THE KNAPP ROLLER BOAT.

Editor CANADIAN ENGINEER:

SIR,—Now that the Knapp boat is laid up for the winter without a speed trial, it may be of interest to consider some of the points which have been made against her success. Foremost among these is the great wind question. It is claimed that wind pressure reduces the speed of the "Campania" from 560 to 180 knots a day. Is this the whole truth? I think not. A vessel of that class is submerged about 33 feet, or nearly two-thirds of her entire bulk. The air, through which the smaller portion of the vessel has to make its way, is some 700 times lighter than the water which resists the submerged portion. But the water in a high head or quarter wind acquires under the influence of the wind, a very rapid motion. This rapidly-moving water, weighing hundreds of tons, is hurled against the bows of the on-coming vessel. A vastly lighter body of air is at the same time opposing her upper works. But which has the greater effect in reducing her speed? Obviously 700 tons of water will retard her speed more than one ton of air. It is probable, may we not say certain, then, that the "Campania's" speed is reduced, not by the wind pressure on her upper works, but by the resistance of the rapidly-moving water against the submerged portion of her hull. The wind pressure in itself can add but very little to the retardation.

Now, discarding all other elements but those of water resistance, how will this affect the full-sized Knapp boat? To begin with, the immersion will be considerably less than one-half that of the "Campania." The serious resistance will therefore be diminished in that proportion. But this is not all advantage to the Knapp boat. The trials have shown that increase of water resistance produces increase of speed, thus completely reversing present conditions. The weight of water flung against the submerged portion, which is curving downwards and away from the on-coming wave, will tend to "sweep her legs from under her," just as a beam sea causes the staunchest boat to roll. But to roll is just what Mr. Knapp's boat is built to do. Consequently this terrible f. e of present-day craft will be an actual friend to the new monster.

But how about the wind on the upper works? Here, indeed, there is a tremendous increase of surface to play upon. But here also another principle appears which may very possibly sur rise the cock-sure prophets. If two moving bodies meet, the lighter of the two will be inevitably overcome by the heavier. Now the Knapp boat will weigh some 15,000 tons, and will present 112,500 square feet to the wind, less the submerged portion. Now in calm weather, at a speed of a mile a minute, the heaviest pressure of wind would be about 18 lbs. to the square foot, or, adding the resistance of a 40-mile gale, about 26 lbs. to the square foot. The weight of wind to be encountered would thus be about 1,012 tons in calm weather, or 1,462 tons in a 40-mile gale. What will happen to that 1,462 tons when 15,000 tons are thrown forcibly against it at the rate of a mile a minute? Which must give way? I imagine there can be no two answers to this problem.

But very competent engineers think that the surface presented to the wind would be more accurately represented by multiplying the length by one-half the diameter, for the reason that the shape of the boat and its peculiar motion would greatly reduce the retarding effect of the wind upon it. If this be admitted, the pressures given above must be divided by two, giving 506 tons wind resistance in calm weather, or 731 tons in a 40-mile gale, and with the boat going at a mile a minute. It will be seen, therefore, that everything against the boat is conceded in the above argument, while in what I am about to say I shall concede everything in favor of my examples.

It will doubtless be objected that the horse-power necessary to drive that 15,000 tons against 1,462 tons at the rate of 5,280 feet a minute will be so enormous that the boat could never carry it. To this the inventor replies that the momentum of his boat will be in itself sufficient to overcome wind resistance, and all his engines need do is to roll his boat *in* the water at that speed The weight of the boat and the aid of the resisting water will do the rest. But we are told "there is nothing in momentum." Fortunately that fact can be tested, because ships are not the only moving bodies which are confronted with wind resistance. Let us take then as a test the Holman engine, which recently ran at the rate of a mile in 28 seconds for a short distance, and made the whole mile in 32 seconds, or the Empire State express, which has a record of 34 seconds for a mile. It is noticeable in both cases that a long run was made first, in order to "get up speed;" in other words, to acquire momentum. The Empire State express traveled 17 miles for this purpose; the Holman engine, 3 miles. Both present approximately 120 square feet of area when driving directly against the wind. If the wind is slightly on the quarter, this area would be much increased. But let us take the smallest area for our purpose. Taking the speed at two miles an hour the wind pressure would be 4 1-3 tons upon the square surface area of the train, head on. Reduced to horse-power, this would be roughly 3,000 h.p. But the engine actually possesses only about 1,500 h.p., and this is mainly used in overcoming the mechanical resistance of the inertia of the train, and all the friction of the machinery. Here, then, is a problem for objectors. It is evident that power is required merely to move the train. It is also evident that the engine does not possess sufficient horse-power to overcome the wind resistance alone, as ordinarily calculated. Whence then does the power come that not only moves the train, but overcomes the wind pressure also, and speeds along at a rate of a little under or over two miles a minute? Mr. Knapp says it is gained from the momentum. The engineers say there is nothing in momentum, but they do not answer this curious problem. Until they can it is at least possible, perhaps even probable, that Mr. Knapp is right. What you say in your July number as to the limitation of the effective power of the engines is admitted by Mr. Knapp to be true, and he has all along objected that this was a wasteful mode of applying the power. He wishes to apply it direct to the axle by the action of cranks.

I may add that I know the inventor well, and have constantly discussed the boat with him for the last three years. I do not wish him to be held responsible, however, for anything I have said except when it is directly attributed to him.

ONE OF THOSE INTERESTED.

Kingston, Dec., 1897.

NOTE.—The writer of the above letter has, in starting out, evidently confused wave motion with current. If he goes out on Lake Ontario after a storm, when a dead swell is on, and drops a stick on the water, he will find that though the waves heave ever so high the stick does not move away, but swings back and forward with each undulation. Even in a gale the surface water blown along by the wind is only a shallow "skim," and never keeps pace with the undulations of the waves. All the arguments built on this misconception fall to the ground, and need not be discussed. The writer asks, "What will become of that 1,462 tons (wind pressure) when 15,000 tons (weight of boat) are thrown against it?" One might answer that question by asking what will become of the roller boat when, with motive power limited to the slight leverage obtained by the weight of the internal machinery, it is exposed with its 112,500 square feet of surface to a howling gale? Our correspondent talks of the momentum of his boat overcoming the wind resistance, but how will he get his momentum without power? And power he has not got, and cannot get a boat on this plan. He is equally wrong in his speculations on the speed of a railway train. It is power, and not momentum, that enables a train to get into motion on an up-grade against a gale of wind. A gentleman of wide experience and good judgment, both on marine and mechanical questions, and who has studied Mr. Knapp's boat, is of opinion that three to six miles per hour is all she is capable of even in a comparative calm. With regard to the arguments used by "One of those Interested," he says:

"The supposition that the movement of the water against the direction of the vessel would help it to go ahead is absurd. The current of a river would be analogous to such a movement of water (if it existed). Therefore, if the Knapp boat was rolling up a river, the more rapid the river the faster the boat would run up it! The certainty is that the same law would hold good as in the case of any vessel. The speed up the river along the land would be the ordinary speed of the boat in calm water, minus the miles per hour of the current against it. The illustration is given of a beam sea causing a boat to roll. But a beam sea rolls the boat away from the wave, not towards it: With reference to the action of wind on the upper works, the proposition is made that if two moving