

the head is 3 feet in diameter, it will have an area of 1,017 square inches, and the total pressure against it, tending to push it from its place, will be 9,153 pounds.

If, in place of the confined head, you have a movable piston of the same size fitted into a smooth cylinder, and if your pipe has one inch of cross area with a movable piston fitted into it, then by pressing down the small piston with a force of 9 pounds, you raise the large one with a force of 9,153 pounds; but you raise the large piston through only one-thousandth part of the distance that you press downward the small one.—Eds.

Milling Tool Patterns.

MESSRS. EDITORS:—As you frequently inform machinists on little details connected with the trade, I take the liberty to ask you a question about something that has troubled me.

I recently bought a milling tool of a new and peculiar pattern. I don't know that I can describe it very well, but it was something like the letter L turned upside down all the way round the wheel, as in this figure: $\Gamma \Gamma \Gamma \Gamma \Gamma$. I applied this tool to a job, but instead of making the same pattern, there was a confused mass of nothing. What is the trouble?

J. J. H.

Philadelphia, Feb. 8, 1866.

[The trouble is in the respective sizes of the work and the wheel. Where such milling tools are used, the circumference of the wheel and the work must agree, or be in the same ratio. If the milling tool is three-fourths of an inch in diameter, the circumference of it will be 2.3562 inches. The surface to be worked on must be divided by this an even number of times. To find the circumference of any given circle, multiply the diameter by $3\frac{1}{4}$. The confusion arises from one part of the pattern running over the other. If you do not use figures, take a piece of tin, lap it round the wheel, and then make the job four or five times as large, or to suit the wheel.—Eds.

Coating Iron with Copper--Secret Processes.

MESSRS. EDITORS:—Will you be kind enough to send me the address of the gentleman who professes to cover iron with copper?

J. E. CARVER.

Bridgewater, Mass., Feb. 12, 1866.

[We are frequently in the habit of publishing the wants of our readers, and whenever we do so it is sure to bring to us a large number of responses. We can not for obvious reasons publish such replies except as advertisements at our usual rates. We cannot give Mr. Carver the information he seeks, but we presume some of our readers will be able to inform him.—Eds.

THE ALGONQUIN AND WINOOSKI---OFFICIAL REPORT OF THE CHIEF ENGINEERS.

GENERAL INSPECTOR'S OFFICE,
STEAM MACHINERY, UNITED STATES NAVY,
NEW YORK, Feb. 19, 1866.

SIR—The undersigned, appointed by you to conduct the experiments with the competitive machinery of the United States paddle-wheel steamers *Winooski* and *Algonquin*, have the honor to submit the following preliminary report of the result of the trial on Long Island Sound for maximum power of machinery and speed of vessel, and for economy of fuel under these conditions.

It will be followed by a full report, embracing the results of all the trials at the wharf as well as of that on Long Island Sound, together with our conclusions from the same, and all the data *in extenso*.

The trial on Long Island Sound was intended to embrace eight consecutive double runs, between Execution Rock Lighthouse and Faulkner's Island Lighthouse, passing round both. Each double run measured on the vessels' tack was, according to the coast survey chart, 113 geographical miles; but a violent storm accompanied by weather so thick as to prevent the lights being seen beyond a mile or two, and the refusal of the pilots to run in it, terminated the trial after the *Winooski* had performed three double runs, or 339 geographical miles and the *Algonquin* two double runs, or 226 geographical miles. Our data and results are accordingly for these distances respectively.

Neither vessels steered well, but they were about equal in this particular, which, of course, still further lessened their speed. The machinery of both vessels was in excellent order. That of the *Algonquin*, after

the completion of the wharf trials, had been for two and a half months in the hands of the contractor for repairs, during which time he had renewed all the vertical tubes of the boilers, substituting a new circulating pump.

In the course of the trial the feed pump worked by the main engine was inoperative ten and a half hours, during which time the boilers were supplied by the auxiliary steam pump; as, however, this pump draws the feed water from the hot well, its substitution in no way affected the performance of the machinery. The counter balance of the eccentric broke at the commencement of the trial, but its fracture was not of the least importance. A paddle on one of the wheels was also broken; but it took place on the return of the vessel to port, and not during the trial.

On board the *Algonquin* the blower was used, but as it delivered the blast into an open fire room its efficiency must have been very small. The steam jet in the smoke pipe was in use, and, with a boiler pressure of 68 lbs. per square inch above the atmosphere, was doubtless very efficient in forcing the draft. On board the *Winooski* the blowers were not used. They are two in number, driven by an independent steam cylinder, and delivered their blast into the ash pits of the boilers, which are closed by air tight doors; when employed, an enormous rate of combustion can be obtained, and a supply of steam much exceeding that used during the trial. A steam jet (a duplicate of that of the *Algonquin*) in the smoke-pipe was employed during the trial, with a boiler pressure of 38 pounds per square inch above the atmosphere.

At the commencement of the trial the *Algonquin's* draft of water was 8 feet 5 inches forward and aft, and the *Winooski's* draft was 8 feet 10 inches forward, 8 feet 8 inches aft. The difference of 4 inches in the mean draft was an allowance made for the deeper false keel of the latter vessel; both vessels being presumed to be in other respects identical, as they were constructed from the same building directions and mold-loft dimensions.

The boilers of the *Winooski* contain 200 square feet of grate surface and 5,036 square feet of heating surface, and have no means of superheating the steam. The boilers of the *Algonquin* contain 144 square feet of grate surface, and 2,678 square feet of heating surface, together with 1,132 square feet of steam superheating surface in tubes. The boilers of both vessels have water tubes. In the *Winooski* they are vertical and are arranged above the furnaces, according to Martin's patent; and in the *Algonquin* they are inclined and arranged in combination with the superheating tubes, according to the patent of Mr. E. N. Dickerson, who designed the entire machinery of that vessel.

Each vessel has one inclined and direct acting engine. The cylinder of the *Winooski* is 58 inches diameter, and its piston has a stroke of 8 feet 9 inches. The cylinder of the *Algonquin* is 48 inches diameter, and its piston has a stroke of 10 feet.

The space occupied in the *Winooski* by the machinery and coal is 57 feet 11 inches long, by the entire breadth and depth of the vessel; and in this space there is a coal bunker capacity of 9,429, cubic feet. The space occupied in the *Algonquin* by the machinery and coal is 85 feet 9 inches long, by the entire breadth and depth of the vessel.

The weight of the machinery of the *Winooski*, exclusive of the water in the boilers, is 541,718 pounds, and inclusive of the water, 623,918 pounds. The weight of the machinery in the *Algonquin*, exclusive of the water in the boilers, is 629,144 pounds, and inclusive of the water, 701,144 pounds. The distribution of the weight of her machinery was so faulty that when the vessel was fully stowed for sea, with her coal bunkers filled, water in boilers, etc, she had a list of 22 inches to port, giving her port paddle-wheel an immersion of 7 feet 3½ inches, and her starboard wheel an immersion of 3 feet 7½ inches. To bring the vessel upright, there was required a weight of 73 tons to be stowed on her decks, in the extreme wing, after the hold had been stowed, in such a manner as to place all the weight possible on the starboard side.

The following are the principal dimensions of each vessel, the greatest transverse section, and the displacement corresponding to their draft of water

at the commencement of the trial:—Depth 8 feet 2½ inches, length 240 feet, extreme breadth on mean load water line 35 feet; displacement, 1,280.78 tons; area of greatest immersed transverse section, 263.85 square feet.

During the time the machinery of both vessels was in operation a complete steam log was kept of their performance, in which was noted, in proper columns, at the end of each hour, the number on the counter, the number of revolutions made by the engines per minute during the hour, the steam pressure in the boilers and in the main steam pipe near the engine, the vacuum in the condenser and the position of the throttle valve, the temperature of the atmosphere on deck, of the engine room, of the fire room, of the injection water, of the discharge water, and of the hot well or feed water; also the height of the barometer in the engine room. An accurate account was kept of the coal thrown into the furnace each hour, and of the refuse withdrawn from the furnaces and ashpits at the end of each watch of four hours. At the end of every half hour an indicator diagram was taken from each end of the cylinder, and the complete data marked on it at the time taken, and of the number of revolutions of the engine per minute, steam pressure, vacuum etc. A naval engineer was always on watch in the fire room and engine room of each vessel. The point at which the steam valve of the *Winooski* closed and cut off the admission of steam to the cylinder, measured on the main crosshead guides, was 6 feet 4 inches from the commencement of the piston on the lower stroke, and 6 feet on the upper stroke. The mean point of cutting off, therefore, was at seven-tenths of the stroke of the piston from the commencement. As the cut-off of the *Algonquin* was not a positive one, the point of cutting off was obtained from the indicator diagrams, and is the mean given by them.

The contract for the *Algonquin's* machinery provides that the entire responsibility is to rest with the said party of the first part, who will make their own working drawings, and arrange and proportion the details of the said machinery in such manner as they shall deem best calculated to secure the most successful operation.

The machinery of the *Winooski* has worked in the most perfect manner throughout, and its performance in every particular leaves nothing to be desired for efficiency in a paddle-wheel steamer. Its durability and reliability could be depended upon for any length of cruising. Its workmanship, material, finish, accessories and appointments are first-class throughout. The machinery of the *Algonquin* is wanting in these particulars, and in proper adaptation for marine purposes. In style, finish and convenience for manipulation, and in all its appointments, it is much inferior to that of the *Winooski*.

We find that the machinery of the *Algonquin* developed only 54.29 per centum of the power developed by the *Winooski's* machinery, and that the cost of the indicated horse power in pounds of anthracite consumed per hour with the machinery of the *Algonquin* was 18.58 per centum more than with the machinery of the *Winooski*, taking that of the latter for units. If the comparison be made as it properly should be, for economy of fuel, by taking the combustible matter of the coal, instead of the coal itself, for the expression of the cost of the power, as the per centum of refuse in ashes and clinker in an accidental and variable proportion, then the cost of the indicated horse power in pounds of combustible consumed per hour with the machinery of the *Algonquin* was 23.28 per centum more than the machinery of the *Winooski*. In this most important guarantee for amount of power and economy of fuel this failure of the contractor is the greatest of all, resulting in a loss of speed of nearly two geographical miles per hour, and a large increase of the cost of the steam power, *pro rata*.

In every point guaranteed by the contractor for the *Algonquin's* machinery he has failed, and we are of the opinion that it is totally unfit for the naval service. The steam logs of the experiments and the indicator diagrams are herewith forwarded.

ROBERT DANBY,
EDWIN FITHIAN,
MORTIMER KELLOGG, } Chief Eng'rs, U.S.N.

JOHN B. WOLFF will oblige us by sending his Post Office address.