

(No Model.)

2 Sheets—Sheet 1.

S. MALTBY.
PISTON.

No. 277,305.

Patented May 8, 1883.

Fig. 1.

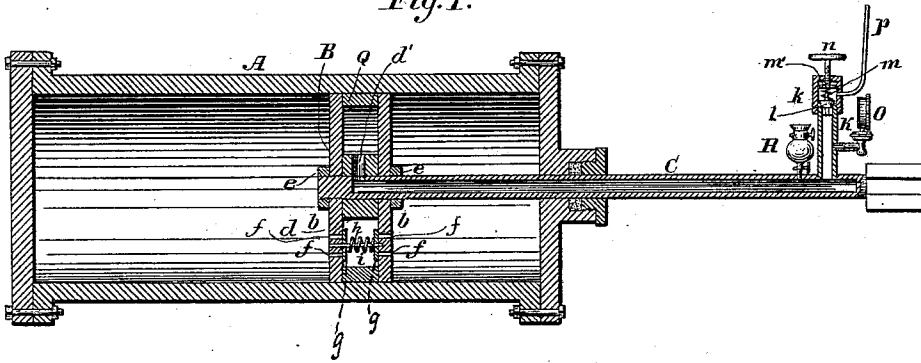
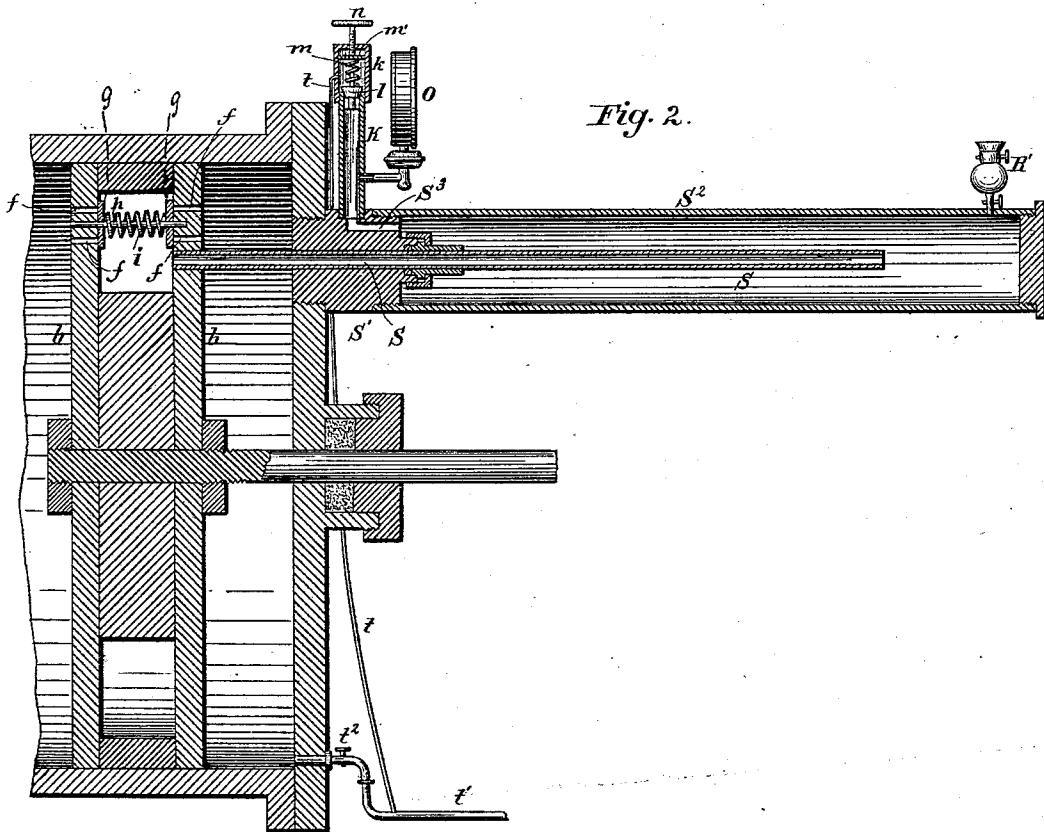


Fig. 2.



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Inventor

Sidney Maltby

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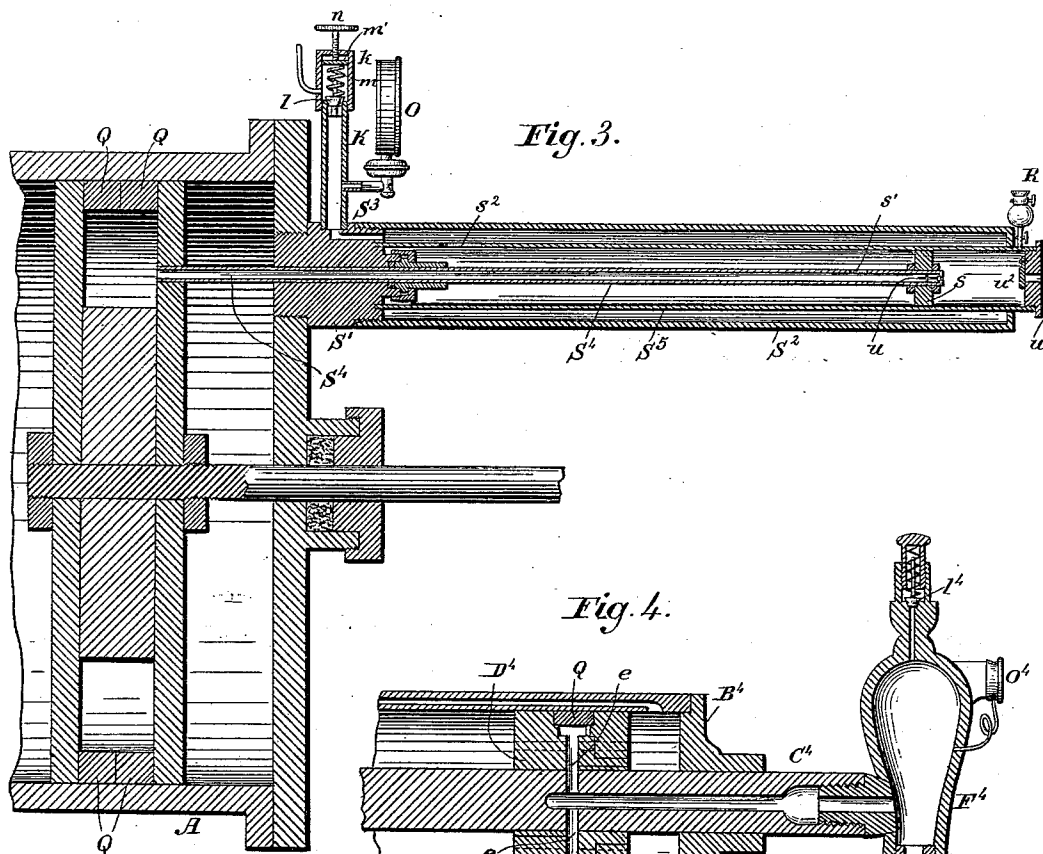


Fig. 5.

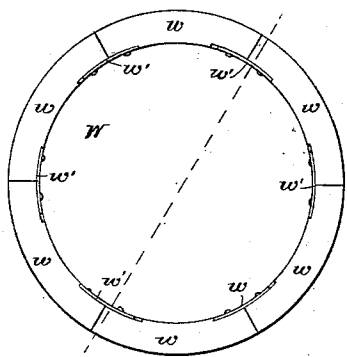
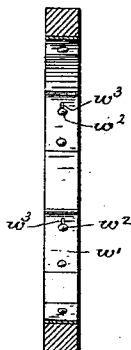


Fig. 6.



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UNITED STATES PATENT OFFICE.

SIDNEY MALTBY, OF WASHINGTON, DISTRICT OF COLUMBIA, ASSIGNOR OF
ONE-HALF TO EDWARD L. LAMBIE, OF SAME PLACE.

PISTON.

SPECIFICATION forming part of Letters Patent No. 277,305, dated May 8, 1883.

Application filed March 10, 1883. (No model.)

To all whom it may concern:

Be it known that I, SIDNEY MALTBY, a citizen of the United States, residing at Washington, in the District of Columbia, have invented certain new and useful Improvements in Pistons, of which the following is a specification, reference being had therein to the accompanying drawings.

This invention relates, generally, to that class of pistons in which the packing is set out by pressure of steam, air, gas, or other similarly-acting agent; and it has especial reference to means for regulating and controlling the pressure exerted in setting out the packing, so that the latter will be prevented from excessively and unevenly wearing the inner surface of the cylinder or barrel in which the piston plays.

The object of the invention is to provide means whereby the pressure which sets out the packing will be applied independently of the pressure which drives the piston.

It has the further object to provide means whereby the setting-out pressure of the packing may be regulated while the engine of which the piston forms a part is in motion, and also to enable the supplying of lubrication to the interior of the cylinder, while the engine is in motion, through the devices used for applying the setting-out pressure of the packing.

My improvement consists in certain novel constructions and combinations of devices, which will be clearly understood by reference to the accompanying drawings and the following specification, and which will be definitely pointed out in the appended claims.

In the drawings, Figure 1 is a longitudinal vertical section of a steam-engine cylinder and piston having my improvement applied thereto. Fig. 2 is a similar section illustrating a modification of my invention. Fig. 3 is a similar section illustrating a modification of the invention adapted to applying air-pressure for setting out the packing. Fig. 4 is a similar section illustrating another modification of devices for applying air-pressure for setting out the packing. Fig. 5 is a side view of a preferred form of expansible packing-ring, and Fig. 6 is a section of the same on the line *x x* of Fig. 5.

Referring to Fig. 1, the letter A indicates

the steam-cylinder, and B its piston, to which is connected a hollow piston-rod, C, which plays through a stuffing-box in the head of the cylinder in the usual manner. The piston B is composed in the present instance of two heads, *b b*, separated by hub *d*, through which and both of the heads *b b* the rod C passes and is secured by nuts *e*. The bore or central passage of the rod C has a lateral opening between the heads of the piston, and this opening connects with a passage, *d'*, to the interior chamber of the piston through the hub *d*.

In the opposite heads of the piston are formed openings or ports *f*, which are closed on the inside by spring-pressed valves *g*, which slide upon a rod, *h*, which is screwed through one of the heads of the piston and enters a socket in the other. The valves *g* are simply disks or collars perforated centrally to receive the rod, and against which bear the opposite ends of a light spring, *i*, which has a sufficient tension to keep both valves normally closed, but will permit either to readily open in response to pressure on its outer face. It will be observed that when one of the valves opens the tendency of the spring *i* will be to press the other valve to its seat with increased pressure.

Near its outer end the hollow piston-rod has its bore intersected by a short vertical tube, K, the top of which is provided with a hollow cap, *k*.

In the upper end of tube K is fitted a valve, *l*, upon which bears one end of a spring, *m*, the upper end of which bears against a plate, *m'*, upon which impinges the tip of a hand-screw, *n*, which passes through the head of the cap *k*.

To the pipe K is connected, in a well-known manner, the pressure-gage O, of any ordinary construction, adapted to indicate steam or other fluid pressure. With the cap *k* is connected, above the valve *l*, a small projecting pipe, *p*, open at its outer end.

The letter Q indicates an expansible packing-ring, which is located between the heads of the piston, and may be of any suitable known construction, but preferably that which will be hereinafter described. A single packing-ring may be used, or two or more, side by side.

The operation of the invention as now de-

cribed is as follows: When steam is admitted to the cylinder on one side of the piston and drives the same the valve *g* on the side to which steam is admitted will be forced open, and steam will enter the interior of the piston and set out the packing-rings, and will at the same time flow through the passage *d'* and the bore of the piston-rod to the tube *K*, where it exerts a pressure upon the valve *l* and the pressure-gage. It will now be observed that by properly regulating the degree of force with which the spring *m* presses the valve *l* to its seat said valve may be caused to open and relieve the pressure within the piston and against the packing-rings whenever that pressure exceeds a predetermined point. The pressure within the piston, its hollow rod, and tube *K* will obviously be the same, and this pressure will be indicated by the gage *O*, so that the amount of force with which the packing-rings are pressed against the inner face of the cylinder can be readily ascertained by observation of said gage. For example, if it is known that a pressure of fifteen pounds will set out the packing-rings properly the tension of the spring *m* will be regulated by means of the hand-screw *n* so that the pressure-gage will indicate a pressure of fifteen pounds without the valve *l* being opened; but immediately that pressure is exceeded said valve will open and allow the excess to escape into the cap *k* and through the vent-tube *p*. It will now be seen that however great may be the pressure with which the piston is driven the pressure which sets out the packing-rings can never exceed the point at which the valve *l* has been regulated to open, and this setting-out pressure will be maintained uniformly throughout the stroke of the piston in both directions. It will also be observed that at whatever point the engine may be stopped both valves *g g* will be automatically closed by the pressure of the spring between them and the steam within the piston and the steam-pressure in said piston will be retained and keep the packing-rings well set out, so that the engine may be again promptly started, as no leakage past the piston will occur when steam is again admitted to the cylinder.

The letter *R* indicates an oil-cup attached to the piston-rod and connected with its bore, so that lubrication may be at any time applied through said piston-rod and find its way to the interior of the piston, whence it will be forced outward through the joints of the packing ring or rings. Thus it will be seen that the setting-out pressure of the packing may be regulated or lubrication applied at any time without stopping the engine for such purposes.

In the modification shown in Fig. 2 the piston is constructed the same as shown in Fig. 1; but instead of making the piston-rod hollow I lead a separate hollow rod, *S*, from the interior of the piston, and this rod passes through a boss, *S'*, which is screwed into the cylinder-head and projects outwardly, said

boss being provided at its outer end with a suitable stuffing-box for the passage of said hollow rod. To the outer end of the boss *S'* is secured a sleeve, *S²*, which projects outwardly, is closed at its outer end, and surrounds the hollow rod *S*. Into the boss *S'* is screwed the tube *K*, which is identical with the tube *K* in Fig. 1, and is provided with a safety-valve and pressure-gage in the same manner. From the tube *K* a passage, *S³*, leads through the boss *S'* to the interior of the sleeve *S²*. From the cap *k*, above the safety-valve, a pipe, *t*, leads to the waste-pipe *t'*, which is connected with petcock *t²*, so that the escape of steam from the safety-valves will be carried off and not observed within the vicinity of the engine. In this instance an oil-cup, *R'*, is connected with the sleeve *S²*.

The operation of the modification now described will be readily understood. The steam which finds its way to the interior of the piston through either of the valves *g* flows through the hollow rod *S*, through the sleeve *S²*, and thence through the passage *S³* and tube *K* to the safety-valve *l* and pressure-gage *O*, so that whenever the pressure within the piston and against the packing-rings exceeds the force under which the valve *l* is regulated to open said valve will automatically relieve the pressure, and a uniform pressure will thus be maintained behind the packing-rings.

In the modification of my invention illustrated in Fig. 3 the devices are adapted for applying air-pressure for setting out the packing-rings of the piston of a steam-engine, though they may be similarly applied to an engine driven by any other motive agent. In this modification the piston-heads have no valves for admitting steam to the interior, and the hollow rod *S⁴*, which leads from the interior of the piston, acts as the plunger of an air-pump, which consists of a barrel or sleeve, *S⁵*, which is inserted within the sleeve *S²* and surrounds the hollow rod, its inner end being supported by being inserted in an annular groove or recess in the outer end of the boss *S'*, and its outer end supported by being passed through and screwed into an opening formed to receive it in the head of the sleeve *S²*. The hollow rod *S⁴* is provided with a piston-head, *s*, which plays air-tight in the inner sleeve or barrel, *S⁵*, and in the outer end of said hollow rod is arranged a valve, *u*, which opens inwardly with respect to the rod. In the outer end or head of the sleeve *S⁵* is formed an opening or port, *u'*, which is guarded by a valve, *u²*, which opens inwardly. Behind its piston-head an opening, *s'*, is formed in one side of the rod *S⁴*, and an opening, *s²*, is formed in the sleeve *S⁵* near its inner end. The arrangement of the tube *K* and its connections on the boss *S'* is the same as shown in Fig. 2, except that the vent-pipe *t* need not lead to the waste-pipe. The operation of this modification is as follows: When the engine is at rest the sleeves become filled with air, as the valves of the rod *S⁴* and sleeve *S⁵* are not

normally pressed to their seats with sufficient force to prevent access of air to the interior of said sleeves. Now, supposing the engine to be started on its outstroke, the hollow rod S^4 and its head will move inwardly, and the air which is behind it will be compressed and driven partly through the opening s' and the bore of the rod to the interior of the piston, and partly through the opening s' to the space between the two sleeves, and through the passage S^3 and tube K to the safety-valve and pressure-gage. The portion which enters the piston-chamber acts by its pressure to set out the packing-rings; and as there is free communication between the interior chamber of the piston and the tube K it is obvious that the compressed air will exert an equal pressure upon the packing-rings and the safety-valve, and this valve being regulated, as heretofore described, to open under a given amount of pressure, it is obvious that this predetermined amount of pressure can never be exceeded on said packing-rings. As the rod and its head move inwardly air is drawn into the barrel or sleeve S^2 , past the valve w^2 , and when the piston is on its instroke the valve u opens, and this air is forced partly in through the hollow rod to the interior of the piston, and partly through the opening s' , sleeve S^5 , and opening s^2 to the sleeve S^2 , and thence through the passage S^3 to the safety-valve and pressure-gage, its pressure upon the packing-rings being controlled in the same manner as when the piston was on its outstroke.

In the modification illustrated in Fig. 4, the letter C^4 represents a hollow piston-rod, the end of which projects out through a stuffing-box in the cylinder-head B^4 . This is the opposite end of the rod from the cross-head. D^4 is a piston-head made in two parts bolted together, and having between them an annular chamber, in which a packing-ring, Q, is placed in the usual manner. This chamber communicates by passages e with the hollow piston-rod C^4 . To the end of the said rod is attached the receiver F^4 of an air-pump, G^4 . This pump and receiver are carried back and forth with the rod C^4 , and the pump is so arranged as to be operated by this movement, its piston-rod H^4 passing through a projection, I^4 , on the cylinder-head, and having an adjustable stop, J^4 , by means of which its strokes may be regulated. In the top of the receiver is arranged the safety-valve l^4 for regulating the air-pressure, and to the side of the receiver is attached the gage O^4 for indicating the pressure within. The operation of this modification is as follows: When the piston is working the air-pump supplies the receiver with air, and there being a direct communication between the said receiver and the chamber of the piston through the hollow piston-rod, the packing-ring Q is forced outward against the inner surface of the cylinder in accordance with the degree of pressure in said receiver, thus independently employing an unvarying force for setting out the packing-rings independently

of the pressure which drives the piston. The pressure may be regulated by the safety-valve in the same manner as explained heretofore.

Instead of attaching the pump and receiver to a rod projecting through the rear head of the cylinder, they may be carried by the cross-head of the piston-rod, which may be bored to communicate with the chamber of the piston.

The form of packing-ring which I prefer to use, and which is illustrated in Figs. 5 and 6, is formed of segments w , which are placed end to end to form a complete packing-ring, W. These segments are connected together by metallic spring-plates w' , attached to their inner surfaces, one end of one of these plates being attached firmly to one segment and loosely to the adjacent segment by means of a pin, w^2 , which projects from the segment through a small longitudinal slot, w^3 , in the end of the plate. The segments are thus well connected together to form a ring, but may separate sufficiently at their ends to allow the ring to expand properly. In using two or more of these rings, I prefer to arrange them so that the segments will break joints—that is, the joint between any two segments of a ring will stand opposite a solid portion of a segment of an adjacent ring.

Having now fully described my invention and explained the operation thereof, I wish it to be understood that I do not confine myself to the precise construction and arrangement of parts as illustrated in my drawings, but may vary the same by the substitution of equivalents for any of said parts, and may rearrange and modify the general construction of the apparatus in any manner for the better carrying out of my invention without departing from the essential principle thereof.

What I claim is—

1. The combination, with a chambered piston and expansible packing, of devices for applying to the packing a setting-out pressure different from the pressure used to drive the piston, and means for automatically regulating said setting-out pressure, substantially as described.

2. The combination, with a chambered piston and an expansible packing ring or rings arranged to close the outer opening of said chamber, of a hollow rod leading out from the interior of the piston, and automatic means for controlling pressure in the interior of the piston through said hollow rod, substantially as described.

3. The combination, with a chambered piston and an expansible packing ring or rings arranged at the outer opening of the piston-chamber, and means for supplying pressure within said piston-chamber, of a hollow rod leading from the interior of said piston, and an automatic regulating-valve connected either directly or intermediately with said hollow rod, substantially as described.

4. The combination, with a chambered piston adapted to receive an expansible packing ring or rings in the outer opening of its cham-

ber, of ports and valves for admitting the piston-driving agent to the interior of the piston at each side alternately, a hollow rod leading out from the interior of the piston, and a safety-valve arranged to control the pressure in the piston through said hollow rod, substantially as described.

5 5. The combination, with a chambered piston adapted to receive an expansible packing and having ports in the opposite walls of its chamber, of valves arranged to close said ports simultaneously, as a result of pressure within said piston, a hollow rod leading from the piston-chamber and adapted to play through an

opening in the cylinder-head, and automatic means for regulating pressure in the piston through said hollow rod, substantially as described.

6. A packing-ring composed of segments joined end to end by spring-plates having slip-joint connection with said segments, substantially as described.

In testimony whereof I affix my signature in presence of two witnesses.

SIDNEY MALTBY.

Witnesses:

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E. L. LAMBIE.