This manner of using steam proving unsatisfactory, the cylinders were altered as shown in indicator diagrams, Nos. 5, 6, 7, and 8. Nos. 5 and 6 were taken in succession from the front and back ends of the *starboard* cylinder; the steam pressure in boiler per square inch above atmosphere was respectively 15 and 18 pounds; double strokes of piston, 21 per minute. In No. 5, the mean effective pressure per square inch of piston was 14 pounds; in No. 6, 17·33 pounds; the steam in starboard cylinder was cut off at one-sixth the stroke from the commencement.

Nos. 7 and 8 were taken immediately after Nos. 5 and 6, from the front and back ends of the *port* cylinder; the steam pressure in boiler per square inch above atmosphere was respectively 16 and 17 pounds; double strokes of piston, 21 per minute. In No. 7 the mean effective pressure per square inch of piston was 13.33 pounds; in No. 8, 14·83 pounds; the steam in port cylinder was cut off at one-ninth the stroke from the commencement. In all of these diagrams the vacuum in condenser per gauge was 28 inches of mercury; throttle wide open.

I have no account of the fuel now used, but am informed that no difficulty is found in keeping steam; the corners of the diagrams are also much squarer than before, and the expansion curve shows the cylinder valves, which were of the "balance puppet" kind, to have been tight.

For the Journal of the Franklin Institute.

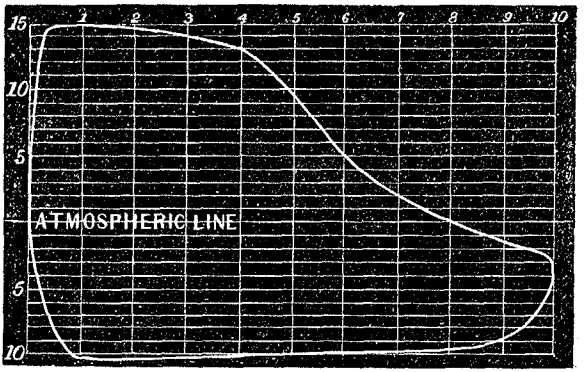
Performance of the U. S. Mail Steamer Arctic, on her Eighth Voyage from New York to Liverpool. By B. F. Isherwood, Chief Eng. U. S. Navy.

Day.	Date. 1852.	Average steam pressure in boiler. Pounds per sq. in.	Average revolutions per minute.	Total revolutions made per day.	Time h. m.	Anthracite coal. Tons burn'd per day.	Geographical miles ran per day.
1st	Feb. 8th.	17·0	14·5	20,550	23 45	85	300
2d	" 9th.	16·7	14·3	20,167	23 30	75	310
3d	" 10th.	17·5	15·3	21,704	23 34	80	325
4th	" 11th.	17·5	15·8	22,419	23 30	88	331
5th	" 12th.	17·0	15·7	22,254	23 25	89	336
6th	" 13th.	16·1	15·3	21,497	23 31	89	234
7th	" 14th.	17·0	16·4	23,104	23 25	92	316
8th	" 15th.	17·0	16·7	23,440	23 23	90	307
9th	" 16th.	16·7	16·5	23,237	23 22	91	301
10th	" 17th.	16·5	17·5	22,594	21 25	87	295
	Totals,			220,966	d. h. m. 9 16 41	866	3055
	Means,	16·9	15·827			8337·3 lbs. per hour.	13·13 pr h'r.

Indicator Diagram.—The accompanying indicator diagram shows the mean performance. When taken, steam pressure in boiler above atmos-

phere per square inch, 17 pounds; double strokes of piston per minute, 16; mean effective pressure on piston throughout the stroke, 16·9 pounds; throttle partly closed; calculating the horse power developed by the engine for this pressure and for 15·827 double strokes of piston per minute, we have, area of both pistons, 14176·46 square inches; stroke of piston, 10 feet; mean effective pressure per square inch of pistons, 16·9 pounds; speed of piston per minute, 316·54 feet.

$$\frac{14176{\cdot}46\times16{\cdot}9\times316{\cdot}54}{33000}=2298{\cdot}1 \text{ horse power.}$$



Evaporation by the Boilers.—The mean initial steam pressure in the boilers may be taken at 14·3 pounds per square inch above atmosphere, cut off at 4½ feet from commencement of stroke of piston. Space displacement of both pistons filled per stroke with steam, 443·016 cubic feet, to which add space comprised between cut off valve and piston at one end of cylinder, (for both cylinders,) 25 cubic feet, making a total bulk of 468·016 cubic feet of steam of the total pressure of 29 pounds per square inch, used per stroke of piston, which per hour would become (468·016×15·827×2×60) 888874·708.

The loss by *blowing off* at $\frac{2}{3}\frac{2}{2}$, will be as follows: neglecting small corrections, total heat of steam, 1202° F.; temperature of feed water, 100°F.; temperature of steam of 29 pounds total pressure, 249·6°; then, 1202° —100° = 1102°; and, 249°·6—100 = 149·6°. Sum of the caloric utilized in steam and lost in *blowing off*, (1102°+149°·6)1251°·6, of which 1102° is 88 per cent. and $\frac{888874{\cdot}708\times100}{88}=1010084{\cdot}9$ total cubic feet of steam of 29 pounds total pressure generated per hour. The relative volumes of this steam and the water from which it is generated, is 911· and 1, and $\frac{1010084{\cdot}9}{911}=1108{\cdot}765$ cubic feet of sea water evaporated per hour, which at 64·3 pounds per cubic foot, would amount to 71293·59 pounds of water evaporated per hour by 8337·3 pounds of anthracite, or 8·55 pounds of water per pound of coal.

This is perhaps a higher result than has ever before been attained by a marine boiler making a long trip, and fired and cleaned in the ordinary manner by ordinary firemen. It will be observed that the results obtained

under the above practical conditions, are very different from what would be given by a more experimental trial of a few hours on shore, with a small quantity of fuel skilfully burned, and all avenues of losses carefully guarded. It must also be considered that these boilers have been in use for some time, and are probably considerably encrusted with scale.

The features of these boilers are, 1st, The heating surface is nearly all vertical surface.

2d, The proportion of calorimeter or draft area to the grate surface is very large at first, and diminishes to nearly one half in the chimney, being at front of tubes, 1·000 to 5·205; at back of tubes, 1·000 to 7·840; in chimney, 1·000 to 10·000.

3d, The proportion of heating to grate surface is very large, being $33\frac{1}{4}$ to 1.

4th, The hot gases are kept by means of a hanging bridge in contact with the heating surface, until their temperature is properly reduced.

5th, A very great height of chimney, being 75 feet above grates, giving a good draft even with the greatly diminished chimney calorimeters; the rapidity of the combustion is not remarkable as either fast or slow, being at the rate of 13·13 pounds of coal per square foot of grate per hour.

6th, A double tier of furnaces, one furnace in the upper and one in the lower tier, mingle their hot gases at the same bridge. By alternate firing below and above, the temperature of the mingled gases is always kept sufficiently high for combustion, while practically, no inconvenience is found in firing furnaces so arranged.

Slip of the Paddle Wheel.—The circumference of the centre of effort of the paddles is 107·3 feet. The mean slip was, therefore,

107·3×15·827×60=101894·226 ft.=sp. of cen. effort of paddles p. h.
13·13×6140 = 80618·200 ft.=speed of vessel per hour.

21276·026 ft.=slip per hour, or 20·88 per cent.

For the Journal of the Franklin Institute.

Propeller Steamers between Boston and Halifax.

The Boston merchants, after chaining their tri-mount City to the surrounding States as well as the Canadas, by the aid of their seven magnificent railroads, have concluded to extend the sphere of their mercantile enterprise, by launching into a new element, in the establishment of a line of propeller steamers, to ply between Boston and Halifax; and to that end, Messrs. Clark & Jones have contracted for a propeller as the pioneer, of the dimensions herein given.

The trade between Boston and Halifax has heretofore been carried on by a line of sailing vessels, belonging to the same gentlemen, except what may have been done by the English Mail Steamers.

The manifest advantages of propellers over sailing vessels is so plain, from the fact, that the trips of the latter must necessarily be without regularity, while those of the former, under all ordinary circumstances, can be be depended on, that the surprise is, that a line of this description has not been put in operation before this. Many passengers from Halifax, as