In the bursting tests fifty-one wrought-iron and thirty-six steel pipes were subjected to hydraulic pressure, the results being summed up in the accompanying table:—

TESTS OF WROUGHT-IRON AND STEEL PIPES.

Size of Pipe.	Weight in Pounds per Running Foot.						Bursting-pressure, Pounds per Sq. Inch.					
	Wrought Iron.			Steel.			Wrought Iron.			Steel.		
	Min.	Max.	Av.	Min.	Max.	Av.	Min.	Max.	Av.	Min.	Max.	Av.
2 in. line pipe ...	3·105	3·702	3·452	3·331	4·073	3·821	1,000	4,000	2,918	2,300	6,000	4,733
2 in. tubing ...	3·592	3·995	3·864	3·739	3·961	3·840	3,300	5,000	4,106	5,150	6,000	5,800
5⅝ in. casing ...	8·991	10·417	10·003	9·293	10·328	9·824	250	1,400	931	1,450	2,750	2,038

Size of Pipe.	Tensile Strength, Pounds per Sq. Inch Section.					
	Wrought Iron.			Steel.		
	Min.	Max.	Av.	Min.	Max.	Av.
2 in. line pipe ...	43,107	53,809	50,002	63,025	67,586	65,999
2 in. tubing ...	47,244	55,074	51,852	60,370	66,495	63,057
5⅝ in. casing ...	47,312	61,309	54,311	75,931	91,591	82,325

This shows that the bursting-strength of the steel pipes of the three classes tested exceeded that of wrought-iron by 62 per cent., 84 per cent., and 119 per cent. respectively. These percentages should probably be increased, as twelve pieces of the steel pipe did not burst under a pressure of 6,000 lb., the highest measured. Comparing the minimum strength of the two classes, the weakest iron 2 in. line pipe was found less than one-half as strong as the worst steel one; the worst 2 in. iron tube had only 64 per cent. of the strength of the worst steel; while six out of sixteen of the 5⅝ in. iron casings were only from one-sixth to one-half as strong as the weakest steel ones.

The 2 in. steel pipes were slightly heavier than the wrought-iron pipe of the same diameter, but the difference in weight was far too small to account for the great difference in strength. The tensile tests were made on eleven steel and eleven wrought-iron pipes, and the results are given in the accompanying table. The steel showed tensile strength greater by 32 per cent. in the 2 in. pipe, 22 per cent. in the 2 in. tubes, and 52 per cent. in the 5⅝ in. casing. The results do not call for special remarks.

The friction tests are described by Professor Howe as follows: "These were of two kinds, scraper tests and hydraulic tests. The scraper tests were made by drawing through each of ten steel and twelve wrought-iron pipes a steel boiler-tube scraper under a constant pull and noting how fast it travelled. In the hydraulic test I coupled together six 2 in. steel pipes in one lot about 104 ft. long, and six 2 in. wrought-iron pipes in another lot of the same length. Through each 104 ft. lot thus made I then ran water at full hydrant pressure, and also at lower pressure, and noted in each case the loss of pressure of water in travelling the length of the pipe. This loss of pressure gives us a measure of the friction in each 104 ft. lot. In the scraper tests neither metal has a decided advantage over the other. In many cases, owing to the lightness of the pull used, the scraper was arrested by the friction of the surface of the pipe after it had travelled only part of the measured distance. As regards the proportion of the arrests thus caused the steel stands somewhat better than the wrought iron, the arrests being 34 per cent. of the total number of trials for steel against 44 per cent. for wrought iron. On the other hand, on a general average of those cases in which the scraper was drawn through without arrest, the velocity of travel was rather greater in the wrought-iron than in the steel pipes. But as this leaves out of consideration all the cases in which the scraper was arrested, and thus did not give sufficient weight to the rougher pipes of each class, and as the number of arrests thus left out of consideration was greater in case of wrought-iron pipes than in the case of the steel ones, these averages give an undue advantage to the wrought-iron pipes. In the hydraulic tests the steel showed a constant and pretty uniform superiority to the wrought iron. For given initial pressure the final pressure is on an average of 0·1 lb. per square inch greater in case of steel pipe than in case of wrought-iron pipe. In other words, for given initial pressure the final pressure is about 5 per cent. greater in case of steel than in that of wrought iron."

In the resistance to bursting-strain, which is the most important point in the investigation, Professor Howe's conclusions are strongly in favour of the steel pipe. In his summing-up on this point he says, "Whether we compare the average of the worst of the steel and wrought-iron pipes together, we find that the steel excels the wrought iron very greatly; so greatly, indeed, and so uniformly, that we may safely conclude that steel pipe resists bursting much better than the wrought-iron pipes of the brands which I examined. The explanation of the very great superiority of the steel pipe over the wrought iron pipe is twofold: First, that the bursting-strength of a pipe is limited by the strength of the metal across the grain, and that, while wrought iron is very weak across the grain, steel is nearly as strong across as along the grain. It is natural that, owing to the extreme weakness of wrought iron across the grain, pipes made of it should be very deficient in