

71, 72. *Cape Ann, Massachusetts.*—This 10-inch steam whistle was in operation 465 hours and consumed about 30 tons of coal.

1891. 84. *Boston, Massachusetts.*—This first-class steam siren was in operation 793 hours, consuming about 56 tons of coal.

93. *Race Point, Massachusetts.*—The 12-inch steam whistle was in operation 614 hours and consumed about 29 tons of coal.

Second District.

99. *Cape Cod, Massachusetts.*—This first-class Daboll trumpet was in operation 567 hours, consuming about 6 tons of coal.

105. *Pollock Rip Light-Vessel, No. 42, Massachusetts.*—This 12-inch steam whistle was in operation 914 hours and consumed about 75 tons of coal.

109. *Great Round Shoal Light-Vessel, No. 47, Massachusetts.*—This light-ship, which has a 12-inch steam chime whistle, will be placed on this station by mid-summer.

127. *West Chop, Massachusetts.*—This 10-inch steam whistle was in operation 494 hours and consumed about 25 tons of coal.

130. *Vineyard Sound Light-Vessel, No. 41, Massachusetts.*—The 12-inch steam whistle was in operation 905 hours and consumed about 77 tons of coal.

Second District.

73, 74. *Cape Ann, Massachusetts.*—This 10-inch steam whistle was in operation 511 hours and consumed about 25 tons of coal.

1892. 86. *Boston, Massachusetts.*—This first-class steam siren was in operation 757 hours, consuming about 52 tons of coal.

95. *Race Point, Massachusetts.*—The 12-inch steam whistle was in operation 627 hours and consumed about 28 tons of coal.

101. *Cape Cod, Massachusetts.*—This first-class Daboll trumpet was in operation 522 hours, consuming about 6 tons of coal.

107. *Pollock Rip Light-Vessel, No. 42, Massachusetts.*—This 12-inch steam whistle was in operation 1,146 hours and consumed about 86 tons of coal.

111. *Great Round Shoal Light-Vessel, No. 47, Massachusetts.*—This 12-inch steam chime whistle was in operation 856 hours and consumed about 93 tons of coal.

129. *West Chop, Massachusetts.*—This 10-inch steam whistle was in operation 485 hours and consumed about 24 tons of coal.

132. *Vineyard Sound Light-Vessel, No. 41, Massachusetts.*—The 12-inch steam whistle was in operation 1,134 hours and consumed about 93 tons of coal.

1893

75. *Cape Ann, Massachusetts.*—This 10-inch steam whistle was in operation 590 hours and consumed about 36 tons of coal.

87. *Boston, Massachusetts.*—This first-class steam siren was in operation 467 hours and consumed about 47 tons of coal.

96. *Race Point, Massachusetts.*—This 12-inch steam whistle was in operation 753 hours and consumed about 38½ tons of coal.

102. *Cape Cod, Massachusetts.*—This first-class Daboll trumpet was in operation 597 hours and consumed about 8½ tons of coal.

108. *Pollock Rip light-vessel, No. 47, Massachusetts.*—This 12-inch steam chime whistle was in operation 1,103 hours and consumed about 105½ tons of coal.

112. *Great Round Shoal light-vessel, No. 42, Massachusetts.*—This 12-inch steam whistle was in operation 933 hours and consumed about 108¾ tons of coal.

115. *Nantucket New South Shoal light-vessel, No. 54, Massachusetts.*—This 12-inch steam whistle was in operation 616 hours and consumed about 104 tons of coal.

130. *West Chop, Massachusetts.*—This 10-inch steam whistle was in operation 438 hours and consumed about 20¾ tons of coal.

133. *Vineyard Sound light-vessel, No. 41, Massachusetts.*—This 12-inch steam whistle was in operation 1,018 hours and consumed about 97¾ tons of coal.

FOG SIGNALS OPERATED BY STEAM OR HOT-AIR ENGINES.

1894

75. *Cape Ann, Massachusetts.*—This 10-inch steam whistle was in operation some 554 hours and consumed about 37 tons of coal.

88. *Boston, Massachusetts.*—This first-class steam siren was in operation some 709 hours and consumed about 55 tons of coal.

97. *Race Point, Massachusetts.*—This 12-inch steam whistle was in operation some 593 hours and consumed about 37 tons of coal.

103. *Cape Cod, Massachusetts.*—This first-class Daboll trumpet was in operation some 688 hours and consumed about 8½ tons of coal.

109. *Pollock Rip light-vessel, No. 47, Massachusetts.*—This 12-inch steam chime whistle was in operation some 859 hours and consumed about 106 tons of coal.

113. *Great Round Shoal light-vessel, No. 42, Massachusetts.*—This 12-inch steam whistle was in operation some 791 hours and consumed about 85 tons of coal.

116. *Nantucket New South Shoal light-vessel, No. 54, Massachusetts.*—This 12-inch steam whistle was in operation some 1,027 hours and consumed about 137 tons of coal.

131. *West Chop, Massachusetts.*—This 10-inch steam whistle was in operation some 565 hours and consumed about 25 tons of coal.

134. *Vineyard Sound light-vessel, No. 41, Massachusetts.*—This 12-inch steam whistle was in operation some 1,182 hours and consumed about 105 tons of coal.

1895 77, 78. *Cape Ann, Massachusetts*.—This 10-inch steam whistle was in operation some 692 hours, and consumed about 41 tons of coal.

89. *Boston light-vessel, No. 54, Massachusetts*.—This 12-inch steam chime whistle was in operation some 556 hours, and consumed about 121 tons of coal. It was established on October 1, 1894.

91. *Boston, Massachusetts*.—This first-class steam siren was in operation some 925 hours, and consumed about 70 tons of coal.

102. *Race Point, Massachusetts*.—This 12-inch steam whistle was in operation some 693 hours, and consumed about 29 tons of coal.

108. *Cape Cod, Massachusetts*.—This first-class Daboll trumpet was in operation some 704 hours, and consumed about 11 tons of coal.

114. *Pollock Rip light-vessel, No. 47, Massachusetts*.—This 12-inch steam chime whistle was in operation some 1,327 hours, and consumed about 158 tons of coal.

118. *Great Round Shoal light-vessel, No. 12, Massachusetts*.—This 12-inch steam whistle was in operation some 956 hours, and consumed about 99 tons of coal. It gave out in June, 1895, and was temporarily replaced by a bell.

121. *Nantucket New South Shoal light-vessel, No. 54, Massachusetts*.—This 12-inch steam whistle was in operation some 234 hours, and consumed about 19 tons of coal. She was on this station only from July 1 to October 1, 1894.

Light-vessel No. 58.—This 12-inch steam whistle was in operation some 1,121 hours, and consumed about 137 tons of coal. She was on this station only from October 1, 1894, to June 30, 1895.

136. *West Chop, Massachusetts*.—This 10-inch steam whistle was in operation some 631 hours, and consumed about 32 tons of coal.

141. *Vineyard Sound light-vessel, No. 41, Massachusetts*.—This 12-inch steam whistle was in operation some 1,325 hours, and consumed about 112 tons of coal.

1896

85, 86. *Cape Ann, Massachusetts*.—This 10-inch steam whistle was in operation some 470 hours, and consumed about 31 tons of coal.

97. *Boston light-vessel, No. 54, Massachusetts*.—This 12-inch steam chime whistle was in operation some 628 hours, and consumed about 118 tons of coal.

100. *Boston, Massachusetts*.—This first-class steam siren was in operation some 657 hours, and consumed about 78 tons of coal.

116. *Race Point, Massachusetts*.—This 12-inch steam whistle was in operation some 660 hours, and consumed about 29 tons of coal.

122. *Cape Cod, Massachusetts*.—This first-class Daboll trumpet was in operation some 761 hours, and consumed about 10 tons of coal.

128. *Pollock Rip light-vessel, No. 47, Massachusetts*.—This 12-inch steam chime whistle was in operation some 1,064 hours, and consumed about 115 tons of coal.

132. *Great Round Shoal light-vessel, No. 42, Massachusetts*.—The boilers of this ship were disabled from July 1, 1895, and the whistle could not be used while she was on her station. During the time relief light-vessel No. 39 was on the Great Round Shoal station her steam whistle was in operation some 151 hours, and she consumed about 17 tons of coal.

135. *Nantucket New South Shoal light-vessel, No. 58, Massachusetts*.—This 12-inch steam whistle was in operation some 1,137 hours, and consumed about 135 tons of coal.

150. *West Chop, Massachusetts*.—This 10-inch steam whistle was in operation some 526 hours, and consumed about 29 tons of coal.

155. *Vineyard Sound light-vessel, No. 41, Massachusetts*.—This 12-inch steam whistle was in operation some 526 hours, and consumed about 29 tons of coal.

EXPERIMENTS WITH FOG SIGNALS.

1896

The following is an abstract of the report made to the Board by Maj. W. R. Livermore, Corps of Engineers, United States Army, engineer of the First and Second light-house districts:

Early in the year some preparations for fog-signal experiments were made at Boston light. Last fall the temporary fog-signal building was removed to a more convenient location, on the eastern side of the rain sheds, and was enlarged and

Second District.

improved. An 8 by 8 inch Knowles air compressor was set up in it, also a small alternating dynamo to furnish current for experimental electrical siren.

Kites similar to those used at the Blue Hill meteorological observatory were prepared and tested. The necessary electrical connections were made to send up a telephone receiver to detect sounds in the upper air. A combined baro-thermo-hydrograph, designed by Mr. Rotch, of Blue Hill, was made by Richard Frères, of Paris, France. It is proposed to send this instrument up in the air in order to obtain

hyrograph, designed by Mr. Ketch, of Blue Hill, was made by Richard Frères, of Paris, France. It is proposed to send this instrument up in the air in order to obtain an automatic record of the meteorological conditions.

Several hand strikers, to give uniform blows of 50 foot-pounds on fog bells, were made in the machine shop at Boston for Negro Island, Dice Head, Grindel Point, and other light and fog-signal stations. The advantages of this type are that the bell must be struck each time with the same force. The machine is simple in design, with parts easily repaired and duplicated. One has been installed at the Cuckolds light-station, Maine, for more than a year and has proved very satisfactory. It is used when the trumpet is disabled or when fogs come up before the trumpet is ready to blow.

During the spring of 1895 an electrical striking apparatus, consisting of a hammer actuated by an electro-magnet, was installed in Portland Harbor, Maine, on the Staniford Ledge bell buoy. The operating electric current was supplied through a submarine cable by gravity cells at the Portland Breakwater light-station, about 300 feet distant, and clockwork at the same place automatically made and broke the circuit at the desired intervals. The arrangement worked satisfactorily, but the blow was too feeble.

When the buoy was taken up in the fall the bell was transferred to the lantern deck of the light-house, and in January was provided with an apparatus made at the Boston machine shop designed to strike the bell a heavier blow. The arrangement consists of a small motor, which, by means of a worm, a train of gears, cam, and bell crank lever draws the hammer arm back against the tension of the spring, releasing it once for every revolution of the cam. With the exception of the hammer and hammer arm, the parts are all inclosed in a weather-proof composition box.

The power is supplied by a battery of chloride accumulators in the light-house. They have given satisfaction, but the cells of the latest form, soon to be installed, will probably be still better. A switch and rheostat on the first floor of the light-house admit of the control of the apparatus from that point. In May, 1896, the striker was transferred to the buoy. The motor armature was supplied with a new commutator and brushes. Several other improvements were made on the machine to lessen friction.

The composition box which contains the motor and gears was remodeled, so that now all parts of the machine are readily accessible. A new cam was designed, that the load on the motor might be constant. Further improvements are under consideration.

In connection with the experiments with electrical sirens, six trumpet buzzers were purchased. These contain metallic disks, vibrated by an automatically interrupted current.

The pitch of a 4,000-pound bell of the ordinary type is rather too low for a fog signal, so a thicker one has been cast giving a higher pitch. This bell stood 116,000 blows of about 100 foot-pounds, and it is believed that the bell is capable of standing such blows indefinitely. It is to be installed at Pemaquid Point light-station, Maine.

One 1,000-pound bell of the ordinary type was broken by 6,000 blows of 150-foot pounds each. Another 1,000-pound bell of another make, which had been used a short time at the Cuckolds light-station, was broken by 12,160 blows of 150 foot-pounds.

A 10-inch chime whistle has been tested in comparison with an ordinary 10-inch whistle, with steam at 50 pounds pressure, but no exact measurements have been made.

1896.

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During the winter and spring the principal work was the comparison of caloric and oil engines.

The caloric engines tested were the old Ericsson 36-inch engine at Manana Island fog-signal station, and the Rider engine at Cuckolds light-station, Maine. In the former a fresh supply of air is drawn in at every revolution. It is necessary to have the doors open in order to keep the fires, with the wind in certain directions. The engine develops only a little over 1 horsepower, which is not sufficient for the work.

The Rider engine differs in principle from the Ericsson in that the same air is used over and over, being passed from the power cylinder over the fire box through a bundle of wire gauze into a supply cylinder cooled by water and back again. The wire gauze alternately abstracts heat from the air and restores it as it passes through. The engine tested was in good condition, but it was found to be inadequate for its work. It develops about one-third horsepower, and its action was dependent on the direction of the wind.

The oil engines tested were of two classes, one deriving power from the explosion of a mixture of kerosene vapor and air in the cylinder, the other using kerosene as a fuel and steam as a motor power. They were each of a vertical type. The comparison between the classes was made with the Hornsby-Akroyd and the Shipman.

The Hornsby pumps oil through an atomizer into a cast-iron hood placed on top of the power cylinder, where it mixes with the air drawn in at every second stroke. The mixture is exploded by the heat of the hood, which is kept hot by the explosion. Before starting, it is heated by a blast lamp. The water for cooling the cylinder is supplied by a pump connected to the engine.

A Grob engine, belonging to the same class as the Hornsby, but requiring a lamp to keep the explosive chamber hot, was tested to some extent. It could not easily develop more than 1 horsepower, though rated at 2½ horsepower.

The Shipman engine has a boiler of the water-tube type, tested to four times the working pressure.

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A 10-inch chime whistle has been tested in comparison with an ordinary 10-inch whistle, with steam at 50 pounds pressure, but no exact measurements have been made.

1896.

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Second District.

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A Grob engine, belonging to the same class as the Hornsby, but requiring a lamp to keep the explosive chamber hot, was tested to some extent. It could not easily develop more than 1 horsepower, though rated at 2½ horsepower.

The Shipman engine has a boiler of the water-tube type, tested to four times the working pressure.

A 1 horsepower Kane engine of the same type was tested in previous years. It was designed for a marine engine, being fitted to use coal as well as oil for fuel.

The engines were first tested with the regular oil of 150 degrees used for lamps, and subsequently with oil of 115 degrees test.

The following is a summary of the tests that have been made on the Shipman and Hornsby engines:

Name of engine.	Horse-power.	Oil per hour.	Water per hour.	Boiler pressure.	Revolutions.
Shipman, 2 horsepower:		Quarts.	Gallons.	Pounds	
115 test oil	0.076	2	3.2	60.2	291
Do .....	.50	1.6	6.2	63.3	404
Do .....	.93	3.5	7	97.4	397
150 test oil	1.13	4.4	8.7	68.7	164
Do	1.20	6.4	9.2	83.2	276
115 test oil	1.64	4.3	12	98	395
Hornsby, 3½ horsepower:					
115 test oil .....	.69	1.2	* 46.2	.....	186
Do	1.57	1.9	* 85.4	.....	234
Do	2.40	2.5	* 51.1	.....	225

* Water for cooling.

The results of the tests so far made warrant the conclusion that oil-consuming engines have decided advantages over caloric engines using coal as fuel in weight and space occupied by the apparatus, in reliability of operation, and in cost of fuel and the space required for storing it.

1897 87, 88. *Cape Ann, Massachusetts.*—This 10-inch steam whistle was in operation some 550 hours and consumed about 37 tons of coal.

102. *Boston light-vessel, No. 54, Massachusetts.*—This 12-inch steam chime whistle was in operation some 656 hours and consumed about 72 tons of coal; besides, for heating ship, etc., 68 tons in addition was used, making a total of 140 tons consumed.

105. *Boston, Massachusetts.*—This first-class steam siren was in operation some 528 hours and consumed about 127 tons of coal.

121. *Race Point, Massachusetts.*—This 12-inch steam whistle was in operation some 592 hours and consumed about 26 tons of coal.

127. *Cape Cod, Massachusetts.*—This first-class Daboll trumpet was in operation some 855 hours and consumed about 12 tons of coal.

134. *Pollock Rip light-vessel, No. 47, Massachusetts.*—This 12-inch steam chime whistle was in operation some 1,060 hours and consumed about 120 tons of coal; besides, for heating ship, etc., 38 tons in addition was used, making a total of 158 tons consumed.

138. *Great Round Shoal light-vessel, No. 42, Massachusetts.*—This 10-inch whistle, operated by compressed air, was in operation some 676 hours and consumed 4,275 gallons of mineral oil in the engines.

141. *Nantucket New South Shoal light-vessel, No. 66, Massachusetts.*—This 12-inch steam whistle was in operation some 1,058 hours and consumed about 166 tons of coal; besides, for electric lighting, 268 tons in addition was used, making a total consumption of 434 tons of coal.

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156. *West Chop, Massachusetts.*—This 10-inch steam whistle was in operation some 595 hours and consumed about 33 tons of coal.

161. *Vineyard Sound light-vessel, No. 41, Massachusetts.*—This 12-inch steam whistle was in operation 1,061 hours and consumed about 83 tons of coal; besides, for heating ship, etc., 53 tons in addition was used, making a total of 136 tons consumed.

1898 85, 86. *Cape Ann, Massachusetts.*—This 10-inch steam whistle was in operation some 602 hours, and consumed about 41 tons of coal.

87. *Eastern Point, Massachusetts.*—This 4,000-pound fog bell was in operation 513 hours, and consumed 422 gallons of mineral oil at a cost of about 8.69 cents per gallon. An oil-burning steam engine was installed December 3, 1896.

101. *Boston light-vessel, No. 54, Massachusetts.*—This 12-inch steam chime whistle was in operation some 633 hours, and consumed about 97 tons of coal.

104. *Boston, Massachusetts.*—This first-class steam siren was in operation some 802 hours, and consumed about 53 tons of coal.

121. *Race Point, Massachusetts.*—This 12-inch steam whistle was in operation some 552 hours, and consumed about 25 tons of coal.

127. *Cape Cod, Massachusetts.*—This first-class Daboll trumpet was in operation some 846 hours, and consumed about 13 tons of coal.

135. *Pollock Rip light-vessel, No. 47, Massachusetts.*—This 12-inch steam chime whistle was in operation some 1,013 hours, and consumed about 114 tons of coal at a cost of about 54 cents per hour.

139. *Great Round Shoal light-vessel, No. 42, Massachusetts.*—This 10-inch whistle, operated by an oil engine of 25 horsepower, was in operation some 923 hours, and consumed 3,842 gallons of mineral oil in the engines at a cost of about 36½ cents per hour.

142. *Nantucket Shoals light-vessel, No. 66, Massachusetts.*—This 12-inch steam whistle was in operation some 860 hours, and consumed about 150 tons of coal.

157. *West Chop, Massachusetts.*—This 10-inch steam whistle was in operation some 490 hours, and consumed about 30 tons of coal.

162. *Vineyard Sound light-vessel, No. 41, Massachusetts.*—This 12-inch steam whistle was in operation some 897 hours, and consumed about 85 tons of coal.

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165. *Dumpling Rock, Massachusetts.*—This Daboll trumpet was in operation 381 hours, and consumed 307 gallons of mineral oil. An oil-burning steam engine was installed October 12, 1897.

166. *Butler Flats, Massachusetts.*—This 4,000-pound fog bell was in operation 71 hours, and the oil-burning steam engine which worked it consumed 45 gallons of mineral oil. This station was established on April 30, 1898.

Second District.

FOG-SIGNALS OPERATED BY STEAM OR HOT-AIR ENGINES.

1899

87-88. *Cape Ann, Massachusetts.*—This 10-inch steam whistle was in operation some 195 hours and consumed about 42 tons of coal.

89. *Eastern Point light-station, Massachusetts.*—This 4,000-pound fog bell was in operation some 553 hours and consumed about 503 gallons of mineral oil.

103. *Boston light-vessel, No. 54, Massachusetts.*—This 12-inch steam chime whistle was in operation some 705 hours and consumed about 120 tons of coal, besides what was needed for heating ship. In addition, 14 tons were used, making a total of 134 tons consumed.

106. *Boston, Mass.*—This first-class steam siren was in operation some 789 hours and consumed about 32 tons of coal.

124. *Race Point, Massachusetts.*—This 12-inch steam whistle was in operation some 830 hours and consumed about 36 tons of coal.

130. *Cape Cod, Massachusetts.*—This first-class Daboll trumpet was in operation some 1,068 hours and consumed about 14 tons of coal. A kerosene engine to operate the trumpet was installed in May.

139. *Pollock Rip light-vessel, No. 47, Massachusetts.*—This 12-inch steam chime whistle was in operation some 1,234 hours and consumed about 118 tons of coal; besides, for heating ship, etc., 9 tons in addition were used, making a total of 127 tons consumed.

143. *Great Round Shoal light-vessel, No. 42, Massachusetts.*—This 10-inch whistle, operated by compressed air, was in operation some 1,116 hours and consumed 4,546 gallons of mineral oil.

146. *Nantucket Shoals light-vessel, No. 66, Massachusetts.*—This 12-inch steam whistle was in operation some 1,273 hours and consumed about 173 tons of coal; besides, for electric lighting and heating the ship, 291 tons in addition were used, making a total of 464 tons consumed.

161. *West Chop, Massachusetts.*—This 10-inch steam whistle was in operation some 559 hours and consumed about 32 tons of coal.

166. *Vineyard Sound light-vessel No. 41, Massachusetts.*—This 12-inch steam whistle was in operation some 1,243 hours and consumed about 112 tons of coal; besides, for heating ship, etc., 20 tons in addition were used, making a total of 132 tons consumed.

169. *Dumpling Rock light-station, Massachusetts.*—This Daboll trumpet was in operation 862 hours and consumed 998 gallons of mineral oil.

170. *Butler Flats light-station, Massachusetts.*—This 4,000-pound fog-bell was in operation 385 hours and consumed 349 gallons of mineral oil. A Stevens bell-striking machine was substituted for the Shipman oil engine in May, 1899.

— *Relief light-vessel No. 58, Massachusetts.*—This 12-inch steam whistle was in operation some 355 hours and consumed about 14 tons of coal.

1900 90-91. *Cape Ann, Massachusetts*.—This 10-inch steam whistle was in operation about 617 hours and consumed some 38 tons of coal.

92. *Eastern Point, Massachusetts*.—This 4,000 pound fog-bell was in operation about 474 hours, and consumed some 468 gallons of mineral oil.

107. *Boston light-vessel, No. 54, Massachusetts*.—This 12-inch steam-chime whistle was in operation about 596 hours, and consumed some 126 tons of coal. In addition, 13 tons were used for heating ship, etc., making a total of 139 tons consumed.

110. *Boston, Massachusetts*.—This first-class siren was in operation some 652 hours, and consumed about 31 tons of coal.

128. *Race Point, Massachusetts*.—This 12-inch steam whistle was in operation some 694 hours, and consumed about 30 tons of coal.

134. *Cape Cod, Massachusetts*.—This first-class Daboll trumpet was in operation some 838 hours, and consumed about 419 gallons of mineral oil.

143. *Pollock Rip light-vessel, No. 47, Massachusetts*.—This 12-inch steam-chime whistle was in operation some 892 hours, and consumed about 102 tons of coal. In addition, 8 tons were used for heating ship, etc., making a total of 110 tons consumed.

147. *Great Round Shoal light-vessel, No. 42, Massachusetts*.—This 10-inch whistle, operated by compressed air, was in operation some 1,073 hours, and consumed about 4,830 gallons of mineral oil in engine.

150. *Nantucket Shoals light-vessel No. 66, Massachusetts*.—This 12-inch steam whistle was in operation some 951 hours, and consumed about 153 tons of coal. In addition, 293 tons were used for electric lighting and heating the ship, making a total of 446 tons consumed.

165. *West Chop light-station, Massachusetts*.—This 10-inch steam whistle was in operation some 669 hours, and consumed about 47 tons of coal.

170. *Vineyard Sound light-vessel No. 41, Massachusetts*.—This 12-inch steam whistle was in operation some 852 hours, and consumed

Second District.

about 81 tons of coal. In addition, 17 tons were used for heating ship, etc., making a total of 98 tons consumed.

173. *Dumpling Rock, Massachusetts*.—This Daboll trumpet was in operation some 707 hours, and consumed about 1,099 gallons of mineral oil.

— *Relief light-vessel No. 58, Massachusetts*.—This 12-inch steam whistle was in operation some 264 hours, and consumed about 61 tons of coal. In addition, 15 tons were used for heating ship, etc., making a total of 76 tons consumed.

1901

90-91. *Cape Ann, Massachusetts*.—This 10-inch steam whistle was in operation some 714 hours, and consumed about 48 tons of coal.

92. *Eastern Point, Massachusetts*.—This 4,000-pound fog bell was in operation some 515 hours, and consumed about 495 gallons of mineral oil.

108. *Boston light-vessel, No. 54, Massachusetts*.—This 12-inch steam chime whistle was in operation some 697 hours, and consumed about 128 tons of coal.

111. *Boston, Massachusetts*.—This first-class steam siren was in operation some 690 hours, and consumed about 44 tons of coal.

129. *Race Point, Massachusetts*.—This 12-inch steam whistle was in operation some 699 hours, and consumed about 31 tons of coal.

135. *Cape Cod, Massachusetts*.—This first-class Daboll trumpet was in operation some 1,013 hours, and consumed about 508 gallons of mineral oil.

144. *Pollock Rip light-vessel, No. 47, Massachusetts*.—This 12-inch steam chime whistle was in operation some 1,038 hours, and consumed about 97 tons of coal.

148. *Great Round Shoal light-vessel, No. 42, Massachusetts*.—This 10-inch whistle, operated by compressed air, was in operation some 905 hours, and consumed about 3,940 gallons of mineral oil.

157. *Nantucket Shoals light-vessel, No. 66, Massachusetts*.—This 12-inch steam whistle was in operation some 1,345 hours, and consumed about 181 tons of coal.

170. *West Chop, Massachusetts*.—This 10-inch steam whistle was in operation some 619 hours, and consumed about 48 tons of coal.

176. *Vineyard Sound light-vessel, No. 41, Massachusetts*.—This 12-inch steam whistle was in operation some 825 hours, and consumed about 86 tons of coal.

179. *Dumpling Rock, Massachusetts*.—This Daboll trumpet was in operation some 657 hours, and consumed about 889 gallons of mineral oil.

— *Relief light-vessel, No. 58, Massachusetts*.—This 12-inch steam whistle was in operation some 571 hours, and consumed about 81 tons of coal.

1902 91 and 92. *Cape Ann, Massachusetts*.—This 10-inch steam whistle was in operation some 539 hours, and consumed about 43 tons of coal.

93. *Eastern Point, Massachusetts*.—This 4,000-pound fog-bell was in operation some 430 hours, and consumed about 500 gallons of mineral oil.

109. *Boston light-vessel, No. 54, Massachusetts*.—This 12-inch steam chime whistle was in operation some 674 hours, and consumed about 141 tons of coal. For heating the ship, etc., some 16 tons in addition were used, making a total of 157 tons consumed.

112. *Boston, Massachusetts*.—This first-class steam siren was in operation some 665 hours, and consumed about 52 tons of coal.

130. *Race Point, Massachusetts*.—This 12-inch steam whistle was in operation some 539 hours, and consumed about 29 tons of coal.

136. *Cape Cod, Massachusetts*.—This first-class Daboll trumpet was in operation some 958 hours, and consumed about 478 gallons of mineral oil.

142. *Pollock Rip Shoals light-vessel, No. 73, Massachusetts*, was established January 20, 1902. This 12-inch steam chime whistle was in operation some 332 hours, and consumed about 114 tons of coal. For heating ship, etc., 19 tons in addition were used, making a total of 133 tons consumed.

144. *Pollock Rip light-vessel, No. 47, Massachusetts*.—This 12-inch steam chime whistle was in operation some 802 hours, and consumed about 88 tons of coal. For heating ship, etc., 14 tons in addition were used, making a total of 102 tons consumed.

148. *Great Round Shoal light-vessel, No. 42, Massachusetts*.—This 10-inch whistle, operated by compressed air, was in operation some 1,066 hours, and consumed about 4,382 gallons of mineral oil.

151. *Nantucket Shoals light-vessel, No. 66, Massachusetts*.—This 12-inch steam whistle was in operation some 1,166 hours, and consumed about 186 tons of coal. For electric lighting, heating the ship, etc., 336 tons in addition were used, making a total of 522 tons consumed.

170. *West Chop, Massachusetts*.—This 10-inch steam whistle was in operation some 678 hours, and consumed about 45 tons of coal.

176. *Vineyard Sound light-vessel, No. 41, Massachusetts*.—This 12-inch steam whistle was in operation some 1,008 hours, and consumed about 88 tons of coal. For heating the ship, etc., 18 tons in addition were used, making a total of 106 tons consumed.

179. *Dumpling Rock, Massachusetts*.—This second-class Daboll trumpet was in operation some 753 hours, and consumed about 575 gallons of mineral oil.

Relief light-vessel, No. 58, Massachusetts.—This 12-inch steam whistle was in operation some 506 hours, and consumed about 75 tons of coal, besides for banked fire, heating ship, and main engine, 98 tons in addition, making a total of 173 tons consumed.

1903

92-93. *Cape Ann, Massachusetts*.—This 10-inch steam whistle was in operation some 754 hours and consumed about 53 tons of coal.

94. *Eastern Point, Massachusetts*.—This 4,000-pound fog-bell was in operation some 576 hours on a consumption of about 703 gallons of mineral oil.

124. *Boston light-vessel, No. 54, Massachusetts*.—This 12-inch steam chime whistle was in operation some 670 hours and consumed about 138 tons of coal.

127. *Boston, Massachusetts*.—This first-class steam siren was in operation some 952 hours and consumed about 50 tons of coal.

136. *Race Point, Massachusetts*.—This 12-inch steam whistle was in operation some 819 hours and consumed about 28 tons of coal.

142. *Cape Cod, Massachusetts*.—This first-class Daboll trumpet was in operation some 972 hours and consumed about 487 gallons of mineral oil.

148. *Pollock Rip Shoals light-vessel, No. 73, Massachusetts*.—This 12-inch steam chime whistle was in operation some 1,073 hours and consumed about 237 tons of coal.

150. *Pollock Rip light-vessel, No. 47, Massachusetts*.—This 12-inch steam chime whistle was in operation 1,062 hours and consumed about 118 tons of coal.

154. *Great Round Shoal light-vessel, No. 42, Massachusetts*.—This 10-inch whistle, operated by compressed air, was in operation some 1,019 hours, and consumed about 4,241 gallons of mineral oil.

157. *Nantucket Shoals light-vessel, No. 66, Massachusetts*.—This 12-inch steam whistle was in operation some 994 hours, and about 177 tons of coal were consumed.

176. *West Chop, Massachusetts*.—This 10-inch steam whistle was in operation some 703 hours, and consumed about 44 tons of coal.

182. *Vineyard Sound (Sow and Pigs) light-vessel, No. 41, Massachusetts*.—This 12-inch steam whistle was in operation some 909 hours, and consumed about 82 tons of coal.

185. *Dumpling Rock, Massachusetts*.—This first-class Daboll trumpet was in operation some 902 hours, and consumed about 625 gallons of mineral oil.

— *Relief light-vessel, No. 58, Massachusetts*.—This 12-inch steam whistle was in operation some 312 hours, and consumed about 81 tons of coal.

1904

92 and 93. *Cape Ann, Massachusetts*.—This 10-inch steam whistle was in operation 743 hours and consumed about 58 tons of coal. The fog-signal plant consists of locomotive-type boilers, Crosby automatic clocks and whistle valves, and 10-inch whistles, all in duplicate. They run with 55 pounds pressure, 81 cubic feet of steam being used a second of blast.

94. *Eastern Point, Massachusetts*.—This 4,000-pound fog bell was in operation 465 hours, and 556 gallons of mineral oil were used by the engine. The old Shipman engines which operated the fog bell were replaced by two 2½-horsepower oil engines, and a cistern for storing rain water was provided.

124. *Boston light-vessel, No. 54, Massachusetts*.—This 12-inch chime whistle was in operation some 637 hours, and consumed about 124 tons of coal, besides which, for heating ship, etc., 11 tons in addition was used, making a total of 135 tons consumed.

127. *Boston, Mass.*—This first-class steam siren was in operation 830 hours, and consumed 44 tons of coal. This fog-signal plant consists of locomotive-type boilers, steam siren engines, and first-class sirens, all in duplicate. They use 55 pounds pressure and 60 cubic feet of steam a second of blast.

136. *Race Point, Massachusetts*.—This 12-inch steam whistle was in operation 666 hours and consumed 32 tons of coal. This fog-signal plant consists of locomotive-type boilers, improved automatic clocks and whistle valves, all in duplicate, with one 10-inch and one 12-inch whistle. They use 55 pounds pressure and 64 cubic feet of steam for a second of blast.

142. *Cape Cod, Massachusetts*.—This first-class Daboll trumpet was in operation 961 hours, and 485 gallons of mineral oil was used by the engine. This fog-signal plant consists of 4-horsepower oil engines, air compressors and air tanks, all in duplicate, and a first-class Daboll trumpet. They use 5 pounds pressure and 5.2 cubic feet of free air a second of blast.

148. *Pollock Rip Shoals light-vessel, No. 73, Massachusetts*.—This 12-inch steam chime whistle was in operation some 995 hours and consumed about 195 tons of coal, besides for heating ship, etc., 13 tons in addition was used, making a total of about 208 tons consumed.

150. *Pollock Rip light-vessel, No. 47, Massachusetts*.—This 12-inch steam chime whistle was in operation some 756 hours, and consumed about 99 tons of coal, besides for heating ship, etc., 11 tons in addition was used, making a total of 110 tons consumed.

154. *Great Round Shoal light-vessel, No. 42, Massachusetts*.—This 10-inch whistle, actuated by compressed air, was in operation some 996 hours, and about 4,036 gallons of mineral oil was used by the engine.

157. *Nantucket Shoals light-vessel, No. 66, Massachusetts*.—This 12-inch steam whistle was in operation about 921 hours, and some 218 tons of coal was consumed, besides, for heating ship, dynamo, and main engine, 343 tons in addition was used, making a total of, say, 561 tons consumed.

176. *West Chop, Massachusetts*.—This 10-inch steam whistle was in operation some 863 hours and consumed about 49 tons of coal. This fog-signal plant consists of two locomotive-type boilers, steam engines, and two 10-inch whistles. They use 55 pounds pressure and 77 cubic feet of steam a second of blast.

182. *Vineyard Sound light-vessel, No. 41, Massachusetts*.—This 12-inch steam whistle was in operation some 809 hours and consumed about 79 tons of coal, besides which, for heating ship, etc., some 14 tons in addition was used, making a total of, say, 93 tons consumed.

185. *Dumpling Rock, Massachusetts*.—This first-class Daboll trumpet was in operation some 746 hours, and about 653 gallons of mineral oil was used by the engine. This fog-signal plant consists of 4-horsepower oil engines, air compressors, and air tanks, all in duplicate,

and a first-class Daboll trumpet. They use 5 pounds pressure and 2.63 cubic feet of free air a second of blast.

— *Relief light-vessel, No. 58, Massachusetts*.—This 12-inch steam whistle was in operation about 325 hours and consumed some 146 tons of coal, besides which, for heating ship and main engine, 78 tons in addition were used, making a total of, say, 224 tons consumed.

1900 90-91. *Cape Ann, Massachusetts*.—This 10-inch steam whistle was in operation about 600 hours, and consumed about 148 tons of coal.

92. *Eastern Point, Massachusetts*.—This 4,000-pound fog-bell was in operation some 405 hours, and about 208 gallons of mineral oil were used by the engine.

122. *Boston light-vessel, No. 54, Massachusetts*.—This 12-inch chime whistle was in operation about 550 hours, and consumed some 105 tons of coal.

125. *Boston, Massachusetts*.—This first-class steam siren was in operation about 594 hours, and consumed some 31 tons of coal.

1905 134. *Race Point, Massachusetts*.—This 12-inch steam whistle was in operation about 613 hours, and consumed some 37 tons of coal.

140. *Cape Cod, Massachusetts*.—This first-class Daboll trumpet was in operation about 820 hours, and some 408 gallons of mineral oil were used by the engine.

146. *Pollock Rip Shoals light-vessel, No. 73, Massachusetts*.—This 12-inch steam chime whistle was in operation about 1,320 hours, and consumed about 214 tons of coal.

148. *Pollock Rip light-vessel, No. 47, Massachusetts*.—This 12-inch steam chime whistle was in operation about 1,226 hours, and consumed some 108 tons of coal.

152. *Great Round Shoal light-vessel, No. 42, Massachusetts*.—This 10-inch whistle, operated by compressed air, was in operation about 1,117 hours, and some 5,261 gallons of mineral oil were used by the engine.

155. *Nantucket Shoals light-vessel, No. 66, Massachusetts*.—This 12-inch steam whistle was in operation about 722 hours, and some 135 tons of coal were consumed.

174. *West Chop, Massachusetts*.—This 10-inch steam whistle was in operation about 922 hours, and consumed some 51 tons of coal.

180. *Vineyard Sound light-vessel, No. 41, Massachusetts*.—This 12-inch steam whistle was in operation about 831 hours, and consumed some 68 tons of coal.

183. *Dumpling Rock, Massachusetts*.—This first-class Daboll trumpet was in operation about 781 hours, and some 832 gallons of mineral oil were used by the engine.

Relief light-vessel, No. 58, Massachusetts.—This 12-inch steam whistle was in operation about 370 hours, and consumed some 124 tons of coal.

1906

90-91. *Cape Ann, Massachusetts*.—This 10-inch steam whistle was in operation some 569 hours and consumed about 57 tons of coal.

92. *Eastern Point, Massachusetts*.—This 4,000-pound fog bell was in operation some 390 hours, and about 112 gallons of mineral oil were used.

122. *Boston light-vessel, No. 54, Massachusetts*.—This 12-inch chime whistle was in operation some 581 hours, and consumed about 125 tons of coal.

125. *Boston, Mass.*—This first-class steam siren was in operation some 507 hours, and consumed about 37 tons of coal.

134. *Race Point, Massachusetts*.—This 12-inch steam whistle was in operation some 507 hours, and consumed about 43 tons of coal.

140. *Cape Cod, Massachusetts*.—This first-class Daboll trumpet was in operation some 710 hours, and consumed about 356 gallons of mineral oil.

146. *Pollock Rip Shoals light-vessel, No. 73, Massachusetts*.—This 12-inch steam chime whistle was in operation about 1,065 hours, and consumed some 213 tons of coal.

148. *Pollock Rip light-vessel, No. 47, Massachusetts*.—This 12-inch steam chime whistle was in operation some 1,016 hours, and consumed about 93 tons of coal.

152. *Great Round Shoal light-vessel, No. 42, Massachusetts*.—This 10-inch whistle, worked by compressed air, was in operation some 916 hours, and about 3,513 gallons of mineral oil were consumed.

155. *Nantucket Shoals light-vessel, No. 66, Massachusetts*.—This 12-inch steam whistle was in operation about 863 hours, and some 347 tons of coal were consumed.

174. *West Chop, Massachusetts*.—This 10-inch steam whistle was in operation about 1,040 hours, and consumed some 56 tons of coal.

180. *Vineyard Sound light-vessel, No. 41, Massachusetts*.—This 12-inch steam whistle was in operation about 747 hours, and consumed some 74 tons of coal.

183. *Dumpling Rock, Massachusetts*.—This first-class Daboll trumpet was in operation some 713 hours, and some 639 gallons of mineral oil were used.

Relief light-vessel, No. 58, Massachusetts.—This 12-inch steam whistle was in operation about 64 hours, and consumed some 24 tons of coal.

107. *The Graves, Massachusetts*.—This first-class Daboll trumpet was in operation about 347 hours, and consumed some 409 gallons of mineral oil. The fog-signal was established in November, 1905.

1907.

92-93. *Cape Ann, Massachusetts.*—This 10-inch steam whistle was in operation some 812 hours and consumed about 56 tons of coal.

94. *Eastern Point, Massachusetts.*—This 4,000-pound fog-bell was in operation about 647 hours, and some 199 gallons of mineral oil were used in running the small steam engine which operates the bell striker.

No. 125. *Boston light-vessel, No. 54, Massachusetts.*—This 12-inch chime whistle was in operation about 870 hours and consumed some 136 tons of coal.

No. 110. *The Graves, Massachusetts.*—This first-class Daboll trumpet was in operation about 876 hours, and some 900 gallons of mineral oil were used in running the operating engine.

128-129. *Boston, Mass.*—This first-class steam siren was in operation some 824 hours and consumed about 44 tons of coal.

137. *Race Point, Massachusetts.*—This first-class Daboll trumpet was in operation some 204 hours and consumed about 59 gallons of mineral oil in running the operating engine.

143. *Cape Cod, Massachusetts.*—This first-class Daboll trumpet was in operation about 1,020 hours and consumed some 512 gallons of mineral oil in running the operating engine.

149. *Pollock Rip Shoals light-vessel, No. 73, Massachusetts.*—This 12-inch steam chime whistle was in operation about 1,361 hours and consumed some 231 tons of coal.

151. *Pollock Rip light-vessel, No. 47, Massachusetts.*—This 12-inch steam chime whistle was in operation about 1,367 hours and consumed some 110 tons of coal.

157. *Great Round Shoal light-vessel, No. 42, Massachusetts.*—This 10-inch whistle, operated by compressed air, was in operation some 1,356 hours, and about 5,330 gallons of mineral oil were used by the engine.

160. *Nantucket Shoals light-vessel, No. 66, Massachusetts.*—This 12-inch steam whistle was in operation about 1,134 hours, and some 201 tons of coal were consumed.

180. *West Chop, Massachusetts.*—This 10-inch steam whistle was in operation about 1,006 hours, and consumed some 61 tons of coal.

188. *Vineyard Sound light-vessel, No. 41, Massachusetts.*—This 12-inch steam whistle was in operation about 983 hours, and consumed some 89 tons of coal.

191. *Dumpling Rock, Massachusetts.*—This first-class Daboll trumpet was in operation some 786 hours, and about 837 gallons of mineral oil were used by the engine.

From "Statement of Appropriations, &c."
 from March 4, 1789, to June 30, 1882.
 Published in 1888.

FORM 152.

General object (title of appropriation), and details and explanations.	Date of act making the appropriation.	Reference to the Stats. at Large.			Amount of annual appropriation.	Year of expenditure.	Expenditure by warrants.	Repayments.	Amount carried to the surplus fund.	Net expenditures.
		Volume.	Page.	Section.						
<i>Fog-signals.</i>										
For a fog-signal to be placed at the outer light-house in Boston Bay, State of Massachusetts.....	Sept. 28, 1850	9	501	1	3,000 00	1851	3,000 00	.....	.....	3,000 00
For Jones' fog-bells at Baker's Island, at the entrance of Salem Harbor, and at Race Point, Cape Cod.....	Aug. 31, 1852	10	114	1	5,000 00	1855	5,000 00	.....	.....	5,000 00
For large fog-bells for light-vessels in the Vineyard Sound, in exchange for the small ones now in use on board of these vessels.....	Aug. 3, 1854	10	337	1	1,500 00	1856	1,500 00	.....	.....	1,500 00
For four iron twelve-pounder guns and equipments for fog-signals on board of light-vessels in Vineyard Sound.....	Aug. 3, 1854	10	337	1	2,000 00	1856	381 44	.....	.....	381 44
						1857	1,618 56	.....	.....	1,423 15
						1858		195 41	195 41	
For a fog-bell at Easton Point light-house.....	Aug. 18, 1856	11	96	1	800 00	1857	800 00	.....	.....	800 00
For a steam fog-signal (to guide into a harbor of refuge) at Race Point, Cape Cod.....	Mar. 3, 1873	17	520	1	5,000 00	1873	5,000 00	.....	.....	5,000 00
For a steam fog-signal at the Highlands, Cape Cod.....	Mar. 3, 1873	17	520	1	5,000 00	1873	5,000 00	.....	.....	5,000 00
For fog-signals on light-ships at entrance to Vineyard Sound.....	June 23, 1874	18	218	1	10,000 00	1876	10,000 00	.....	.....	9,999 20
						1877		80	80	
Total.....					32,300 00		32,300 00	196 21	196 21	32,103 79

Spindles on the N.E. ledge of the Graves and Harding's ledge (March 3, 1851)	\$2,000
--	---------

An.
Rep.

An additional appropriation was made for the same purpose August 31, 1852	8,000
	<u>\$8,000</u>

1853.

p. 227.

I have not been able to get on the Graves rock to examine its structure; but, judging from the formation in the immediate vicinity, I am led to the conclusion that it would not sustain the proposed spindle, nor does there appear to be base enough to build a mere permanent beacon. Harding's ledge is still lower than the Graves, and may have sufficient stability to hold a spindle; yet, so long as there is a doubt, I think it would be much better to expend the appropriation in placing a bell buoy, with a bell of about three hundred pounds, at the Graves, and a triangle buoy at Harding's and a fog-whistle at the Boston light.

The fog-bell at Boston light, from its position, the confinement, or in proper deflection of the sound, or some other cause, is heard in storms but a few hundred yards in the direction of the channel of entrance; and it is believed that, independent of other aids, a fog-whistle would better answer the purposes of navigation.

* * * * *

Respectfully submitted,

C. A. Ogden,
Major Corps of Engineers.

1853
A. 230.

2d. Light-boats on our northeastern coast, particularly in Vineyard sound, Pollock rip, and Tuckanuck, should have larger bells, and should, during thick fogs, fire guns at stated intervals.

1864

Needful repairs to the fog-signals (bells) at Eastern Point, Cape Ann, and Race Point have been made. The signal at Cape Ann (whistle sounded by caloric engine) has been reported as being inefficient from want of power.

1865

The various fog-signals in the district have received careful attention, and are now in as good condition as their character will permit. *2d Dist.*

1866

The fog-signals have been maintained in as thorough a state of efficiency as is consistent with their nature and without repair, except in the case of the caloric engine at Cape Ann, all, with this exception, being fog-bells struck by machinery.

FOG-SIGNALS OPERATED BY STEAM OR HOT AIR ENGINES.

1872

Cape Ann, Massachusetts.—A steam fog-whistle.
Boston, Massachusetts.—An air-trumpet.

2d District.

FOG-SIGNALS OPERATED BY STEAM OR HOT-AIR ENGINES.

1873

Cape Ann.—Twelve-inch steam-whistle.
Boston.—First-class Daboll air-trumpet.
Race Point.—Twelve-inch steam-whistle.
Cape Cod.—First-class Daboll air-trumpet.
All of the above are in good condition.

2d District.

FOG SIGNALS ON LIGHT-SHIPS IN VINEYARD SOUND.

The entire commerce by sea between the East and New York and the South passes through Vineyard Sound, and depends on the light-ships at "Pollock Rip," on the eastern, and the "Sow and Pigs Reef," at the western entrance, to guide them in entering and leaving the sound. In foggy weather these lights are not available and many disasters occur in consequence.

The Board therefore earnestly recommend that an appropriation of \$10,000 be granted for the purpose of putting fog-signals in these vessels, which may be operated by steam or hot air.

FOG-SIGNALS OPERATED BY STEAM OR HOT-AIR ENGINES.

1874

Cape Ann.—Twelve-inch steam-whistle.
Boston.—First-class Daboll air-trumpet.
Race Point.—Twelve-inch steam-whistle.
Cape Cod.—First-class Daboll air-trumpet.

2d Dist.

Repairs more or less extensive have been made at each of the stations, and a duplicate signal furnished at Race Point.

An appropriation of \$10,000 was made at the last session of Congress for the purpose of placing fog-signals in the light-ships that mark the entrances to Vineyard Sound, Massachusetts. Plans are now being prepared, and the signals will be put in place as soon as possible.

FOG-SIGNALS OPERATED BY STEAM OR HOT-AIR ENGINES.

1875

Cape Ann.—Twelve-inch steam-whistle.
Boston light.—First-class Daboll trumpet.
Race Point.—Twelve-inch steam-whistle.
Cape Cod.—First-class Daboll trumpet.

2d Dist.

FOG-SIGNALS OPERATED BY STEAM OR HOT-AIR ENGINES.

1876. Cape Ann.—Twelve-inch whistle.
 Boston.—First-class Dabol trumpet.
 Race Point.—Twelve-inch steam-whistle.
 Cape Cod.—First-class Dabol trumpet.

2d District.

The usual repairs required have been made at the above-named stations, and the machinery kept in good order.

Pollock Rip and Vineyard Sound.—The fog-signals established on light-ships at these points have proved perfectly satisfactory.

FOG SIGNALS OPERATED BY STEAM OR HOT-AIR ENGINES.

1877. Cape Ann, Massachusetts.—Ten-inch steam-whistle.
 Boston, Massachusetts.—First-class Daboll trumpet.
 Race Point, Massachusetts.—Twelve-inch steam-whistle.
 Cape Cod, Massachusetts.—First-class Daboll trumpet.

2d Dist.

There are duplicate fog-signals at each of the above stations, and all are in good working order.

Pollock Rip light-ship, No. 40.—Twelve-inch steam-whistle.

Vineyard Sound light-ship, No. 41.—First-class siren, operated by hot air.

The two last-named fog-signals continue to satisfy mariners, who now run for the light-ships in the thickest weather with perfect confidence.

FOG-SIGNALS OPERATED BY STEAM OR HOT-AIR ENGINES.

1878. Cape Ann.—Ten-inch steam-whistle.
 Boston.—First-class Daboll trumpet.
 Race Point.—Twelve-inch steam-whistle.
 Cape Cod.—First-class Daboll trumpet.
 There are duplicate fog-signals at all of the above stations and are all in good working order.
 Pollock Rip light-ship No. 42.—First-class siren.
 Vineyard Sound light-ship No. 41.—First-class siren.
 Both operated by hot air.
 These signals continue to give great satisfaction to mariners.

2d District.

FOG-SIGNALS OPERATED BY STEAM OR HOT-AIR ENGINES.

1879. Cape Ann, Massachusetts.—Ten-inch steam-whistle.
 Boston, Massachusetts.—First-class Daboll trumpet.
 Race Point, Massachusetts.—Twelve-inch steam-whistle.
 Cape Cod, Massachusetts.—First-class Daboll trumpet.
 There are duplicate fog-signals at all of the above stations and all are in good working order.
 Pollock Rip Light-ship No. 42.—First-class hot-air siren.
 Vineyard Sound Light-ship No. 41.—First-class hot-air siren.
 These signals continue to give great satisfaction to mariners.

FOG-SIGNALS OPERATED BY STEAM OR HOT-AIR ENGINES.

1880. Cape Ann, Massachusetts.—Ten-inch steam-whistles.
 Race Point, Massachusetts.—Twelve-inch steam-whistles.
 Cape Cod, Massachusetts.—First-class Daboll trumpets.
 Boston, Massachusetts.—First-class Daboll trumpets.
 There are duplicate fog-signals at all of the above stations and all are in good working order.
 Pollock Rip Light-ship No. 42.—First-class siren.
 Vineyard Sound Light-ship No. 41.—First-class siren.
 Both operated by hot-air. Steam-signals should be substituted for these last two.

FOG-SIGNALS OPERATED BY STEAM OR HOT-AIR ENGINES.

65. *Cape Ann (Thatcher's Island), off Cape Ann, Massachusetts.*—Ten-inch steam-whistle in duplicate, giving each minute a blast of 8 and a blast of 4 seconds, with alternate intervals of 4 and 44 seconds.
1887. 77. *Boston, on Little Brewster Island, entrance to Boston Harbor, Massachusetts.*—First-class Daboll hot-air trumpet in duplicate, with blasts of 7 seconds, followed by intervals of 43 seconds.
83. *Race Point, northwesterly point of Cape Cod, Massachusetts.*—Twelve-inch steam-whistle in duplicate, giving blasts of 4 seconds at intervals of 8 and 44 seconds.
89. *Cape Cod (Highlands, Truro), Massachusetts.*—First-class Daboll trumpet, giving blasts of 8 seconds at intervals of 30 seconds.

FOG-SIGNALS OPERATED BY STEAM OR HOT-AIR ENGINES.

- 65, 66. *Cape Ann, on Thatcher's Island, Massachusetts.*—A 10-inch steam whistle, in duplicate.
1882. 77. *Boston, on the north side of the main entrance to Boston Harbor, Massachusetts.*—A first-class Daboll trumpet, in duplicate.
83. *Race Point, on the northwest point of Cape Cod, Massachusetts.*—A 12-inch steam whistle, in duplicate.
89. *Cape Cod (Highlands), on the northeast side of Cape Cod, Massachusetts.*—A first-class Daboll trumpet.
- 95, 117. *Pollock Rip and Vineyard Sound Light-ships, Massachusetts.*—Steam fog-whistles.

FOG-SIGNAL REPAIRS.

- 65, 66. *Cape Ann, Massachusetts.*—The whistle-pipes were furnished with new collars at the junction of the pipes with the roof of the building. The feed-pumps were repaired and a new draught-pipe from the reservoir was laid; the furnace door and hand-hole plates of the south signal were repaired.
67. *Eastern Point, Massachusetts.*—The 1,000-pound fog-bell was removed and one of 2,100 pounds substituted, and the machinery was repaired.
76. *Minot's Ledge, Massachusetts.*—The fog bell machinery was repaired.
77. *Boston, Massachusetts.*—Some slight repairs were made on the engines and one of the smoke-pipes.

78. *Narrows, Massachusetts.*—The weight-box of the fog-bell machinery was refastened.

83. *Race Point, Massachusetts.*—The west fog-signal boiler was furnished with new tubes.

89. *Cape Cod, Massachusetts.*—The outer end of the trumpet was repaired by patching.

115. *Holmes's Hole (West Chop), Massachusetts.*—A new fog-signal was established at this station. It is a 10-inch steam whistle, in duplicate. The boilers and machinery, brick cistern, and fuel bins are in a frame building 32 feet square. The roof surface not being quite sufficient for the needed supply of fresh water, the additional quantity required is furnished by a tubular well within the building, driven 30 feet deep. A one and a half story frame dwelling was erected for the keeper, and the signal was put in operation on the 1st of December, 1881.

On board the Pollock Rip and Vineyard Sound light-ships there are duplicate boilers, but single whistles. The increased safety to navigators, by reason of the change to steam whistles, in the fog-signals of these vessels is almost incalculable.

The steam fog-whistles of this district consume, altogether, about 450 tons of coal each year.

FOG-SIGNALS OPERATED BY STEAM OR HOT-AIR ENGINES.

1883. 65, 66. *Cape Ann, on Thatcher's Island, off Cape Ann, Massachusetts.*—Ten-inch steam-whistle in duplicate. The north boiler was retubed, new safety-valve put in, and engine refitted. The steam pumps, valves, and connections of both signals were repaired and repacked. Thirty-four feet of rubber hose, with couplings and connections, and two sets of grate-bars were furnished. The coal-car was fitted with new journals.

77. *Boston, on north side of main entrance to Boston Harbor, Massachusetts.*—The roof of the fog-signal building was resingled and the machinery put in order.

83. *Race Point, on northwest point of Cape Cod, Massachusetts.*—Twelve-inch steam-whistle, in duplicate. A new water-tank and smoke-pipe were furnished for the west signal. The east boiler was retubed and machinery repaired.

89. *Cape Cod, (Highlands,) on northeast side of Cape Cod, Massachusetts.*—

First-class Daboll trumpet. New sheet-iron casings, supply cross-heads, brasses for slides of working piston, and cross-head pins and rollers were supplied, and the machines thoroughly repaired. One rock-shaft was renewed and three oil-gauges furnished.

95. *Pollock Rip Light-Ship, No. 42, off Chatham, Massachusetts.*—Twelve-inch steam-whistle.

115. *Holmes's Hole, (West Chop,) on west side of Vineyard Haven Harbor, Massachusetts.*—Ten-inch steam-whistle, in duplicate. Four glass water-gauges were furnished.

118. *Vineyard Sound Light-Ship, No. 41, near the rocks called Sow and Pigs, Massachusetts.*—Twelve-inch steam-whistle.

There are duplicate signals at each station. All are in excellent order. The Daboll trumpet at the Boston light seems to fail when most needed to indicate the locality. The reasons for this failure are not easily given, nor can it be determined, readily, why the signal is occasionally heard at great distances and then lost until almost up with the light. There were similar complaints at Pollock Rip and at Vineyard Sound light-ships, which had the same machines. With the substitution of steam-whistles at these points, complaints have ceased. There

are two boilers and one whistle on each of the two light-ships, No. 41 and No. 42. The annual consumption of coal is about 120 tons on each vessel.

FOG-SIGNALS OPERATED BY STEAM OR HOT-AIR ENGINES. *2^d Dist.*

1884. 64, 65. *Cape Ann, on Thatcher's Island, off Cape Ann, Massachusetts.*—Ten-inch steam whistle in duplicate. The tubes of the south boiler were calked. The engines of both signals were overhauled and repaired; the steam pumps, valves, and connections of both signals were repacked; 22 feet of rubber hose with couplings and connections, and four glass gauges were furnished; and the ceiling in the south whistle-house was replastered.

77. *Boston, on Little Brewster Island, north side of main outer entrance to Boston Harbor, Massachusetts.*—A new frame fog-signal house, 20 by 30 feet, was built for a 10-inch steam whistle and a siren, which were set up to determine which is the better signal. The 10-inch steam whistle, which is now in use, gives two blasts of 5 seconds' duration per minute with alternate intervals of 10 and 40 seconds. The characteristics of the large Daboll trumpet were made the same as those of the whistle.

A trench 245 feet long was dug from the whistle-house to the wells, and a lead pipe was laid in it.

83. *Race Point, on northwest point of Cape Cod, Massachusetts.*—Twelve-inch steam whistle in duplicate. The west boiler received 15 new tubes and the machinery was repaired. A new boiler was put in this whistle-house, and the house was painted white.

89. *Cape Cod (Highlands, Truro), on the northeast side of Cape Cod, Massachusetts.*—First-class Daboll trumpet. New grate-bars and linings were furnished for each of the three 24-inch caloric engines, and the machinery was thoroughly overhauled and put in good order.

115. *Holmes's Hole (West Chop), on west side of Vineyard Haven Harbor, Massachusetts.*—Ten-inch steam whistle in duplicate. The chimney was built 5 feet higher to give a better draft. A No. 1½ Blake pump, 31 feet of ¾-inch lead pipe and couplings, also 20 feet of iron pipe for the inspirator, were furnished, and the whistle-valves and inspirator were repaired.

FOG-SIGNALS OPERATED BY STEAM OR HOT-AIR ENGINES.

An. Rep. 64, 65. *Cape Ann, Massachusetts.*—This 10-inch steam-whistle was in operation 527 hours.

1885. 77. *Boston, Massachusetts.*—This signal, consisting, temporarily, of a 10-inch steam whistle, a first-class steam siren, and a first-class Daboll trumpet, was in operation 728 hours and 30 minutes.

NOTE.—It having been ascertained by careful experiment that the steam siren is the best fog-signal for this station, the Daboll trumpet and the steam-whistle will be removed and another steam siren, a duplicate of the first, will take their place.

83. *Race Point, Massachusetts.*—This 12-inch steam-whistle was in operation 1,320 hours.

89. *Cape Cod (Highlands, Truro), Massachusetts.*—This first-class Daboll trumpet was in operation 1,012 hours.

95. *Pollock Rip light-ship No. 42, Massachusetts.*—This 12-inch steam-whistle was in operation 1,181 hours.

115. *Holmes's Hole (West Chop), Massachusetts.*—This 10-inch steam-whistle was in operation 802 hours.

118. *Vineyard Sound (Sow and Pigs) light-ship No. 41, Massachusetts.*—This 12-inch steam-whistle was in operation 790 hours and 42 minutes.

FOG-SIGNALS OPERATED BY STEAM OR HOT-AIR ENGINES.

- An. Rep.*
1886. 64, 65. *Cape Ann, Massachusetts.*—This 10-inch steam-whistle was in operation about 494 hours.
77. *Boston, Massachusetts.*—This 10-inch steam-whistle was in operation about 658 hours.
83. *Race Point, Massachusetts.*—This 12-inch steam-whistle was in operation about 1,053 hours.
89. *Cape Cod (Highlands, Truro), Massachusetts.*—This first-class Daboll trumpet was in operation about 1,048 hours.
95. *Pollock Rip light-ship, No. 42, Massachusetts.*—This 12-inch steam-whistle was in operation about 889 hours.
116. *Holmes's Hole (West Chop), Massachusetts.*—This 12-inch steam-whistle was in operation about 649 hours.
119. *Vineyard Sound (Sow and Pigs) light-ship, No. 41, Massachusetts.*—This 12-inch steam-whistle was in operation about 1,075 hours.

FOG-SIGNALS OPERATED BY STEAM OR HOT-AIR ENGINES.

- 66, 67. *Cape Ann, Massachusetts.*—The 10-inch steam-whistles, in duplicate, were in operation 772½ hours.
79. *Boston, Massachusetts.*—The first-class steam-sirens, in duplicate, were in operation 820 hours.
85. *Race Point, Massachusetts.*—The 12-inch steam-whistles, in duplicate, were in operation 871 hours.
91. *Cape Cod (Highlands, Truro), Massachusetts.*—The first-class Daboll trumpets, in duplicate, were in operation 1,060 hours.
97. *Pollock Rip light-ship, No. 42, Massachusetts.*—The 12-inch steam-whistles, in duplicate, were in operation 1,266 hours.
118. *Holmes's Hole (West Chop), Massachusetts.*—The 12-inch steam-whistles, in duplicate, were in operation 753 hours.
121. *Vineyard Sound (Sow and Pigs), light-ship, No. 41, Massachusetts.*—The 12-inch steam-whistles, in duplicate, were in operation 1,062 hours.

An. Rep.
1887.

FOG-SIGNALS OPERATED BY STEAM OR HOT-AIR ENGINES.

- An. Rep.*
1888. 66, 67. *Cape Ann, Massachusetts.*—The 10-inch steam-whistles, in duplicate, were in operation about 731 hours, consuming 71,903 pounds of coal.
79. *Boston, Mass.*—The first-class steam-sirens, in duplicate, were in operation 856 hours, consuming 92,850 pounds of coal.
86. *Race Point, Massachusetts.*—The 12-inch steam-whistles, in duplicate, were in operation 756 hours, consuming 64,225 pounds of coal.
92. *Cape Cod (Highlands, Truro), Massachusetts.*—The first-class Daboll trumpets, in duplicate, were in operation about 937 hours, consuming 22,793 pounds of coal.
98. *Pollock Rip light-ship, No. 42, Massachusetts.*—The 12-inch steam-whistles, in duplicate, were in operation 1,290 hours, consuming 142,920 pounds of coal.
119. *West Chop, Massachusetts.*—The 12-inch steam-whistles, in duplicate, were in operation 517 hours, consuming 40,417 pounds of coal.
122. *Vineyard Sound (Sow and Pigs) light-ship, No. 41, Massachusetts.*—The 12-inch steam-whistles, in duplicate, were in operation 933 hours, consuming 93,040 pounds of coal.

FOG-SIGNALS OPERATED BY STEAM OR HOT-AIR ENGINES.

2^d DistrictAn. Rep.
1889.

69, 70. *Cape Ann, Massachusetts.*—The 10-inch steam-whistle was in operation 699 hours and consumed about 34 tons of coal.

82. *Boston, Massachusetts.*—This first-class steam-siren was in operation 868 hours and consumed about 52 tons of coal.

89. *Race Point, Massachusetts.*—The 12-inch steam-whistle was in operation 744 hours and consumed about 31 tons of coal.

95. *Cape Cod (Highlands, Truro), Massachusetts.*—The first-class Daboll trumpet was in operation 799 hours and consumed about 8 tons of coal.

101. *Pollock Rip light-ship, No. 42, Massachusetts.*—This 12-inch steam-whistle was in operation 1,330 hours and consumed about 79 tons of coal.

122. *West Chop, Massachusetts.*—The 10-inch steam-whistle was in operation 486 hours and consumed about 22 tons of coal.

125. *Vineyard Sound light-ship, No. 41, Massachusetts.*—The 12-inch steam-whistle was in operation 1,060 hours and consumed about 80 tons of coal.

There are duplicate signals at each of the above-named stations.

FOG-SIGNALS OPERATED BY STEAM OR HOT-AIR ENGINES.

70, 71. *Cape Ann, Massachusetts.*—This 10-inch steam-whistle was in operation 578 hours and consumed about 34 tons of coal.

1890

83. *Boston, Massachusetts.*—This first-class steam-siren was in operation 829 hours, consuming about 58 tons of coal.

90. *Race Point, Massachusetts.*—The 12-inch steam-whistle was in operation 811 hours and consumed about 36 tons of coal.

96. *Cape Cod (Highlands, Truro), Massachusetts.*—This first-class Daboll trumpet was in operation 641 hours, consuming about 6 tons of coal.

102. *Pollock Rip light-vessel, No. 42, Massachusetts.*—This 12-inch steam-whistle was in operation 1,033 hours and consumed about 68 tons of coal.

124. *West Chop, Massachusetts.*—This 10-inch steam-whistle was in operation 479 hours, consuming about 23 tons of coal.

127. *Vineyard Sound light-vessel, No. 41, Massachusetts.*—The 12-inch steam-whistle was in operation 770 hours and consumed about 57 tons of coal.