No. XXIII.

Description of an Improved Piston for Steam Engines, without Hemp Packing. By P. A. Browne, Esq.—Read, Nov. 1816.

To the President, &c. of the
Am. Phil. Society.

GENTLEMEN,

I TAKE the liberty of communicating to your respectable body an improvement I have lately made in mechanics. It consists of a Piston which operates without any packing, being perfectly air-tight, and requiring much less power than any hitherto used.

From the following description and the drawing which accompanies this letter, the principle will be perfectly understood; and the model which I send to be viewed by the society, will show that it is capable of being reduced to practice.

The foot of the piston rod (Plate IX. fig. 5. *a.*) which gradually widens at the bottom, passes into and fits upon a flat circular piece (*b.* fig. 6.) the size of the cylinder (which has the shoulder or shoulders hereafter described) and with the circular plate hereafter described, keeps the parts of the piston next described, in their places.

Between the above piece and the circular plate hereafter described are three* or more segments or pieces of brass† or other metallic substance, or other substance (A. fig. 6.) of the thickness required by the power of the engine,‡ the outer extremities of the whole of which, when placed together. will form a circle equal in size to the cylinder; the shape of the inner parts of these pieces differs according to their number, but must always be such as to admit between them the wedge of the triangular form next described.

Between each of these segments or pieces, and exactly filling the interstices between them is a wedge of a triangular form of the same material (B. fig. 5, 6.) the base of each of which triangular wedges rests upon or against a circular spring (*c.* fig. 5, 6.) or spiral or other springs§ fixed, if circular, around, and if spiral, against the sides of the piston rod.

Over these is another circular plate (*d.* fig. 5.) of the size of the cylinder, through a hole in the centre of

* The segments are said to be three or more, because there may not be less than three, but they may be increased to any number. For small pistons, say for engines not exceeding in power that of two horses, and moderate sized pumps, three pieces are best calculated, and it is believed that scarcely any power will require more than eight.

† The segment or pieces, and the triangular wedges, may be of brass or other metallic or other substance. It is believed that brass, from its known durability when liable to friction, is preferable to any other metallic substance, they may however be composed of steel or any other metal, or even of wood or other substances.

‡ The thickness of the segments or pieces, and of course the wedges, must be regulated by the power of the engine; it must be sufficient to exclude the air, and not so thick as to create unnecessary friction. It is believed that for a power less than four horses, it need not exceed one inch, for a power greater, and not exceeding twelve horses, one and a half inch; and two inches thick, will answer for any larger power now in use.

§ There may be one circular spring encompassing the piston rod, and acting equally against the base or end of each wedge, which is preferable; or there may be as many spiral or other springs, of equal force, as there are wedges, each acting on a wedge. Two things must be carefully attended to, 1st. That the spring or springs, (if more than one) act equally on each wedge, so that the pressure of the piston on the cylinder may be uniform, and 2dly. That the spring or springs have just sufficient force to make the cylinder air tight, and yet not enough unnecessarily to increase the friction.

which the piston rod passes. This plate rests upon a shoulder (*e.* fig. 5.) or shoulders, permanent on the lower piece first above described, and projecting from the piston rod. This piece is confined down to its place on the shoulder or shoulders, by a clamp, (*f.* fig. 5.) or other fastening, and a nut (*g*, fig. 5.) or nuts, which screw on the piston rod.

By means of the circular pieces, kept asunder by the shoulder or shoulders, the segments, wedges and spring or springs, are gently confined so as to be prevented from rising or falling from their places, but the spring or springs are allowed to expand, and the wedges are thereby constantly and equally pressed in a direction from the piston rod against the segments, and they against the cylinder, in such a manner as to make it completely air-tight, but at the same time so as to create very little friction as the piston moves up and down.

The advantages of this piston over any hitherto known, are great and obvious.

It is more simple, and of course cheaper than any metallic piston hitherto invented.

It is less liable to get out of repair than any piston now in use; it rather improves by use, for as the friction gradually wears away the segments, so also does it the angles of the wedges, and the whole becomes perfectly smooth, while the exact circular form is preserved unimpaired.

It saves the power of the engine by diminishing the friction. It is well known that the common packing, in order to be air-tight, is required to be large and compact, and a very large proportion of the force of the engine is employed in overcoming its resistance. This piston is more uniform in its pressure, and presents a much smaller surface for friction, being at the same time equally air-tight. It is confidently believed that the power required to drive a steam engine of a three horse power, with the common hemp packing, would drive one of a four horse power with this piston.

It will also be found to possess essential advantages in pumps of all sorts, especially those for hot liquor, which is

so destructive to hemp packing, but which will not in the least injure the metallic piston above described,*

* It has been objected to this piston that it will not be air-tight; the objection however has, it is presumed, been obviated by the use of Dr. Cartwright's metallic piston, which is metal against metal, and which is nevertheless found to operate successfully. Dr. Cartwright's piston is composed of eight radii of a circle or wedges each propelled by a separate spring placed between the piston-rod and wedge, is more complicated, and consequently more liable to get out of repair than this piston, which is perfectly simple and not liable to accidents. It might also be added that the pressure of a number of springs cannot be so uniform as that of one spring, which is all that is used in this improvement.

Fig. 1.

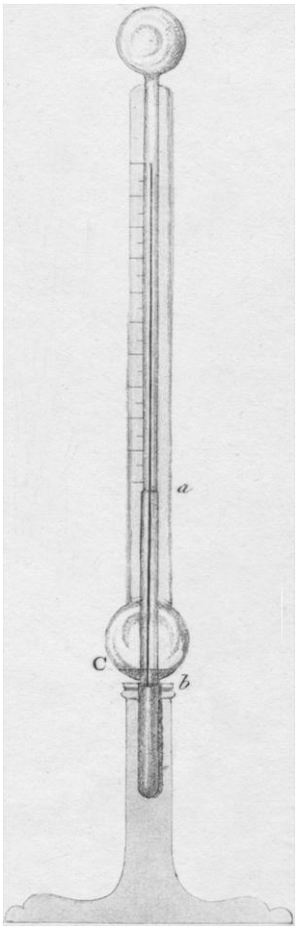


Fig. 2.

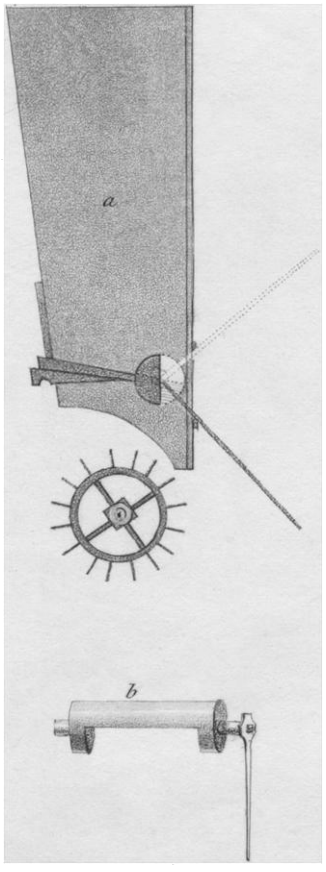


Fig. 3.

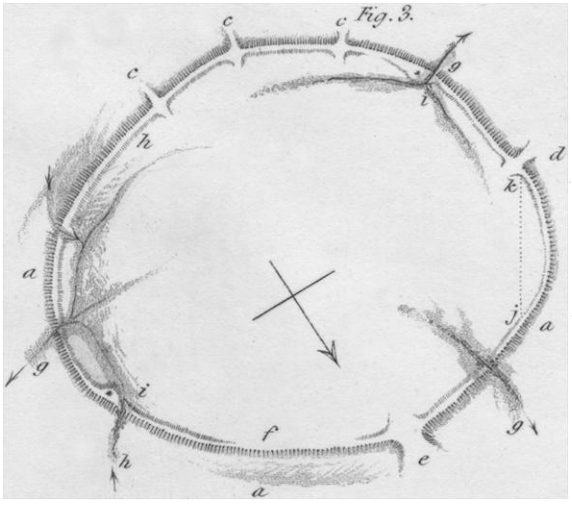


Fig. 4.

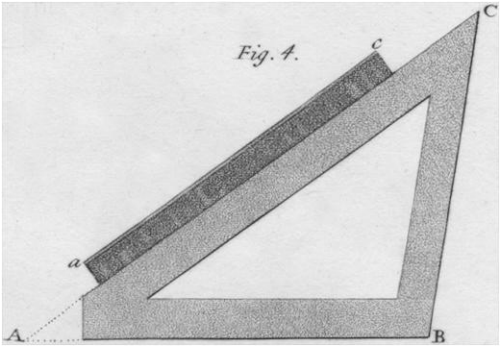


Fig. 6.

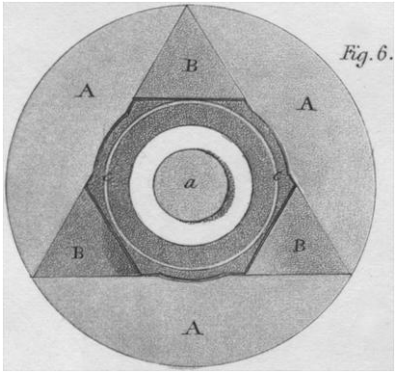


Fig. 5.

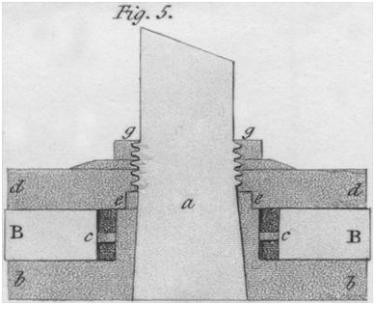


Fig. 8.

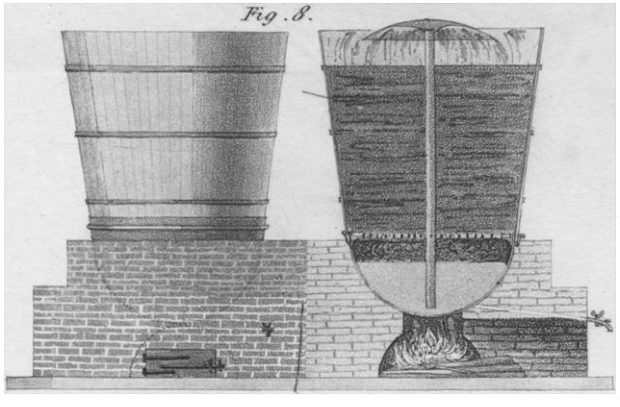


Fig. 9.

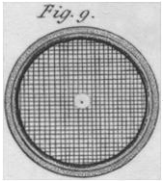
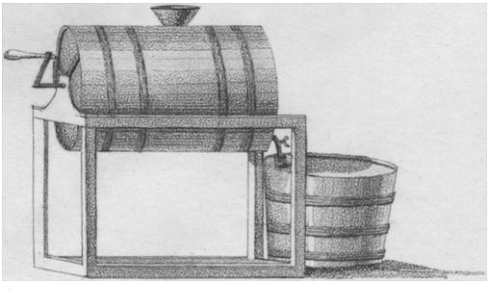


Fig. 7.



Engd. by J. Hill.