objections to point out that the new cruisers are to be sheathed and coppered, and that some of their displacement is due to the extra weight thus involved, for one of the United States cruisers, the "New Orleans," is a sheathed and coppered vessel, and it is only necessary to add from 150 to 200 tons to the displacement of the other vessels to arrive at their actual displacement, if similarly sheathed—an addition which still leaves them a wide margin of superiority over the proposed cruisers.

We will now compare the new cruisers with the other six ships enumerated in the table. The "Montgomery" being a cruiser of the unprotected class—that is, having no protective deck, but merely a thin "watertight" deck—is the ship which naturally suggests itself first for comparison. Her full load displacement is 2,229 tons, or, adding 150 tons for sheathing, say 2,380 tons, which is 1,120 tons less than that of the new ships. Yet, in spite of this disparity, the smaller

this question in order that the remarkable inferiority of the new designs to a well-trying ship of the same type and size may carry its full and proper weight of conviction.

Of foreign ships, we have selected first the "25 De Mayo," of the Argentine navy. If sheathed and coppered, her displacement would be 3,500 tons, or just that of the proposed cruisers, while the increased weight would reduce the speed to about 22 knots. Here, then, we have a cruiser launched ten years ago, and of the same displacement as our new ships, which is of over $5\frac{1}{2}$ knots greater speed, has a more powerful battery (the two 8.2-inch guns having nothing to match them in the new designs), with six torpedo tubes as against none, and with a complete protective deck 2 inches thick on the flat portions and $4\frac{1}{2}$ inches on the side slopes, as against a strip of 2-inch steel on the slopes for a third of the length amidships. On the other hand, the only point of superiority of the $16\frac{1}{2}$ -knot boats is that they carry 700 as against 600 tons of coal.

The next comparison is with the "Puglia," an Italian cruiser which, if sheathed, would displace about 2,800 tons and have a speed of $19\frac{3}{4}$ knots. On 700 tons less displacement, she carries a somewhat more powerful battery and 50 tons more coal, has a complete 1-inch protective deck and $3\frac{1}{4}$ knots advantage in speed, besides carrying two torpedo tubes. This is, perhaps, the most striking comparison of all, for it shows that as compared with a boat fully 25 per cent larger than herself, the Italian cruiser, if sheathed, would possess a positive superiority on all points of comparison and an overwhelming superiority in speed and protection.

Japan, on 200 tons less displacement (supposing the "Suma" were sheathed), possesses a vessel with $3\frac{1}{4}$ knots more speed, a complete protective deck, a slightly less powerful battery, and two torpedo tubes as against none.

Finally, as showing that our $16\frac{1}{2}$ -knot cruisers are directly at variance with the latest trend of ideas in naval construction, we quote the cruiser "Novik," now under construction in a German yard for the Russian navy. She is said to be the first of a fleet of ten similar ships, whose designer represents the theo-

COMPARISON OF PROPOSED 3,400-TON CRUISERS WITH SIMILAR SHIPS IN OUR OWN AND FOREIGN NAVIES.

Name of ship..... Name of navy..... Date.....	Proposed Cruisers. United States. 1899.	"Montgomery." United States. 1889.	"New Orleans." United States. 1896.	"25 de Mayo." Argentina. 1890.	"Puglia." Italy. 1898.	"Suma." Japan. 1899.	"Novik." Russia. 1899.
Full load displacement, tons.....	3,400	2,229	3,437	3,300	2,650	3,100	3,000
L. W. L. length.....	292 ft.	298 ft.	346 ft.	325 ft.	269 ft.	306 ft. 8 in.	347 ft.
Extreme beam.....	43 ft.	37 ft.	43 ft. 9 in.	43 ft.	41 ft.	40 ft.	40 ft.
Total bunker capacity, tons.....	700	340	800	600	750	627	500
Trial speed, knots.....	$16\frac{1}{2}$	19	20	22.4	20	20	25
Protective deck.....	none at ends ten 5-in. r. f. eight 6-pdrs. two 1-pdr.	none ten 5-in. r. f. six 6-pdrs. two 1-pdr.	$1\frac{1}{4}$ in. to 3 in. six 6-in. r. f. four 4.7-in. r. f. ten 6-pdrs. four 1-pdr.	2 in. to $4\frac{1}{2}$ in. two 8.2-in. B.L.R. eight 4.7-in. r. f. twelve 3-pdrs. twelve 1-pdr.	1 in. four 5.9-in. r. f. six 4.7-in. r. f. one 12-pdr. eight 6-pdrs.	1 in. two 5.9-in. r. f. six 4.7-in. r. f. twelve 3-pdrs.	$1\frac{1}{4}$ in. to 2 in. six 6-in. r. f. numerous secondary battery
Battery.....	four machine guns one field gun	one 3 in. field gun	four machine guns two field guns	6	2	2	6
Torpedo tubes.....	None.	2	3				

and older boat has the same battery and $2\frac{1}{2}$ knots higher speed; whereas, on an increase of over 1,100 tons in displacement, the new designs can only show an advantage of 360 tons of coal and 2 inches of steel laid on the slopes of the unprotected deck for a third of the vessel's length amidships. The "Montgomery," moreover, carries two torpedo tubes. The extra speed and the torpedo outfit offset the extra coal carried by the new boats. So that we have about 1,000 tons of displacement unaccounted for, even if we admit that the accommodations for officers and crew are improved.

The comparison with the "New Orleans" of our navy is particularly interesting, as the ships are of practically the same size and both are sheathed and coppered. The "New Orleans" was in active service throughout the war, and on one occasion fairly smothered the Santiago batteries in a single-handed duel; indeed, she has received the highest indorsement from naval officers, and it is with them, surely, that the final word as to a vessel's efficiency must lie. The comparison shows an overwhelming superiority for the "New Orleans," for on about the same displacement she carries 100 tons more coal, she has $3\frac{1}{2}$ knots more speed, she has a complete protective deck with a maximum thickness of 3 inches, she carries three torpedo tubes to none in the new designs and her battery is considerably more powerful. At a cruising speed, she can steam about the same distance as the new boats, she can run away from them or run them down at will, and in a stand-up fight she could deliver a greater energy of fire, while her protective armor would give her an incomparable defensive advantage.

Just here, it will be well to state that the alarmist rumors as to instability of the ship are altogether unfounded. Inquiry of officers in the Construction Department elicits the information that the "New Orleans" was never reported to be unstable, and inquiry of the officer who commanded the ship during the war brings the statement that in a heavy sea off San Juan, when all but empty of coal and ammunition, she showed an apparently ample margin of stability. We touch upon

ries of Admiral Makaroff, one of the most brilliant and thoughtful naval strategists of the day. This vessel is to combine the qualities of the torpedo-boat destroyer and the cruiser; and with her armament of six 6-inch rapid-fire guns, and numerous secondary battery, combined with six torpedo tubes of the under-water type, her offensive qualities may be said to be at least equal to those of the $16\frac{1}{2}$ -knot cruisers. If sheathed, the "Novik" would displace 3,200 tons. On 300 tons less displacement, she carries 200 tons less coal than our proposed boats, but, as against this, she has a complete protective deck, $1\frac{1}{4}$ inches on the flats and 2 inches on the slopes. It is when we come to the comparison of speed, however, that the enormous disparity between the two boats is seen, for the "Novik" will be 50 per cent faster, having a speed of 25 knots as against the $16\frac{1}{2}$ knots of our cruisers.

If the facts of the above comparison prove anything, they establish that if we build the six proposed cruisers, we shall possess a class of vessels regarding which we shall be bound to admit that, for their size and date, they are the slowest and most defenseless vessels in the world, and quite unable to stand comparison with similar foreign ships in military, tactical, or strategical efficiency. Further reference to this subject will be found in our editorial columns.

The General Liquid Air Company.

The General Liquid Air and Refrigerating Company has been reorganized, and its capital stock has been increased from \$300,000 to \$1,000,000. We have already described in detail the plant which demonstrated the efficiency of the process.

It is extraordinary that miners still refuse to use the safety lamps, even when they have had terrible lessons in their own mines. A strike is now said to be in progress in one Pennsylvania mine because the miners object to using safety lamps, yet less than two years ago an explosion occurred in the same mine in which several men were killed.

Science Notes.

Lord Kelvin has been given the freedom of the city of London through the Spectacle-Makers' Company.

The remains of not less than twenty extinct animals have been uncovered by the Wyoming scientific expedition, to which we have already referred. Three tons of bones have been found in two days.

The Belgians are an eminently commercial people. In Antwerp ten traveling commercial scholarships of three years' duration, with an annual income of \$1,000, are given to students who most deserve such opportunities.

George Averoff, the wealthy Greek, died recently at Alexandria, Egypt. He was a great philanthropist, and it was due to his generosity that it was possible to revive the Olympic games in Athens, in 1896. He rebuilt the Stadium at an expense of more than \$600,000.

Interesting experiments were recently conducted on board the French battleship "Jauréguiberry," to determine the limit of distinct vision at sea. From the "Jauréguiberry" a balloon was held captive at an elevation of 1,300 feet while the "Carnot" endeavored to locate the balloon with her searchlights at distances varying from five to twenty-five miles. The experiments proved that the limit of vision under the circumstances was about twenty miles.

It is reported that Herr Montag, of Mannheim, has succeeded in producing coal artificially. At present the newspaper reports are meager, and according to them the new fuel does not develop poisonous gases, creates but little soot, leaves no slate and but a small amount of ash, the latter resembling wood or cigar ash. The fuel is composed of 92 per cent or 94 per cent of ordinary earth and 6 per cent to 8 per cent of chemicals added. It is said that patents for the invention have been applied for in seventeen countries. If this news proves to be authentic, the developments will be looked for with great interest.

A number of gems are being found in the Lake region, and quite a number of diamonds have been discovered. No less than seventeen well identified diamonds, varying in weight from one-half to more than twenty-one carats, have been discovered in the region of the Great Lakes. The localities in which these diamonds have been found are distributed over an area nearly 600 miles in length and 200 miles in width, with its longer axis trending almost exactly northwest and southeast. Nearly all the diamonds were obtained from the deposits of glacial drift. The colors vary from white to white tinged with green and pure yellow. Several of the stones are remarkably fine gems.

The Randolph & Clowes Company, of Waterbury, Conn., has just been made into a stock company under the name of the Randolph-Clowes Company. They manufacture seamless tubes up to 38 inches in diameter, whereas the largest tubes made in Europe are only 12 to 14 inches in diameter. In this country, until quite recently, except those manufactured by the company to which we have referred, seamless tubes have been made only up to 8 inches in diameter. Of course, in order to produce tubes of anything like a diameter of 38 inches, special machinery is necessary and it naturally requires great experience to produce tubes of this nature. This company has made a large number of torpedo tubes for the government. The large tubes are used for pump linings, fire extinguishers, air chambers, soda fountains, etc.

United States Commercial Agent Atwell, of Roubaix, gives some information regarding Dr. Mendel's treatment for tuberculosis which has created considerable interest in Europe. The treatment consists in injecting daily into the bronchial tubes essence of eucalyptus, thyme, and cinnamon, held in solution in olive oil. The oil descending slowly comes into contact with the walls of the tubes in the upper lungs. The vapor which is set free saturates the air in the lungs and acts on the mucous membrane as far as the air penetrates. Dr. Mendel has treated sixteen tuberculosis patients and two suffering from simple bronchitis. In these cases he has noted, after a treatment of one or two weeks, a lessening or complete cessation of the cough and expectoration, as well as a return of sleep, appetite, and strength.

Dr. Robert Stein, of the United States Geological Survey, will leave Washington some time during August on an Arctic expedition, the object of which will be the exploration of the islands lying north of the continent. They will be landed from the Peary supply steamer "Diana" near Cape Sabine, the eastern extremity of Ellesmere Land. Here houses will be built and a reconnoitering trip will be made westward to ascertain whether the inlets afford communication with the western sea or not. If there is no such communication, the trip to the western coast will be made overland. The winter nights will be spent in taking observations, and the westward trip will be begun about the beginning of March. The explorers hope to be able to reach Cape Eden, and so complete the outline of Ellesmere Land, but the direction of the trip will, of course, be determined by the windings of the unknown coast.

Engineering Notes.

Nearly one thousand bids have been received by the Navy Department for the machinery of the Brooklyn dry dock, which was destroyed by fire last spring. The lowest bid was \$165,000. For the six cranes the bids range from \$35,000 to \$60,000.

There has been great difficulty in coaling the transports at Manila, which has resulted in delay in sending home the volunteers. There is now, however, on the way to Manila a hoisting apparatus which will enable the ships to be coaled at the rate of 600 tons a day.

An explosion has occurred on the "Argonaut," which was in dry dock in Brooklyn. It is said that it was caused by the introduction of a lighted lamp into the gasoline tank of the submarine boat. Three men were injured, but fortunately not seriously. The damage to the boat was slight.

The White Pass and Yukon Railroad will be formally turned over to its owners by the builders on August 20. The forty-mile stretch between Skaguay and Lake Bennett was constructed at a cost of \$2,000,000, exclusive of equipment and rolling stock. The work of extending the line to Fort Selkirk will be begun at once and will be continued all winter.

Bombay has a railroad which is used in connection with the sanitation of the town. According to The Engineer, it is over three miles long, and is intended for transporting the road sweepings to a piece of land nearly nine hundred acres in extent. It is considered that this track will fulfill all requirements for about twenty-three years. The sanitary authorities have tried two systems of destructors, but both have been discarded.

Forty-five acres of land on the ocean beach southwest of San Francisco are to be condemned by legal proceedings for the erection of heavy batteries for the defense of the harbor. The site commands the southern approach to the harbor and is admirably adapted for fortification purposes. It has a fine fresh lake in the rear which is fed by subterranean springs. Work on the battery will be commenced as soon as the government secures a title to the land.

A few days ago the final trials of the Holland submarine boat were held over the course in Peconic Bay. The trials were for the purpose of ascertaining the effect of wave motion upon the vessel while going at a high rate of speed while on the surface, and to see if a high speed could be obtained at any increased power. The vessel showed remarkable ability in making rapid headway in moving backward when the power was increased. The trial was made over a thousand foot course, and the time was 1:23; a trifle more than 112 horse power was used. This gave the boat a speed of about ten knots an hour. The new set of dynamos, to be operated by oil, will be installed in the boat to take the place of those now operated by air.

The gas works of the Logansport and Wabash Valley Gas Company, of Wabash, Indiana, were destroyed by a terrific explosion, which shook the city. The explosion took place on August 7. The superintendent and his assistant had just completed charging the tanks with calcium carbide and water when an ominous bubbling was noticed in one of the tanks, and the water was shut off. There was then an explosion in which there was a column of flame eighty feet high. It carried away the iron roof of the works, which was hurled into the air and then settled down to the ground amid a mass of bricks from the walls. The company installed the acetylene plant less than a year ago. It was probably the first ever put in, in this country, to illuminate a city, although an Italian city has been so lighted for some time. Many plate glass windows in the business part of the town were broken by the shock, but fortunately no one was seriously hurt.

There is a great necessity for the introduction of American safety appliances on foreign railroads. In 1895-96, on the railroads in Prussia more than 250 railroad employes lost their lives by accidents and 550 were injured; 1896-97, the figures were 264 killed and 667 injured. On the English roads, in 1897, an average of one brakeman in every 274 was killed, and one in every 15 injured. A member of Parliament supplemented these figures with the astonishing statement that in twenty-five years, 1872-1897, among 1,500,000 English soldiers, 1,396 were killed in battle, while in the same period 9,000 railroad employes were killed. This certainly shows that there is great need of an improved type of railway coupling and other safety devices, both in Great Britain and on the Continent. In Russia the government is now introducing American air brakes throughout the railway system, and it is probable that automatic couplers will also be insisted upon. When improvements of this nature are contemplated, those who were concerned with selecting the particular appliances to be employed will not ignore, says The American Exporter, that the United States is the country in which automatic couplers were first invented and in which they have been most universally used.

Electrical Notes.

Two hundred and forty-eight people have been killed by trolley cars within the limits of the old city of Brooklyn, since the introduction of the electric cars.

The Prussian State Railroads have given an extended trial to a system of electric lighting taking the power from the axle. This system has now been abandoned.

According to The Electrical Review, plans are being matured for substituting electricity for steam in the ferry-boats plying between Philadelphia and Camden, New Jersey.

In a new system of pressing cloth, German silver wires are embedded in asbestos laid up between two sheets of card, the two terminals of the wires being brought to opposite corners of the cards; the whole is then used between the folds of the cloth to be pressed. Contact is made by means of clips. The temperature can be perfectly controlled, and there is no danger of burning the goods.

Each week fuller particulars regarding the destruction of the Volta exposition appear in the foreign papers. We have already on two occasions referred to the instruments used by Volta, which were destroyed. It now seems that almost all of the Volta autograph letters, his books, correspondence and an almost perfect library of books on electricity from the days of his discoveries to the present time were destroyed.

According to The American Exporter Messrs. Vickers Sons & Maxim, Limited, of Sheffield, England, has just placed a contract in the United States for two electric battleship cantilever cranes and trestles and the same number of electric cantilever yard cranes for their great shipbuilding works. This will be the largest shipment of cranes ever made to England from the United States and it will form the largest electric plant of this kind ever erected in England. The contract calls for an expenditure of \$350,000.

In Europe, all kinds of schemes are adopted to outwit the surgeons who examine conscripts as to their availability for military service, and the Roentgen rays have unmasked such frauds. Some time ago a soldier in a military hospital claimed to have been bitten by a horse. A photograph of the finger was obtained and five needles were discovered in it. The next day another photograph was taken, and it was found that the soldier had removed one of the needles. The surgeon took out the remaining needles. The soldier had injured himself in order to obtain relief from irksome military service.

The San Juan and Rio Piedras Railway Company has been incorporated at Albany, New York, to operate an electric railway and furnish electric light at Porto Rico. The company will operate the first electric railway and electric power plant on the island. It has purchased a steam road eight miles long and electricity will be substituted as a motive power, the overhead trolley system being used. The work of reconstructing the road has already begun. San Juan will also be furnished with arc and incandescent lights. It is believed that it is the intention of the new company to build a park resort on the sea coast between San Juan and Rio Piedras.

The new power house of the Third Avenue road will be 320 feet long and 250 feet wide. It will rest on a table of concrete 7 feet thick which will in turn rest on piles 40 feet long. There will be thirty-two batteries of large boilers, sixteen engines each developing 4,000 horse power and which can be worked up to 6,000 horse power, consequently the complete system when it is installed will furnish 96,000 horse power. It is said that the generators will be placed between the cylinders of the engines, in order to avoid waste of power in transmission and the use of the long shafts. The current will be generated at pressure of 1,100 volts and will be reduced at branch stations to 500 volts.

Of the thirty-nine street railways in and around Paris, ten use steam motors in one form or another for traction purposes. Two employ ordinary locomotives; two the Lamm and Franey methods; four employ the Serpollet system, and two the Rowan system. Other lines use the Mekarski system of compressed air. Four employ self-contained cars operated with compressed air. Six use cars worked by electrical accumulators and two with combined accumulators and overhead wires. One is worked electrically by means of a surface contact; another, says Electricity, is operated by means of overhead wires and partly by conduit, and still another is propelled by means of a cable.

An American manufacturer of machine tools is now making magnetic chucks, which are designed to do away with bolting, strapping or otherwise fastening down work by the usual methods, which require considerable time. The chucks are made for the planer, lathe or surface grinder. The mechanism consists of an electro-magnet made in box form completely inclosing an electric coil. A switch is provided to manipulate the current, which is taken from the regular 110-volt shop-lighting arc circuit, and any of the chucks can be connected in place of a lamp. An automatic switching device has also been devised for alternately opening and closing the circuit as the platen reverses.