

One of these is a tug, 50 ft. overall length, for towing lighters, and propelled by a Gardner Diesel engine of 136 b.h.p. Of the other three vessels, two are Danish-seine fishing-boats and one is a fishing-launch, all being fitted with internal-combustion engines.

In addition to the annual surveys, 268 seaworthiness, efficiency, and tonnage surveys were made during the year, inclusive of 46 seaworthiness and efficiency surveys made to overseas vessels not registered or normally surveyed in the Dominion. Of the latter surveys, two were connected with damage to hulls, five with machinery, shafting, and propellers, one with main boilers, and five with windlasses and winches. Twenty-one surveys were made for the renewal of International Safety Radiotelegraphy Certificates, and two for the extension of Board of Trade Passenger and Safety Certificates.

The wreck of one vessel on the Department's register occurred during the year. The s.s. "Waikouaiti," of 3,926 gross tonnage, engaged in foreign-going cargo trade, ran ashore on Dog Island, Bluff, in November, 1939, and became a total loss.

During the annual survey of one steamship serious defects of outstanding interest were found in both main boilers. Each boiler was 14 ft. 9 in. diameter and 10 ft. 6 in. long. The cylindrical shell plates were  $1\frac{1}{4}$  in. thick and were butt-jointed with riveted double butt straps at the port and starboard sides of the steam-space. The boilers were made in 1925 and work at a steam-pressure of 190 lb. per square inch.

Indications of leakage at the longitudinal seams of the port boiler were observed, and a closer inspection revealed several broken rivets in each seam. All the rivets in the seams were then removed. The butt straps were taken off and examined, when cracks on the faying surface of the outer straps at rivet-holes were found. For the purpose of establishing the cause of the cracks, portions of the cracked plates were forwarded to the School of Engineering, Canterbury College, for microscopical examination. In the meantime a thorough search of shell plates for cracks at the joints was made with a magnifying glass, but without results. In view of the nature of the failure of the rivets and butt straps the probability of the existence of very fine cracks in the shell plates could not be overlooked. It was decided, therefore, to endeavour to discover cracks by the aid of the magnetic dry-powder method of crack-detection. It is based on the well-known principle that mobile iron filings in a magnetic field show the direction of the lines of force and migrate into positions of high magnetic resistance. The boiler was then magnetized and dusted with the iron-powder at the rivet-holes. Numerous cracks previously invisible by ordinary means of inspection were then detected. A magnetic test of the starboard boiler also indicated extensive cracking. It has been established that the cracks were caused by what is commonly known as chemical embrittlement of the steel, which is an action said to be due to chemical attack of the boiler water combined with abnormal stress in the material. On account of the creeping character of this form of cracking it is very dangerous, and both boiler shell plates were condemned as unfit for any useful steam-pressure. The boilers have been removed from the ship, and other boilers have been installed.

This is the first occasion on which boilers in New Zealand have been subjected to a magnetic test for detection of cracks, and the experience gained and the result obtained were most interesting and striking.

#### INSPECTION OF MACHINERY.

##### *Boilers.*

The following statement shows the number of inspections of fired boilers, unfired steam-pressure vessels, and air-receivers made during the year, the corresponding figures for the previous year being shown in parentheses :—

Fired boilers	..	..	..	..	4,778	(4,855)
Unfired steam-pressure vessels	..	..	..	..	4,245	(3,889)
Air-receivers	..	..	..	..	1,078	(941)
					10,101	(9,685)

The inspections include 91 new power boilers, aggregating 1,094 horse-power, manufactured within the Dominion, and 43 new power boilers, aggregating 1,027 horse-power, imported from abroad. They also include 181 new steam-pressure vessels and 58 new air-receivers manufactured within the Dominion and 237 new steam-pressure vessels and 44 new air-receivers imported from abroad. The total number of new boilers, pressure vessels, and air-receivers put into service during the year was 654, against 666 for the previous year.

The only explosion reported during the year was that of a pressure vessel neither inspected nor certificated by the Department. It was in use with an air-pressure of 60 lb. per square inch when the bottom end blew out and the remaining portion struck a workman and inflicted serious head injuries. The ends were soldered only, and were therefore quite unsafe for the pressure.

##### *Machinery.*

The following statement shows the number of inspections of machines, machinery plants, lifts, cranes, hoists, and tractors, the corresponding figures for the previous year being shown in parentheses :—

Machines not driven by steam-power; plants (10,721)	..	77,450	(72,123)
Machines driven by steam-power; plants (2,385)	..	10,987	(11,391)
Electric-power-supply stations	..	150	(134)
Lifts	..	3,398	(3,318)
Cranes	..	513	(460)
Hoists	..	1,599	(1,516)
Tractors	..	360	(367)
Total inspections	..	94,457	(89,309)