(No Model.)

S. E. JARVIS.

STEAM ENGINE.

No. 380,488. Patented Apr. 3, 1888.

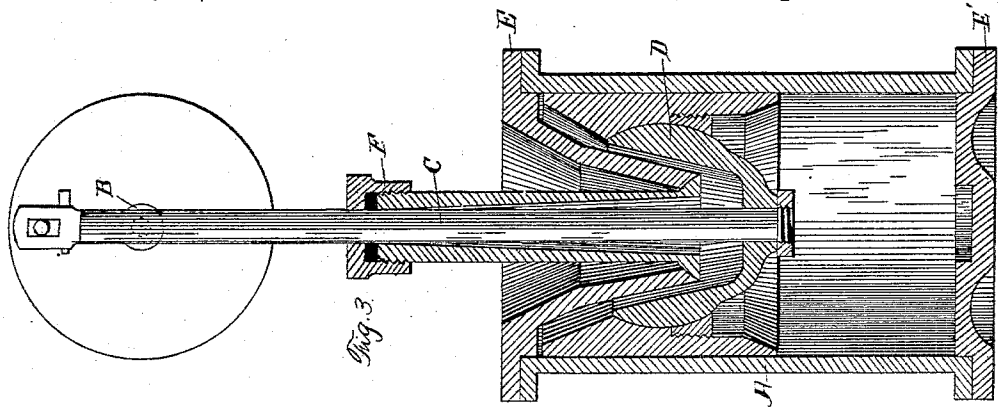


Fig. 3.

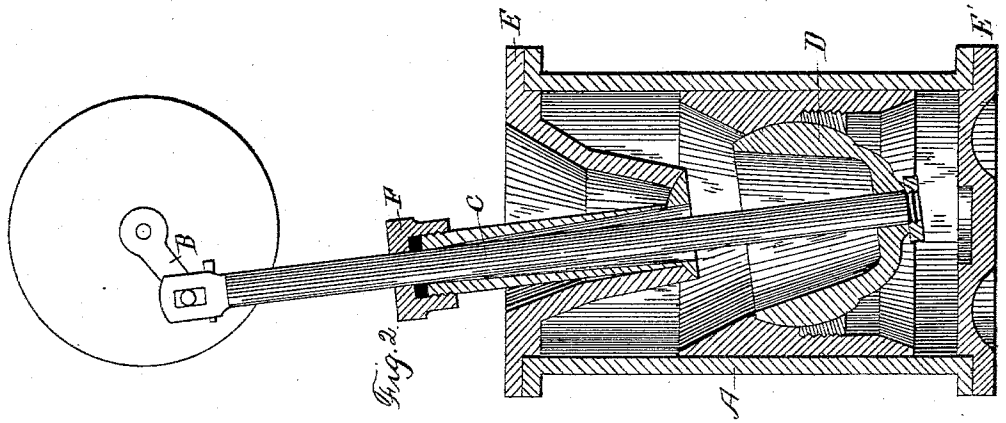


Fig. 2.

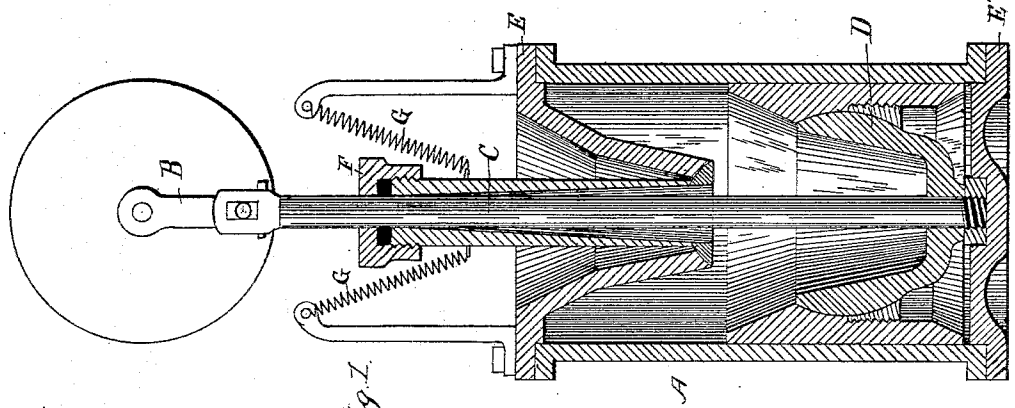


Fig. 1.

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UNITED STATES PATENT OFFICE.

SAMUEL E. JARVIS, OF LANSING, MICHIGAN.

STEAM-ENGINE.

SPECIFICATION forming part of Letters Patent No. 380,488, dated April 3, 1888.

Application filed June 4, 1887. Serial No. 240,246. (No model.)

To all whom it may concern:

Be it known that I, SAMUEL E. JARVIS, of Lansing, in the county of Ingham and State of Michigan, have invented 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, which form a part of this specification.

This invention relates to new and useful improvements in steam-engines; and the invention consists in the peculiar construction, arrangement, and combination of parts, whereby the usual connecting-rod of the engine is dispensed with by enabling the reciprocating piston-rod to assume any angular position resulting from a direct connection with the wrist-pin of the crank, while the cylinder remains in a fixed position, all as hereinafter described.

In the drawings which accompany this specification, Figure 1 is a vertical central section through my improved engine, showing the piston at the beginning of the stroke. Fig. 2 is a similar view showing the piston in its position of greatest angularity, or nearly so. Fig. 3 is a similar view showing the piston at the end of its stroke.

A is the cylinder, provided with the usual induction and eduction ports and steam-chests. (Not shown.) B is the crank. C is a piston-rod. D is a piston. E and E' are the cylinder-heads, and F is the gland of the stuffing-box through which the piston passes. The construction of these parts is as follows:

The piston D consists of a hollow annular outer part which carries any suitable packing, as in the ordinary piston, and of an inner part which is movably secured therein by a ball-and-socket joint, the socket-bearing being formed upon the inner face of the outer part and the ball-bearing upon the inner part, as shown. This inner portion is interiorly hollowed out for the purpose of fitting against the inwardly-projecting head E of the cylinder. The piston-rod C is secured to this inner part in the usual rigid manner, so that the inner portion rocks within the outer portion in accordance with the angular position of the piston-rod during the travel of the piston. The stuffing-box forms a ball-and-socket joint with the head E of the cylinder, as shown, and at its outer end it fits around the piston-rod and is made steam-tight by a suitable packing secured thereon. From the top toward the bottom the bore of the stuffing-box gradually enlarges for the purpose of forming a sufficient clearance for the piston to assume its angular position without binding or producing any lateral pressure or displacement against the inner face of the stuffing-box.

In practice it will be seen that with this construction and arrangement of parts the connecting-rod is entirely dispensed with, as the piston-rod is entirely free to assume its angular position.

The steam pressing against the inner end of the stuffing-box will naturally keep the stuffing-box in place and the joint steam-tight; but to prevent any displacement of such stuffing-box, in case no steam is on and the piston is moved accidentally, I attach a spring or springs, G, in any suitable manner to the stuffing-box to overcome its friction on the piston-rod and prevent the rearward withdrawal of the stuffing-box.

The object of projecting the head E of the cylinder inwardly is to form the center of movement of the ball-and-socket joint of the stuffing-box as near as possible toward the middle of the cylinder for the purpose of reducing the angular play of the piston within the stuffing-box; for it will be seen that the less play there is to be provided for the better I am enabled to make the ball-and-socket joint of relatively small dimension, which it is an object to accomplish, to produce as little friction as possible.

The peculiar conical form of the inwardly-projecting portion of the head E is naturally required to afford a free play for the stuffing-box, and in accordance therewith I form the piston, as described, to fit against the inner face of the head to the exclusion of all undue clearance.

The difference in the relative amounts of angular play of the piston-rod and stuffing-box evidently depends also on the length of the stuffing-box, and if it is desired to decrease the lateral play to be provided for in the stuffing-box it can be done by lengthening out the stuffing-box.

To prevent all binding or injurious friction

of the stuffing-box with the piston-rod, the packing should form the only point of contact between the two.

The point of greatest relative angularity between the piston-rod and stuffing-box is not at the quarter, but nearer the beginning or end of the stroke, as shown in Fig. 2. This is on account of the rapid approach to each other of the center of angular motion of the piston-rod (which is the center of the ball-and-socket joint of the piston) and the center of the ball-and-socket joint of the stuffing-box, and the advantage of constructing the engine in such manner that these two points are at a relative short distance from each other in the positions of the parts in Figs. 1 and 3 therefore clearly appears. This consideration, combined with the one which locates the center of the ball-and-socket joint of the stuffing-box preferably at or near the middle of the cylinder, conditions the relative shape of the head E and of the piston.

I deem it important that the ball-and-socket joint be situated between the inner end of the stuffing-box and the cylinder-head, and the center of motion of the ball-and-socket joint be located inside the cylinder. By this construction in operation the stuffing-box oscillates on a fixed center of motion, which center is the center of the ball-and-socket joint. Now, if this center is below the inner end of the stuffing-box, or, in other words, within the cylinder, it is evident that the inner end of the stuffing-box moves laterally in the same direction in which the piston oscillates, and therefore the relative movement between the piston-rod and stuffing-box is greatly diminished and the required enlargement of the base of the stuffing-box diminished. If, on the other hand, the center of motion of the ball-and-socket joint would be anywhere between the ends of the stuffing-box, or, in other words, outside the cylinder, the stuffing-box would have a tilting motion, which would require a greatly-increased bore on account of an inverse movement of the stuffing-box and piston-rod.

What I claim as my invention is—

1. In an engine of the kind described, the combination, with the oscillating piston-rod, of an oscillating stuffing-box provided with an enlarged bore for the lateral play of the piston, and a ball-and-socket joint between the inner end of the stuffing-box and the cylinder-head, the center of motion of said ball-and-socket joint being located inside the cylinder, substantially as described.

2. In an engine of the kind described, the combination, with the piston-rod, of a stuffing-box having a ball-and-socket bearing with the cylinder-head and an enlarged bore to provide for its relative angular play with the piston-rod, and a spring-connection between the cylinder and the stuffing-box, substantially as described.

3. In an engine of the kind described, the combination of the stuffing-box terminating in a ball-and-socket bearing at its inner end, the cylinder-head provided with a conical inward projection terminating in a socket-bearing at its inner end, and the enlarged bore in the stuffing-box to provide for relative angular play between the stuffing-box and piston-rod, substantially as described.

4. In an engine of the kind described, the combination of the stuffing-box terminating in a ball-and-socket bearing at its inner end and the cylinder-head provided with a conical inward projection terminating in a socket-bearing at its inner end, said ball-and-socket bearing having the center at or near the center of the cylinder, substantially as described.

5. In an engine of the kind described, the combination, with the inwardly-projecting conical head E, of the stuffing-box F, having a ball-and socket joint therewith, and the piston-head D, consisting of an annular outer piston and an inner conically-recessed portion secured to the piston-rod and having a ball-and-socket joint with said outer portion, substantially as described.

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