ON AN IMPROVED PISTON FOR STEAM-ENGINES.

The importance of having the piston of a steam-engine, upon which its satisfactory performance so much depends, made as light, as simple, as steam-tight, and as free from friction as possible, will no doubt be generally admitted, and by none more readily than those who, like the writer, have charge of locomotive engines.

The piston which is the subject of the present paper goes far to secure these advantages, and has realised so far as time would allow all that the writer expected from its introduction. It has been his leading object to reduce as far as possible the amount of rubbing surface, preserving at the same time as nearly as practicable the same pressure per unit of surface, in order to prevent the passage of steam.

This has been done for an 18 inch piston in the proportion of about 141 to 42, and the friction, which may fairly be assumed as proportioned to the extent of rubbing surface, has been reduced accordingly.

This piston is shown in Plate 16, and consists of a single casting A, without cover, bolts, or nuts; it is fixed upon a conical part of the piston rod by a nut, as shown in Fig. 1. Three separate grooves B B B, each ¼ in. wide, ¼ in. apart, and 5-16 deep, are turned in the circumference, and these grooves are fitted with elastic packing rings. These rings, which may be made of brass, steel, or iron, are drawn of a suitable section to fit the grooves in the piston, and are bent in rollers to the proper curvature, the diameter of the circle to which they are bent being about one-tenth larger than the cylinder. They are placed in the grooves in a compressed state, and along with the body of the piston are thus put into the cylinder, care being taken to block the steam port so as to prevent the rings from getting into it. The rings are therefore forced outwards by their own elasticity, which is found quite sufficient to keep them steam-tight.

The joints of the rings are placed in some part of the lower half of the cylinder so as to break joint, as at D D D in Fig. 2. The body of the piston resting as it does upon the bottom of the cylinder, prevents the steam getting at them; should it however by any chance pass the joint of the first ring, it is all but impossible for the solid part of the piston to be so far out of contact as to allow access to the second, and of course still more so to the third joint.

In applying this piston to engines with the ordinary flat covers, the form already described is preferred, and in order to fill up the recess in its inner side and prevent waste of steam, a block C C is riveted to the inner cover. The front cover having no block attached to it is not increased in weight, and is therefore more easy to handle. When, however, the covers are adapted to the piston, the form shown in Fig. 3 is considered best, as it may be made rather lighter.

The advantages obtained in this piston are:—

1st—Lightness, a 15 in. piston of cast iron weighs only 88 lbs. on the new construction, and the lightest the writer had previously in use weighed over 119 lbs. If made of wrought-iron or brass the weight might be still further reduced.

2nd.—Simplicity and economy of construction; the piston consisting only of one piece with the three rings, and having no workmanship upon it except turning the rim and boring the centre. The packing rings being drawn as ordinary wire and then bent, can be produced at a cost little more than nominal.

3rd.—Impossibility of getting deranged, in consequence of there being no loose parts, suchas bolts, nuts, cotters, or pins, which might come out, and cause damage; and no parts that can become unfastened, as each ring is effectually secured in a separate groove.

4th.—Less friction, both from the reduced weight of the piston and the less amount of elastic surface pressed against the cylinders. This latter for an 18 in. piston is about as 42 square inches to 141 square inches, when compared with an ordinary piston with packings 2½ in. deep, and from the results shown in the working the writer is of opinion that it is mainly to this that its satisfactory performance is owing.

It is now sixteen months since the first pair were put to work, and others have since been made to the number of 30 pairs, the whole of which are realising all that could be desired. The piston now shown has been at work fifteen months, and has run a distance of 19,650 miles. A set of rings will run from 3,000 to 4,000 miles, and cost when new, about 2s. 6d; so that in examining and cleaning a piston the renewal of the packing is of little more consideration, so far as cost is concerned, than if the piston were hemp-packed.

A careful average of the consumption of the fifteen engines which were first fitted with these pistons, and which have since run intervals of time varying from four to sixteen months, and an aggregate distance of 269,800 miles, shows a reduction, when compared with the duty of the same engines for four years previous to these pistons being put in, of 5.7 lbs. per mile; a result which has been carefully arrived at, and which goes to show that this piston, either from greater average tightness, or reduced friction, or both combined, is greatly superior to those which it has superseded.

Mr. RAMSBOTTOM showed a new specimen of the pistons, and also one of them that had been 15 months at work, with the old and new packing rings.

The CHAIRMAN inquired whether the particulars of the working of the same engines before and after the new pistons were applied could be given, so as to enable a complete comparison to be made?

Mr. RAMSBOTTOM showed a statement of the consumption of fuel in the engines with the new pistons, since the alteration, and for four years previously, showing the general result of an economy in consumption of 12 per cent., where there had been no material repair or other alteration made to the engines.

Mr. JOBSON thought the difference appeared too great to be attributable entirely to any improvement in the construction of pistons, unless the engines were much out of order previously.

Mr. RAMSBOTTOM said the engines were in average good order both before and after the alteration of the pistons, and he was not aware of any other cause for the economy that was perceived. There were now upon various railways about 120 of the new pistons at work, which he believed had all proved quite satisfactory.

Mr. EVERITT inquired whether any trial had been made of the new pistons in stationary engines?

Mr. RAMSBOTTOM replied that only one or two had been tried at present in stationary engines; the largest of the pistons yet made was 18 inches diameter.

Mr. MATHEWS asked whether the new construction of piston was considered more applicable to locomotive than to stationary engines?

Mr. RAMSBOTTOM said the horizontal position, as in the locomotive engines, was best for it, as the piston body then completely closed the joints in the rings, all the joints being placed in the lower half of the circumference; only one vertical engine and a steam hammer, he believed, had been tried at present with the new piston, but no difficulty had been found in keeping them steam-tight. One great advantage was the lightness of the new piston, which was more particularly valuable in locomotive engines; the 18-inch pistons weighed only 121 lbs. each, instead of about 260 lbs., the usual weight, being a saving of more than half the weight.

The CHAIRMAN inquired what was the comparative cost of the pistons?

Mr. RAMSBOTTOM replied the actual comparison would vary with the different construction of piston, but none of the others he had in use were

less than three times the cost of the new pistons. The great saving in cost arose from the new piston having no fitting about it, and the only work put upon it was boring the centre and turning the circumference; the packing rings were merely iron wire, finished by the process of drawing, and only requiring to be bent to the proper curvature by passing through bending rolls.

Mr. PAYNE asked whether the packing rings were increased in thickness in proportion to the size of the cylinder?

Mr. RAMSBOTTOM said he had only yet tried one size of ring, and this had been found sufficient, as the diameters of cylinders had only varied from 12 to 18 inches; but for much larger cylinders a different size of packing ring would doubtless be advisable.

Mr. CHELLINGWORTH inquired whether any provision was made for preventing the rings from turning round, so as to avoid the risk of the open joints of the rings getting opposite one another?

Mr. RAMSBOTTOM replied, that some of the pistons had been made at first with only two rings instead of three, and it had been originally intended to have a stud riveted into each groove, to prevent the rings from turning round; this had not been found requisite, and therefore had not been carried out. Indeed, it was just as well that the rings should shift a little, as the working faces were thereby improved; even if the three joints should get all opposite at any time, which was very improbable, the total leakage of steam could be only very insignificant in that construction of piston.

Mr. MATHEWS remarked, that the same action which had the effect of turning round the rings, would also separate the joints from one another, and prevent any escape of steam from their simultaneous exposure at the same point.

The CHAIRMAN said, he thought the piston was a very ingenious invention, and its great simplicity and lightness was a great recommendation, and would make it very advantageous for several situations. He proposed a vote of thanks to Mr. Ramsbottom, which was passed.

The following paper, by Mr. Archibald Slate, was then read:—

IMPROVED PISTON.

Plate 16.

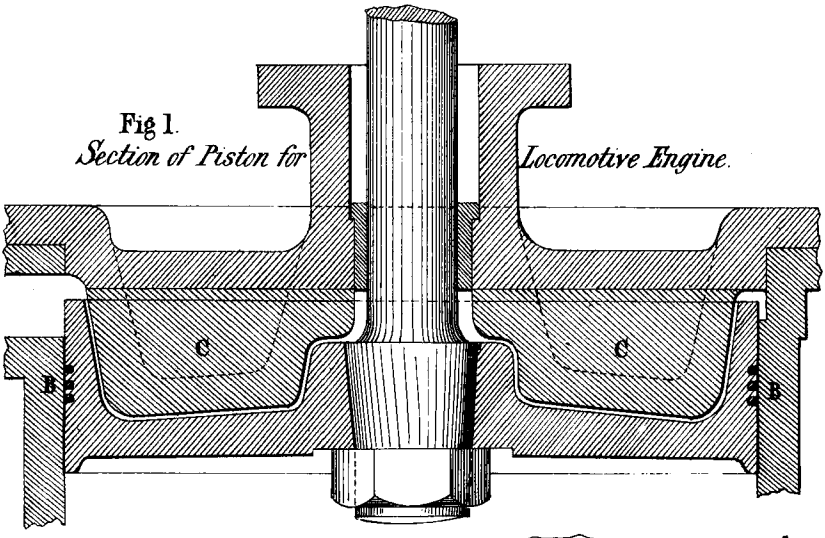

Fig 1.
Section of Piston for Locomotive Engine.

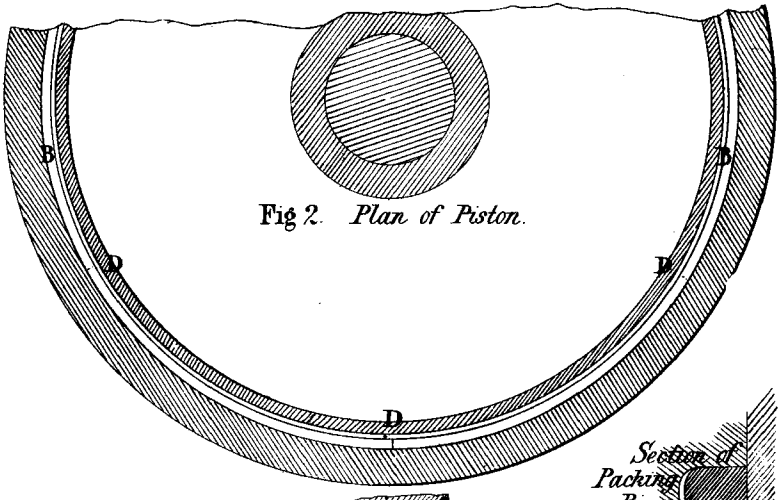

Fig 2. *Plan of Piston.*

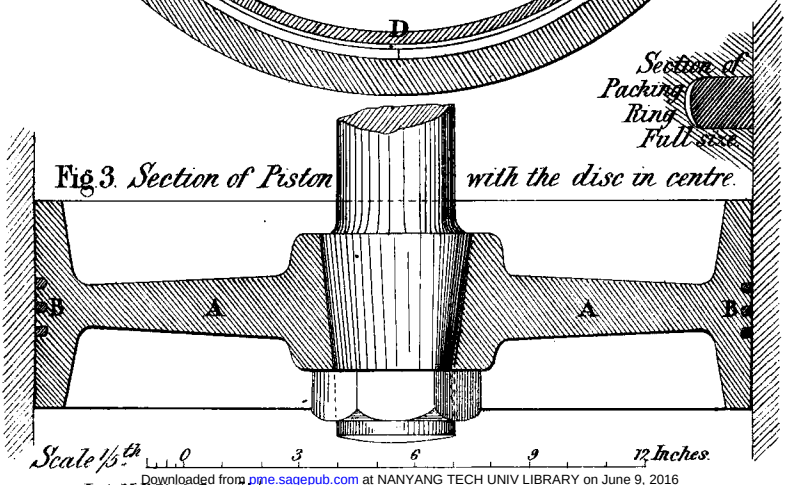

Fig 3. *Section of Piston with the disc in centre.*

(Proceedings Inst M.E. 1854. Page 71.)