(No Model.) 3 Sheets—Sheet 1.

G. SMITH, Jr.

STEAM ENGINE.

No. 292,264. Patented Jan. 22, 1884.

Fig. 1.

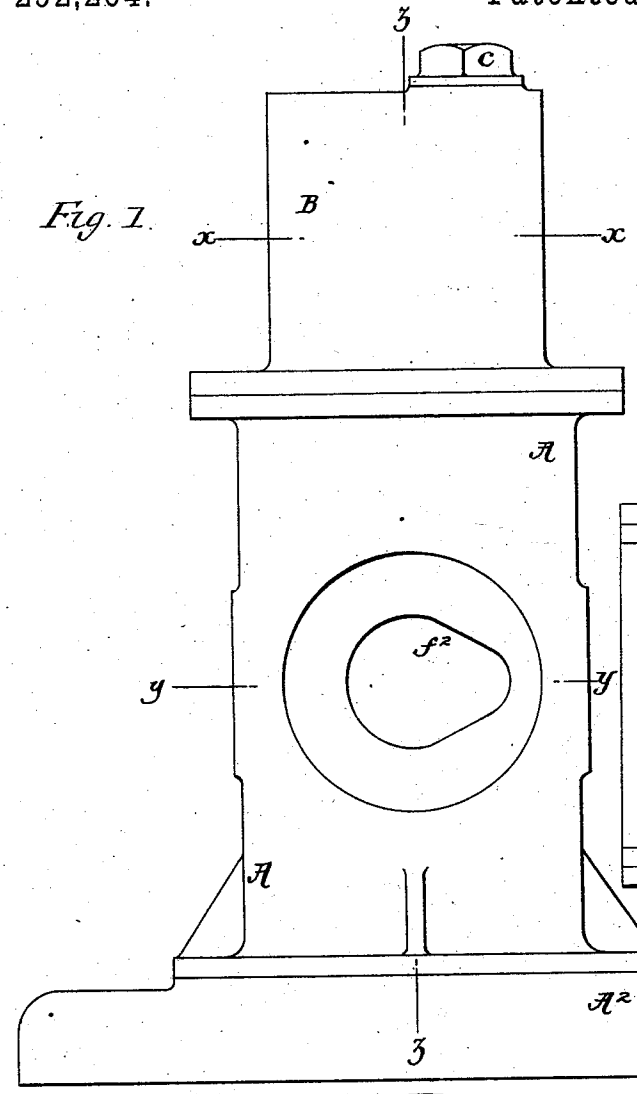


Fig. 6.

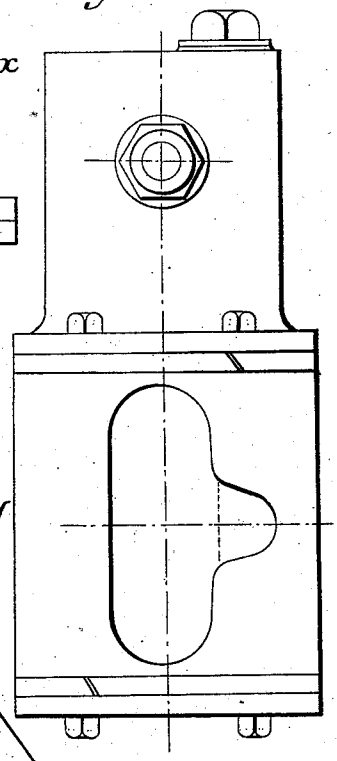
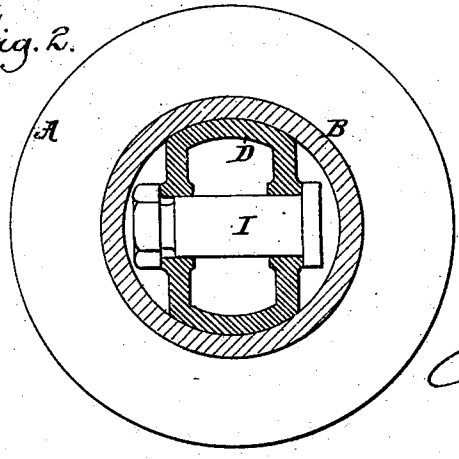


Fig. 2.



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C. M. Austin

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By

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(No Model.) 3 Sheets—Sheet 2.

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Fig. 3.

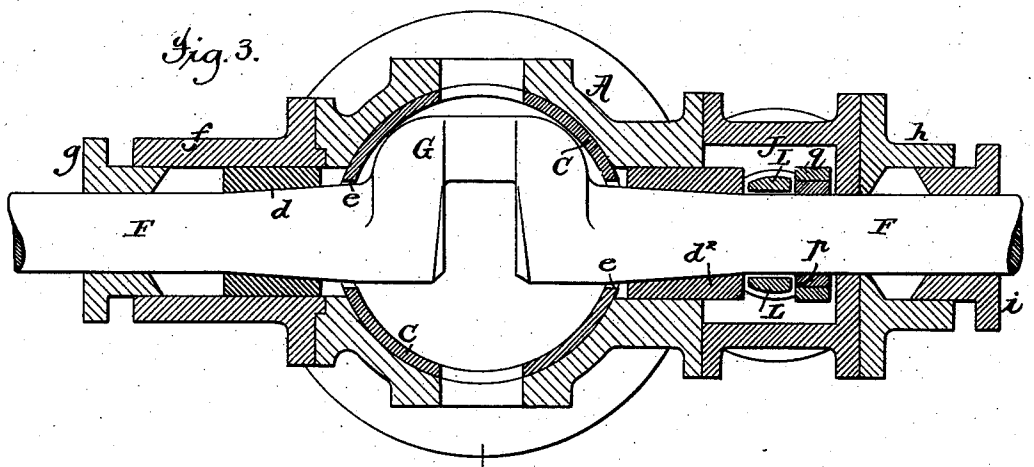
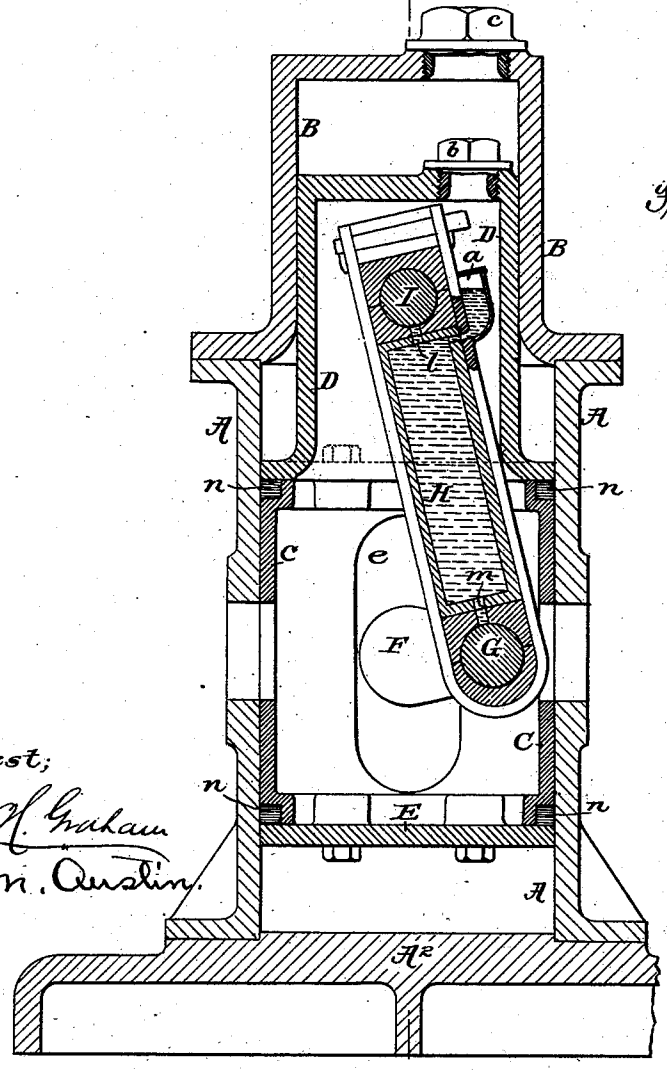


Fig. 5.



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(No Model.) 3 Sheets—Sheet 3.

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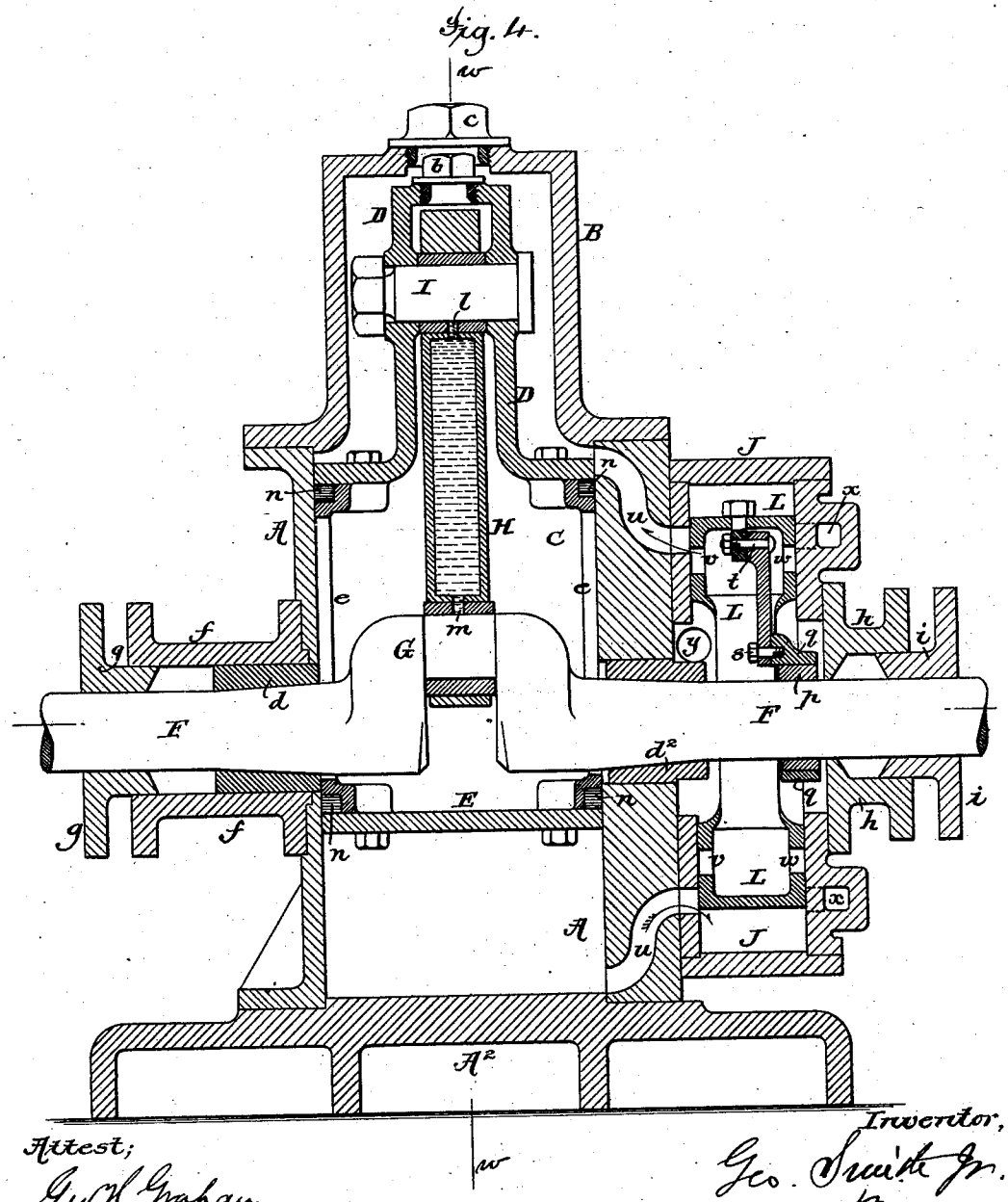
Fig. 4.



Attest;
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UNITED STATES PATENT OFFICE.

GEORGE SMITH, JR., OF NEW YORK, N. Y.

STEAM-ENGINE.

SPECIFICATION forming part of Letters Patent No. 292,264, dated January 22, 1884.

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

To all whom it may concern:

Be it known that I, GEORGE SMITH, Jr., of New York city, in the county of New York and State of New York, have invented certain new and useful Improvements in Steam-Engines; and I do hereby declare that the following is a full, clear, and exact description thereof, reference being had to the accompanying drawings, making part of this application.

My present invention relates to certain new and useful improvements in that kind of steam-engine in which the main crank of the driving-shaft is located within the piston of the cylinder of the engine; and it consists in certain features of construction, which will be hereinafter more fully explained, and specifically pointed out in the claims of this application.

To enable those skilled in the art to make and use an engine containing my several improvements, I will now proceed to more fully describe the invention, referring by letters of reference to the accompanying drawings, forming part of this specification, and in which I have illustrated an engine containing the several features of my improvements as I have so far practically tested them.

In the drawings, Figure 1 is an elevation of one of my improved engines, with the stuffing-box of the main shaft removed, however, for the purpose of showing the aperture in one side of the cylinder through which the main shaft and its crank are passed in putting the engine together. Fig. 2 is a horizontal section of the same at the line *x x* of Fig. 1. Fig. 3 is a horizontal section at the line *y y* of Fig. 1. Fig. 4 is a vertical central section at the line *z z* of Fig. 1. Fig. 5 is a vertical central section taken in a plane at right angles to the plane of section of Fig. 4, or, in other words, at the line *w w* of Fig. 4. Fig. 6 is a detail view of the hollow or cylindrical piston-body detached from the rest of the machine, for the purpose of better illustrating the aperture or hole therein which is adapted to permit the placement within the hollow piston of the main driving-crank.

In the several figures the same part will be found designated by the same letter of reference.

A is the cylinder proper, which is suitably mounted on and secured to the base A^2, which forms the lower head to and closes the lower end of said cylinder, and B is a hat-like extension, the lower flange-like portion of which is bolted, after the fashion of a cylinder-head, to the top of the cylinder A, and securely closes the upper end of said cylinder. C is the cylindrical portion of the piston, which is provided at the lower end with a head-plate or disk, E, (secured in place by bolts,) and at the upper end with a sort of trunk-like extension, D, the lower flange-like and circular portion of which is, in like manner, bolted to said cylindrical part of the piston, suitable packing-rings, *n*, being confined in annular grooves near each end of the piston, in order to have the latter work steam-tight within the cylinder A, all as substantially shown in the drawings.

The trunk-like extension D of the piston, it will be observed, is not cylindrical in cross-sections, but is of the form clearly shown at Figs. 2, 4, and 5, and is of such shape that a portion of its interior surface fits and works against a portion of the interior cylindrical surface of the hat-like extension B of the cylinder A; and within said trunk-like extension D is mounted the wrist-pin or short journal I, to which is connected, by suitable brasses or bearing-boxes, the upper end of a hollow pitman, H, the lower end of which is connected in the usual way of connecting pitmen to the crank G of the crank-shaft F, the arrangement and operation of the parts referred to being such that the rotation of the shaft F is effected through the medium of this crank G and the pitman H, connected to the wrist-pin I by the reciprocatory motion of the trunk-like portion D of the piston of the engine. Said piston has its shell-like portion C formed with two diametrically-opposite openings or slots, *e e*, which are equal each in width to the diameter of the shaft F, and in length the stroke of the piston, plus the diameter of said shaft, and said cylindrical portion C of the piston is also formed or provided with a lateral opening in it of a proper size and shape to permit the passage sidewise through the said piston of the crank G, while one side of the cylinder A of the engine has in it an aperture, f^2, (see Fig. 1,) to permit the crank G to be, in like manner,

passed through said side of said cylinder, in order to permit the putting together of the parts of the engine in working order, as represented in the drawings.

The opening f^2 in one side of the cylinder A is partially filled by the presence of the shaft F, and the rest of said opening is covered by a bonnet-like device, *f*, the external shape of which corresponds to the shape of the aperture f^2, and the internal shape of which is cylindrical, to permit the insertion within it of a tapering bearing-box, *d*, (see Fig. 4,) within which bearing-box is supported and works one portion of the shaft F. Around said shaft is placed an ordinary gland, *g*, which fits within the part *f*, thus forming an ordinary stuffing-box to keep the journal of the shaft F steam-tight. In the top of the hat-like extension B of the cylinder is formed a cylindrical opening, which is closed up by the screw-plug *c*, and immediately beneath said opening (which is made to one side of the center of the circular top of the hat-like extension B) is located a hole in the top of the trunk-like extension D of the piston, which latter hole is covered by a screw cap or plug, *b*, the size of which is such that when the screw-cap *c* shall have been removed the screw-plug *b* may be unscrewed from the top of the trunk-like extension D, and removed through the opening caused by the removal of the screw-cap *c*. The object of this arrangement of holes and screw-plugs is that by the removal of the plugs *c* and *b* the interior of the trunk-like extension D may be accessible for the purpose of getting at the gib and key to the upper end of the hollow pitman H to tighten its boxes, and also to supply oil to the cup or pouch *a* of the pitman, which supply of oil may be made to completely fill the interior of the pitman H, and also fill the said cup or pouch *a*. At that side of the cylinder A opposite where the aperture f^2 is made is a cylindrical hole, through which passes the other end of the shaft F, and within which is arranged the brass box or bearing d^2, in which the tapering portion of this part of the main shaft fits and works, and in this side of the cylinder are also formed the steam and exhaust ports *u u*, through which steam is conveyed to and from the interior of the cylinder, and to and from each end of the piston.

J is the steam-chest, through which passes the shaft F, as clearly shown at Figs. 3 and 4, which shaft is surrounded (after having passed through the steam-chest) by an ordinary stuffing-box, *h*, and gland, *i*, for the purpose of packing the shaft steam-tight in a well-known manner. Within the steam-chest is arranged a plunger-valve, L, the body portion of which is slotted out or made hollow longitudinally, so as to straddle and work around the main shaft F. The steam-ports *v v* and the exhaust-ports *w w* each alternately connect with the ports *u u* of the cylinder and the exhaust-ports *x x* of the steam-chest, to which steam is supplied through the ingress or supply pipe at *y*. The plunger-valve L is worked up and down through the steam-chest and around the shaft F with a rectilinear movement, and by means of an eccentric, *p*, on said shaft F, which eccentric is surrounded by an ordinary eccentric-strap, *q*, to which it is readily connected at *s*, the lower end of an upwardly-extending arm that is pivoted at *t* to a downwardly internally projecting arm or stud of the hollow plunger L, all as substantially illustrated at Fig. 4.

The general operation of the engine may be thus briefly explained. The steam being admitted to the chest, assuming the parts to be in the relative position seen at Fig. 4, the upper end of the piston is acted upon, and as the shaft F is thereby made to begin to turn the plunger-valve L is made to complete its upward stroke, thus fully opening the connection between the upper steam-ports, *v* and *u*, respectively, of the plunger-valve and the engine-cylinder, and as the piston completes its downward stroke the relations of the ports of the cylinder and those of the plunger-valve are so changed in a well-known manner as to cause the entrance of steam to the lower end of the piston and the exhaustion of the steam from the upper end of the cylinder, the up and down movements of the piston C effecting, through the medium of the pitman H and the crank G, the usual rotary motion of the main shaft F.

By the combination, with the crank and trunk-like extension D of the piston, of the hollow pitman H and the employment of removable screw-caps *c* and *b*, all in the manner described, I am enabled, it will be seen, to readily get at the interior of the piston and the pitman-connections for the purposes already mentioned, and am enabled to keep the bearings at both ends of the pitman perfectly lubricated, and thus avoid unnecessary wear, and this with the greatest facility.

I am aware that the hollow pitman, *per se*, is not new; but I am enabled by the employment of such a piston, in connection with the perforated trunk-like extension D and perforated hat-like portion B of the cylinder, to provide means by which the pitman-connections may be kept thoroughly lubricated, in the case of a perfectly inclosed or incased pitman, wrist-pin, and crank-shaft, such as shown and described.

It will be seen that the shell-like or hollow cylindrical portion C of the piston is all cast in one piece, but with the two longitudinal slots, to permit its movement up and down about the crank-shaft, and also with the lateral slot or opening, at one side only, of a proper shape and size merely to permit the insertion and passage of the crank G and its shaft. This construction of this portion of the piston, in the manner shown and described, (instead of making it in two parts,) enables me to produce a piston which is stronger and more

durable, and may be made to fit and work within the cylinder with greater perfection of action than is possible in the use of a cylinder having this portion made in two or more parts, as has commonly been necessary in engines of this type, so far as my knowledge extends. The lateral opening in the shell C for the passage of the crank G is purposely made in the same direction with the opening made (for the same purpose) in one side of the cylinder A, which latter opening is bonneted over in the manner already explained. This relative arrangement of the lateral openings of the shell C and the cylinder A is necessary, in order that during the stroke of the piston the opening therein will not pass, at its uppermost or lowermost points, the corresponding points of the opening in the side of the cylinder, and thus form a sort of passage-way or communication, which would permit the steam in the cylinder to get inside of the piston.

Having now so fully described my invention that those skilled in the art can fully understand and practice it, what I claim as new, and desire to secure by Letters Patent, is—

1. In combination with the inclosed crank-shaft, the piston, and pitman-connection between said shaft and piston, apertures in the upper ends of the piston and the cylinder-head, provided, respectively, with removable lugs or caps *c* and *b*, all substantially as and for the purposes described.

2. In combination with the inclosed crank, the trunk-like extension D, provided with the stud I, and the apertures in said trunk-like extension and in the cylinder-head, provided, as described, with removable plugs *b* and *c*, the hollow pitman H, provided with an oil cup or pouch, *a*, and provided with oil-holes at *l* and *m*, for the purpose of keeping the bearings on crank G and stud I lubricated, all substantially as set forth.

3. In an engine having an inclosed driving-crank, G, a piston, C, the cylindrical shell-like portion of which is all made in one piece, and with two longitudinal slots to permit the movement of the piston about the crank-shaft, and with a lateral slot or opening to permit the insertion of the crank G, all substantially as set forth.

In testimony whereof I have hereunto set my hand and affixed my seal this 21st day of December, 1882.

GEORGE SMITH, JR. [L. S.]

In presence of—
ABRAHAM WORMS,
EDWARD LEDWITH.