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 16½ 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 and older boat has the same battery and 2½ 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 3½ 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 this question in order that the remarkable inferiority of the new designs to a well-tried 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 5½ 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 4½ 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 16½-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 19¾ 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 3¼ 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 3¼ knots more speed, a complete protective deck, a slightly less powerful battery, and two torpedo tubes as against none.

Finally, as showing that our 16½-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 theories 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 16½-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, 1¼ 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 16½ 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 strategetical efficiency. Further reference to this subject will be found in our editorial columns.

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	16½	19	20	22·4	20	20	25
Protective deck	none at ends	none	1¼ in. to 3 in.	2 in. to 4½ in.	1 in.	1 in.	1¼ in. to 2 in.
Battery	ten 5-in. r. f. eight 6-pdrs. two 1-pdr. four machine guns one field gun	ten 5-in. r. f. six 6-pdrs. two 1-pdr. two Colts one 3 in. field gun	six 6 in. r. f. four 4·7-in. r. f. ten 6-pdrs. four 1-pdr. four machine guns two field guns	two 8·2-in. B.L.R. eight 4·7-in. r. f. twelve 3-pdrs. twelve 1-pdr.	four 5·9-in. r. f. six 4·7-in. r. f. one 12-pdr. eight 6-pdrs. two machine guns	two 5·9-in. r. f. six 4·7-in. r. f. twelve 3-pdrs.	six 6-in. r. f. numerous secondary battery
Torpedo tubes	None.	2	3	6	2	2	6

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 $10,000,000. 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.