that when the steam is shut off, as in descending inclines and approaching stations, the piston is free to move without any friction. The cylinders of the four engines from which the specimen rings exhibited have been taken, show a highly polished surface, are very little worn, and are nearly parallel throughout. The operation of putting in these rings so as simply to fit the cylinder is extremely easy, whilst great care and skill are required in giving springs the requisite degree of elasticity, and in making them to maintain it.

A set of brass packing rings was also exhibited, taken out of the pistons of a pair of vertical stationary engine cylinders at the Dublin Railway station, in which they have been in constant work for the last four years, with a pressure of 50 lb. steam. The diameter of the cylinders is 19½ in., and the rings were originally ⅝ in. thick and ¾ in. wide; they are now worn down to 5-16th in. thick.

A number of stationary engine pistons are working with these packing rings, and they have proved very durable and thoroughly satisfactory, giving an advantage in reduction of friction, and in preserving the cylinder face in perfect condition. In one case of the engine of the Oldbawn Paper Mill, near Dublin, with vertical cylinder 18 in. diameter and 2½ ft. stroke, working with 50 lb. steam, the cylinder had previously been worn considerably out of truth and much grooved, and one of these pistons was put in having two steel rings of ¾ in. width and ⅝ in. thickness, and was in constant work for four years without the packing rings requiring renewal. They have lately been taken out for examination, and were found to be still ¼ in. thick; and the cylinder from its previous defective condition, has been brought completely to truth throughout, with a highly polished surface.

These packing rings have also been used for four years for pump buckets, and have proved very satisfactory. In one case of a double acting pump 8 in. diameter, the two packing rings are of brass, ⅝ in. wide, and 5-16ths in. thick, and are pressed out by the pressure of the water acting at the alternate faces of the bucket through two ports, ½ inch diameter, similar to those in the steam pistons. This pump had two years' constant work at quarries and bridge foundations upon the Great Southern and Western Railway, before the packing rings required renewal.

In the case of single acting pumps the bucket has only a single packing ring with ports opening from the upper side. A pump bucket 5 in. diameter has been working constantly for 2½ years at a station on the railway near Dublin. This bucket was exhibited, having been taken out for the purpose; the packing ring was originally ½ in. wide and ¼ in. thick, and has worn less the 1-16th inch in the 2½ years that it has been working up to the present time. As the diameter in this case is too small to allow of the ring being sprung over the body of the bucket into its place, it is put in by means of a junk ring screwed on at the under side of the bucket.

An application of the same construction of packing that has also been made to the gland packing of a 9 in. pump plunger, in which two brass packing rings are used, ½ in. wide and ⅝ in. thick, just like the piston packing rings, except that they act in the opposite direction, being pressed inwards upon the plunger by the pressure of the water through the ports.

Mr. Miller exhibited specimens of the steel packing rings from the pistons of four locomotives which had run from 38,000 to 96,000 miles; and also the brass packing rings from the pistons of the stationary engine, together with the bucket of the 5 in. single-acting pump referred to in the paper.

MANGANESE.

This substance, although not used in the arts in a metallic condition, is in many respects valuable to all who are engaged in the pursuit of science, owing to the peculiar affinity it has for oxygen. The most common source of manganese is the black oxide, known also as the binoxide, or peroxide, MnO_2. In the form in which it is usually met in commerce, peroxide of manganese is an intensely black heavy powder, prepared by grinding up the native variety. The chief uses of peroxide of manganese are for the preparation of oxygen and chlorine. When it is heated to a dull redness, a portion of the contained oxygen is evolved, and sesquioxide of manganese is left behind. If the manganese has been free from chlorides, the oxygen will be pretty pure, but otherwise the first portions of gas which come over are liable to be contaminated with chlorine.

Binoxide of manganese is of constant use in the laboratory for the preparation of chlorine; for this purpose it is acted on by hydrochloric acid, either by the direct addition of this acid to it, or by making a mixture of common salt and binoxide of manganese, and then heating this with oil of vitriol. The chlorine is liable to be contaminated with free hydrochloric acid, and should, therefore, be washed in water which will hold back the free acid. If required dry, it should then be passed through oil of vitriol. When peroxide of manganese is ignited with caustic potash or soda, in contact with air, or when fused with an alkaline chlorate or nitrate, more oxygen is absorbed by the manganese forming manganic acid, MnO_3, which unites with the alkali present forming a manganate. Manganate of potash forms an intense bluish green solution, which is permanent when an excess of alkali is present. When an acid is added, or when the manganate of potash is allowed to remain in contact with the atmosphere containing carbonic acid the manganic acid set at liberty is split up into peroxide of manganese and into another acid, permanganic acid, $Mn\,O_3$, which instantly unites with some of the alkali, forming a permanganate of an intense purple-red color.

Permanic acid in aqueous solution, may be obtained by adding to permanganate of baryta the exact quantity of sulphuric acid necessary to precipitate all the baryta, and then filtering through asbestos or gun-cotton. Sulphate of baryta remains on the filter and the filtrate consists of permanganic in aqueous solution. It forms a beautifully-coloured liquid, which appears dark carmine red by reflected, and dark violet by transmitted, light. When somewhat diluted it is reddish blue, and a still larger addition of water gives it a carmine color. The acid imparts a distinct red color to very large quantities of water. It is inodorous, and has at first