For the Journal of the Franklin Institute.

Performance at Sea of the U. S. Steamship Fulton. By Chief Engineer B. F. Isherwood, U. S. Navy.*

The following account of the steaming of the *Fulton* from St. Mary's, Florida, to Havanna, during the $3\frac{1}{2}$ days she was making the passage, will show the performance of the vessel at sea under the ordinary circumstances of wind and swell. The mean draft of water was slightly less than the draft with half coal out and all other weights full.

Average steam pressure in boiler per square inch above atmosphere,	28 pounds.
Initial " cylinder " "	26·3 "
Average vacuum in condenser, of mercury, . .	27 inches.
Steam cut off at, from commencement of stroke of piston,	3 feet.
Mean effective steam pressure per square inch of piston, calculated for 2 pounds greater back pressure than in the condenser, and including expansive effect of steam in nozzles, clearance, &c.,	25 pounds.
Bulk of steam comprised between cut-off valve and piston at one end of cylinder, ...	3·094 cubic feet.
Double strokes of piston per minute, ...	$19\frac{1}{2}$.
Horses power developed by the engine, ...	599·5.
Soft anthracite consumed per hour, . . .	2200 pounds.
Speed of the vessel per hour in knots of 6140 feet, .	$10\frac{3}{4}$.

Evaporation by the Boilers.

The space displacement of the piston per stroke of 10 feet 4 inches, is 140·9 cubic feet, and for 3 feet of that stroke is 40·644 cubic feet, to which add the space comprised between cut-off valve and piston, 3·094 cubic feet, making a total of 43·738 cubic feet of steam of the total pressure of 41 pounds per square inch, used per stroke; which per hour would become $(43{\cdot}738 \times 19\frac{1}{2} \times 2 \times 60)$ 10234·69 cubic feet: to this must be added the loss by *blowing off*, so as to maintain the density of the water in the boilers at $\frac{2}{3}\frac{2}{2}$.

The temperature of steam of the above pressure is 270·6° F., taking the temperature of the hot well at 100° F., and the total heat of steam at 1202° F., (neglecting small corrections, which would be out of place applied to data taken from the ship's log,) the proportion of caloric expended on the water evaporated would be (1202°—100°) 1102°; and on the water blown out (270·6°—100°) 170·6°, which is 13·4 per cent. of the sum (1102°+170·6°=1272·6) of the two, leaving 86·6 per cent. as the amount utilized. Increasing the evaporation in this proportion, we obtain $\left(\frac{10234{\cdot}69 \times 100}{86{\cdot}6}\right)$ 11818·35 cubic feet of steam per hour. The relative volumes of this steam and the water from which it is generated are 664 and 1, which give for the water evaporated $\left(\frac{84504{\cdot}80}{664}\right)$ 177·99 cubic feet. Taking the weight of a cubic foot of sea water at 64·3 pounds, there would be evaporated per hour by 2200 pounds of soft anthracite, $(177{\cdot}99 \times 64{\cdot}3)$ 11444·757 pounds of sea water, or 5·202 pounds of water per pound of coal.

* See ante, pp. 195 and 122.

SLIP OF THE PADDLE WHEELS.

The circumference of the centre of effort of the paddle wheels is 72·26 feet; consequently,

$72{\cdot}26 \times 19\frac{1}{2} \times 60 = 84544{\cdot}20$ feet = speed centre effort paddles per hour.
$10\frac{3}{4} \times 6140 = 66005{\cdot}00$ feet = speed of vessel per hour.

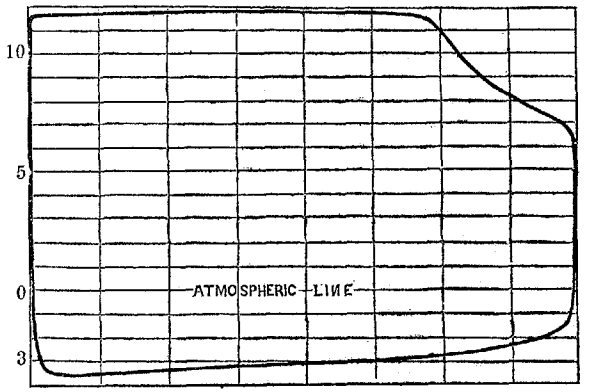
18539·20 feet = slip centre effort paddles per hour, or 21.93 per cent.

INDICATOR DIAGRAMS.

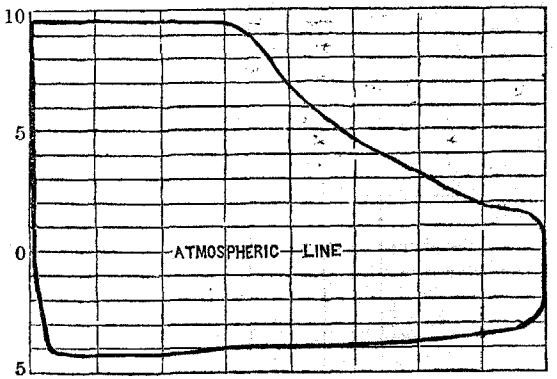
The indicator diagrams are added to show the action of the valves and the manner of using steam. The cut-off is Sickels', and momentarily adjustable. Under ordinary steaming at sea, the blowers are only used occasionally, when cleaning fires, pumping up, &c.

The indicator diagrams were taken in New York Bay, with the vessel deep laden, ready for a cruise.

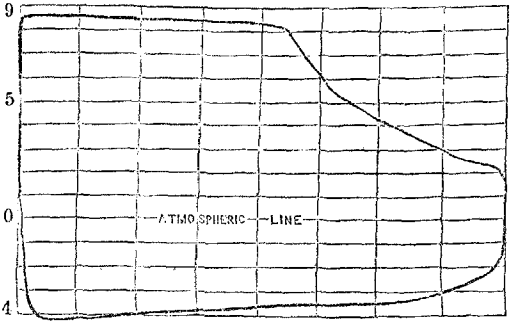
No. 1. Initial steam pressure in cylinder per square inch of piston above atmosphere, 35 pounds; cut off at three-fourths stroke of piston. Mean effective pressure throughout stroke of piston, $41\frac{1}{2}$ pounds. Double strokes of piston, 23 per minute.



No. 2. Initial steam pressure in cylinder per square inch of piston above atmosphere, 29 pounds; cut off at full three-eighths stroke of piston. Mean effective pressure throughout stroke of piston, $30\frac{1}{2}$ pounds. Double strokes of piston, 20 per minute.



No. 3. Initial steam pressure in cylinder per square inch of piston above atmosphere, 25½ pounds; cut off at $\frac{9}{16}$ths stroke of piston. Mean effective pressure throughout stroke of piston, 30½ pounds. Double strokes of piston, 20 per minute.



It will be observed, that the double strokes of piston were nearly in the proportion of the square roots of the effective pressure on it.

The square root of 41½ is 6·442; of 30½ it is 5·523; or the two are in the proportion of 1·166 to 1·000.

The double strokes of piston, 23 and 20, are in the proportion of 1·150 to 1·000.

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U. S. Screw Steam Tug "John Hancock." By Chief Engineer B. F. Isherwood, U. S. Navy. (*With a Plate.*)

The *John Hancock* was constructed in 1850, to answer the double purpose of a steam tug and water tank for the U. S. Navy Yard at Charlestown, Mass., where she has since been stationed, with the exception of a short cruise to the Gulf of Mexico, during the *fillibuster* excitement of the Lopez expedition. On that occasion she was brig rigged, and carried a battery. The results hereinafter given are the mean of her performance at sea, without sail, under ordinary circumstances of weather.

The hull was built at the Charlestown Navy Yard. The machinery was constructed at the Washington Navy Yard, by Mr. Ellis, from the designs of Mr. Charles W. Copeland.

Hull.—Length between perpendiculars,		113 feet.
Beam, extreme,		22 "
Depth of hold,		9 "
Burthen,		208 tons.
Draft of water with half coal in, and all other weights full,	forward,	6 feet.
	mean,	8¼ "
	aft,	10½ "
Immersed amidship section at the mean draft of 8¼ square feet,		154 square feet.
Square feet of immersed amidship section per cubic foot of space displacement of piston, multiplied by number of double strokes of piston per minute,		0·036.
Square feet of immersed amidship section per cubic foot of space displacement of piston,		2·017.