expenses which are lessened, such as interest on the additional equipment which would be needed if it did less work, including shops, care while not in service, etc. The purpose of a locomotive is to do work, and its efficiency is measured by its capacity for hauling trains, and of keeping in service as many days and running as many miles in a year as possible.

The Engineer says that the discussion thus far shows (1) that American coal is inferior to English coal, and (2) American firemen are not equal to their English brethren. The only reply one can make to this is, perhaps: Some is, or are—whichever is grammatical—and some is or are not. The character of American coals and firemen differ very much from each other, so that it does not seem worth while to make a general comparison, but probably if an English fireman should undertake to fire a consolidation or express engine while running up the grade west of Piedmont on the Baltimore & Ohio, or Altoona, on the Pennsylvania Railroad, he would get an experience he never had before.

Further, our contemporary summarizes by saying that the discussion shows that it costs more for fuel to haul heavy trains at slow speeds than would the haulage of lighter trains at higher speeds. Our assertion is that, while it may cost more for fuel, the total cost is less, and that is the important consideration with a railroad company.

Lastly, the writer in the Engineer concludes what he chooses to call the "defects" of the American locomotive "are the result of the conditions under which it is worked, not of defects in design or construction, or in want of adaptability to the work it has to perform." It is not easy to understand just what that means. If it is intended to say that American locomotives have been designed and constructed to do the work which they are intended to do, it is undoubtedly true, and if the converse proposition is asserted, that English locomotives are not designed or constructed so as to be capable of doing as much work as American locomotives, it would also probably be true. If, as the Engineer says, their locomotives, both passenger and goods, are worked as hard as they can be worked, and if, when they are thus worked their average production of steam does not exceed 500 lbs. per square foot of grate per hour, then it is plain from the data we have quoted that the British iron-horse has not as much bottom as his American congener.

Mire is not as common in London or Glasgow roads as it unfortunately is on some American streets, but if such obstruction to travel does exist there, it is doubtful whether a brewer in either of those cities would find a horse which could not pull his beer-wagon out of a "mud-hole" as valuable as one which could, even though the latter should consume more oats than the former.

But the question of the relative economy of feed of the two breeds of iron-horses, as stated by our contemporary, is not conceded. The difficulty is to make comparisons of the performance of engines under like conditions. To make fair comparisons, the weight and dimensions of engines and trains, the speeds and grades and other circumstances must be known. If our contemporary would give us some reports of carefully conducted experiments, it would throw some light on the subject. But why not adopt the suggestion made in our last number—let the *Engineer* and *Engineering News* each submit a design of locomotive to their readers for comparison and criticism. It will then be their readers' turn to be amused.

TWO VALUABLE WATERWAYS.

WHILE in many parts of the country there has been a disposition to abandon the artificial and even the natural waterways, and to allow them to be superseded by the railroads—a disposition much to be regretted for many reasons—a notable exception is to be found in the two canals which connect Hampton Roads with the extensive system of sounds and rivers of Eastern Carolina.

The older of these is the Dismal Swamp Canal, which extends from the Elizabeth River south of Norfolk to the Pasquotank River in North Carolina, and which is one of the oldest artificial waterways in the country. Chartered first in 1785, its seven locks, 100 × 18 ft. in size, were considered engineering feats in their day, and are still in constant use.

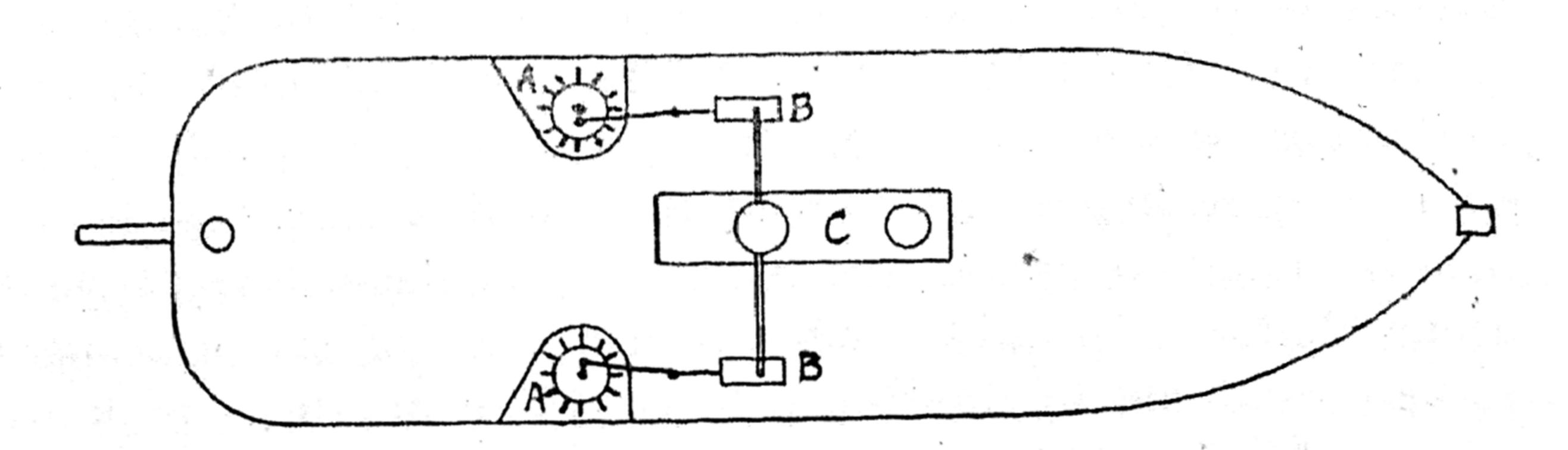
The other, the Albemarle & Chesapeake Canal, is shorter, but of larger section. It extends from the Elizabeth River to the North Landing River and has the advantage of the older work not only in size, but in the fact that it has but a single lock—240 × 95 ft. in size—and that a tidal lock, which has to be closed only at certain stages of water and in certain directions of the wind.

To equalize the conditions somewhat, the Dismal Swamp Canal Company has recently undertaken improvements which will much increase its capacity. These include an enlargement of section and the cutting down of the summit level, so as to dispense with several of the locks, and have really been made necessary by the increasing traffic.

The commercial importance of these canals can be seen from the fact that they brought to Norfolk last year 87 per cent. of the logs which supply the great lumber mills of that city, a very large proportion of the other forest products reaching the port, a considerable part of the corn, rice and naval stores, besides carrying a large traffic in merchandise southward bound.

Besides their commercial importance, these canals would be of great strategic value in case of war. A reference to the map will show how extended their water connections are and how much farther still they might be made to reach. It is to be hoped that before long improvement and extensions will be undertaken which will give, at a comparatively small outlay, an inland waterway from New York Bay to Florida, which might be of almost inestimable value in time of war, and which is sure to be commercially worth much more than its cost.

In this connection it may be of interest to note that a very early attempt at steam navigation on canals in this country was made on the Dismal Swamp Canal. The boat and its machinery were designed by Mr. Harris and by Lieutenant W. W. Hunter, of the United States Navy,



about 1840, and were for a time operated by Commodore Marshall Parks, who is still a resident of Norfolk. The boat is shown in the accompanying diagram, which is prepared from a sketch made by Mr. Parks. There were two wheels placed horizontally in semi-circular recesses cut in the sides of the boat; these wheels were simply drums