(No Model.) 2 Sheets—Sheet 1.

H. MULLEN.

OSCILLATING STEAM ENGINE.

No. 559,591. Patented May 5, 1896.

Fig. 1.

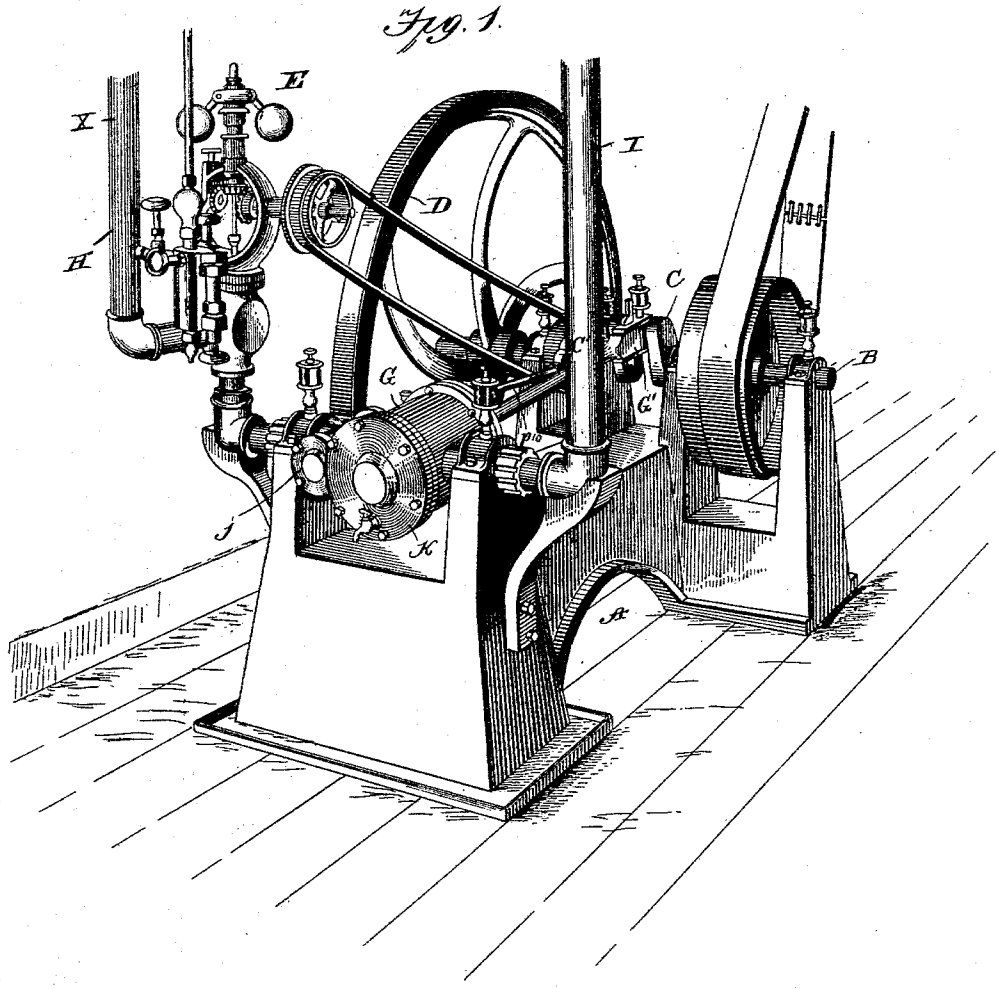
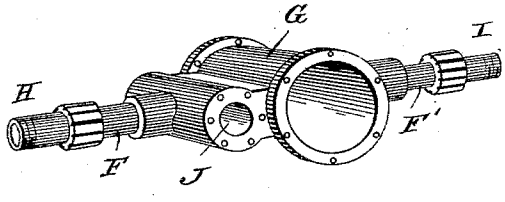


Fig. 2.



WITNESSES:

J. C. Shaw

J. Edw. Luckett

INVENTOR

Harker Mullen

BY

O'Meara & Co

ATTORNEYS

(No Model.) 2 Sheets—Sheet 2.

H. MULLEN.

OSCILLATING STEAM ENGINE.

No. 559,591. Patented May 5, 1896.

Fig. 3.

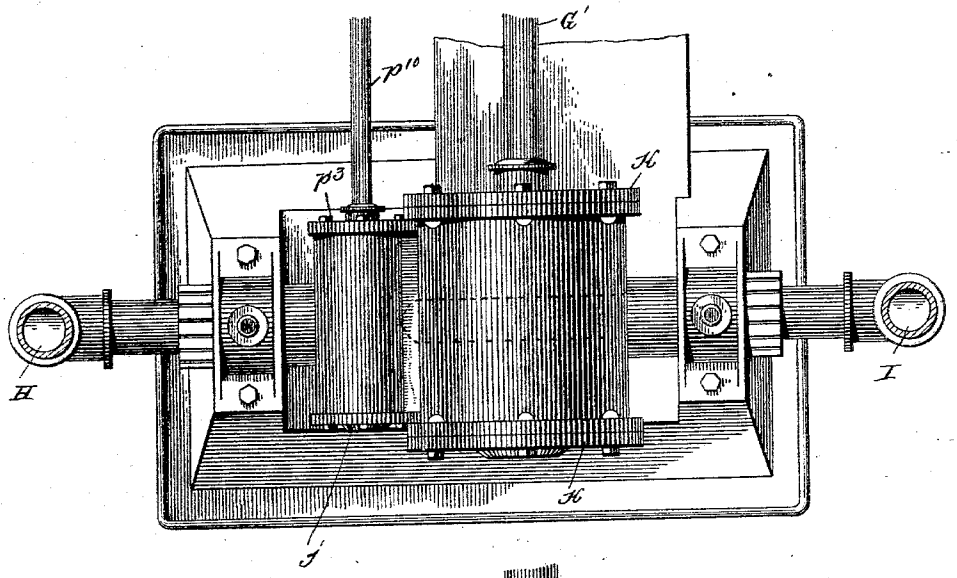


Fig. 4.

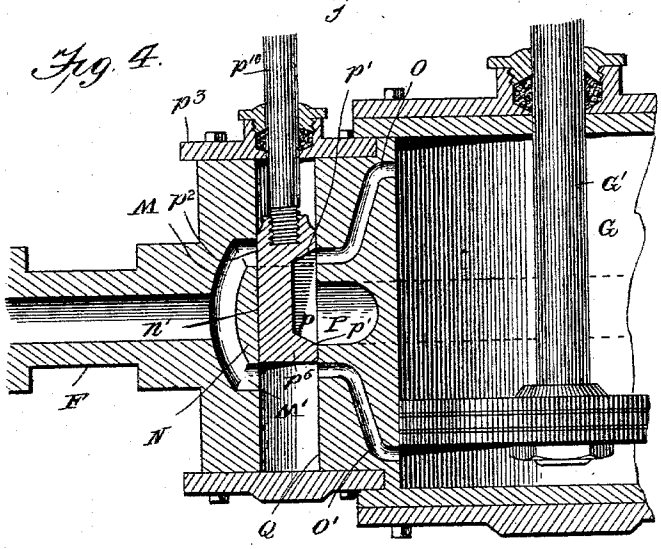


Fig. 6.

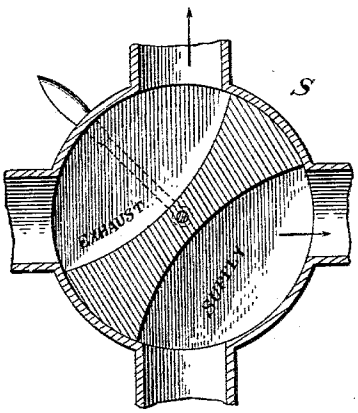
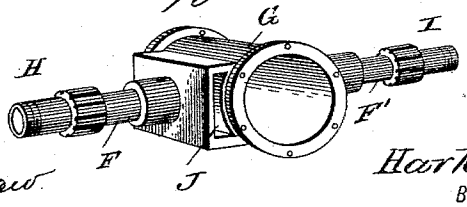


Fig. 5.



WITNESSES:

J. C. Shaw

J. Edw. Luckett

INVENTOR

Harker Mullen

BY

O'Meara & Co

ATTORNEYS

UNITED STATES PATENT OFFICE.

HARKER MULLEN, OF SYCAMORE, ILLINOIS.

OSCILLATING STEAM-ENGINE.

SPECIFICATION forming part of Letters Patent No. 559,591, dated May 5, 1896.

Application filed November 8, 1895. Serial No. 568,305. (No model.)

To all whom it may concern:

Be it known that I, HARKER MULLEN, residing at Sycamore, in the county of De Kalb and State of Illinois, have invented a new and Improved Oscillating Steam-Engine, of which the following is a specification.

My invention relates more particularly to the oscillating type of steam-engines; and it primarily has for its object to provide an engine of this character with a shifting-valve mechanism having a perfect automatic steam-balance without the aid of artificial or mechanical devices.

My invention also has for its object to provide a cylinder and valve-seat therefor arranged to receive any form of slide-valve, round, oval, or flat, and to admit of the operation thereof under a perfect steam-balance.

Furthermore, my invention has for its object to provide a cylinder having a valve-seat and trunnions integrally formed or cast together and having no bolts or screws except to hold the caps at the ends of the cylinder and valve-seat.

My invention also seeks to provide an oscillating engine that will work with ease, be completely balanced, which can be easily operated, and which will effectively serve for its intended purposes.

With other objects in view, which will hereinafter be particularly referred to, the invention consists in the peculiar combination and novel arrangement of parts, such as will be first described in detail, and then be specifically pointed out in the appended claims, reference being had to the accompanying drawings, in which—

Figure 1 is a perspective view of an oscillating engine constructed in accordance with my invention. Fig. 2 is a detail perspective view of the integral cylinder, valve-seat, and trunnions, the valve-seat having a bore for a round valve. Fig. 3 is a partial plan view of the engine, showing the oscillating steam-chest in position. Fig. 4 is a horizontal section of a portion of the steam-chest and the valve-chamber, the same being constructed to receive a round valve. Fig. 5 is a view of an integral cylinder having a flat valve-seat and trunnions, and Fig. 6 is a detail view of a reversing-valve hereinafter referred to.

Referring to the accompanying drawings, A indicates the engine bed or base, B the crank-shaft, C C′ the crank-arms, D the fly-wheel, and E the governor, all of which may be of any suitable construction, and hereinafter will be referred to in a general way only.

At the rear end the bed A has seats or brackets to receive the hollow trunnions F F′ of the cylinder G, to which are connected the supply and exhaust pipes H and I, respectively, as clearly shown. The cylinder at the feed side has a valve-chamber J, which, as well as the trunnions, is formed integral with the cylinder G, such parts in practice being cast together, so as to avoid the use of bolts except for securing the caps *k* and *j* on the ends of cylinder and valve-chamber, respectively, such construction providing a simple and economical means of forming a strong effective oscillating cylinder and valve-holding portion.

In practice the cylinder, the valve-seat, and the trunnions are cast together in one mold, it being only necessary to core out a hole the size and shape of the valve to be used and core the ports to correspond.

In Fig. 2 I have illustrated my improved cylinder, valve-seat, and trunnions body as formed in one piece with a round valve-receiving opening, while in Fig. 5 I have shown a similar integral body having a flat valve-receiving seat or chamber.

Referring now more particularly to Fig. 4, it will be observed that the steam-passage of the trunnion F where it connects with the valve-chamber communicates with bifurcated or branch passages M M′, which extend around a bridge or shield N and communicate with the ports O O′, which open into the front and rear ends, respectively, of the cylinder G. P indicates the exhaust-port, which is disposed centrally between the ports O O′, extends around the cylinder G, as indicated in dotted lines, and opens into the hollow trunnion F′. The bridge or shield N has a smooth guide-face *n*′, against which the cylindrical D slide-valve P³ slides, which valve

seats upon the valve-seat proper, Q, which runs parallel with the bearing-surface of the bridge N. The bridge-piece N, it will be observed, is of a length equal the distance between the ports O O′, and the cylindrical **D** slide-valve, which has the usual recess or steam-passages *p* and abutments *p′ p′*, is somewhat longer than the said bridge-piece N, so that when the said valve is shifted to either of its end thrust a portion thereof will be exposed, as at P^2, to a direct steam-pressure, for a purpose presently explained. The cylindrical **D**-valve P^5 has its rod P^{10} passed through a stuffing-box in the inner cap-plate P^3 and connected with the rod of the crank-arms C′, while the rod of the piston G′ at its free end has the crank-arms C connected with the fly-wheel shaft, as shown. The several steam-ports M M′ within the valve-chamber and the ports O O′ are preferably formed of an equal area throughout, whereby the steam entering from the supply pipe or trunnion, as hereinafter described, will flow through a passage of an approximately equal area throughout to the cylinder. The steam-pipe X from boiler is also of substantially the same area in cross-section as the passage from the feed-trunnion to the cylinder.

So far as described the operation of my improved engine is best explained as follows: Assuming the parts to be in the position shown in Fig. 4, the steam will enter the bifurcated ports M M′ and at one side pass through port O′ into the cylinder at the rear of the piston, and in consequence force such piston in the direction indicated by the arrow, while at the other side of the valve-chamber the live or direct steam-pressure will be upon the exposed or projected end of the valve, and in consequence force it against the seat on which it slides. It is obvious that during this operation the exhaust from the cylinder will discharge through port O direct against the abutment *p′* of the valve before it passes out into the exhaust-port. It is manifest that such discharge has a tendency to move the valve from off its seat, which operation is overcome by my construction, in that the exposed end of the valve and the bridge-piece relatively are so arranged in connection with the ports O O′ that the force of the exhaust-steam against such valve in one direction will be overcome and balanced by the direct pressure of the live steam against the outer face of the valve, thus insuring a perfect steam-balance for the valve, irrespective of the cross-sectional shape of such valve. The slide-valve while fitting loosely under the bridge to insure an easy slide movement with a minimum amount of friction does not slide so freely as to permit the steam to exert any material pressure between the bridge-surface and the rear surface of the valve, the steam moisture on the back of the valve forming an effective lubricant for such valve.

By providing a valve having at all times at the end of each stroke an exposed portion sufficient to form a face to receive a direct steam-pressure equal or approximately so of the exhaust force at right angles to such direct force it follows that all the benefits of a balance slide-valve are thereby obtained. Furthermore, by conducting the steam through a passage from the feed to the cylinder having an approximately equal area throughout, as described, I obtain a degree of steam energy against the piston which would be impossible to obtain were the passages materially enlarged or made of irregular area. So far as I am aware all other constructions of engines of the character stated have a steam-chest or equivalent chamber of greater area than the steam-induction pipe at or near the slide-valve, which causes the steam as it enters from the feed-pipe to expand to a more or less extent its initial and greatest expansive energy before reaching the cylinder. It will thus be clear that as such waste of the expansive energy of the steam makes it necessary to provide a greater initial steam force to provide the same power against the piston my improvement effects a material saving in operation over an engine employing a steam-chest.

As the great consideration in steam-engine construction is to convert the initial force of the steam into the engine-power with the least intermediate waste of energy my improvement will reduce the friction of the slide-valve to the minimum and cause the steam to retain its greatest elastic energy until it exerts itself against the piston.

One of the advantages of construction which my invention possesses over others now in use is that in practice it works with such ease and is so completely balanced that it can be set loose on a loose platform without bolts, pegs, or screws to hold it, run with a high rate of speed, and pulls a load above its rated horse-power, the engine-body requiring not more than one hundred pounds metal to a horse-power, such results being attained by forming the oscillating cylinder, the steam-ports, and valve mechanism in the manner herein described.

When using a round shifting-valve, I employ a four-way gate S, (see Fig. 6,) whereby I can quickly change the steam supply from one trunnion to the other. By using a gate of this kind I do not have to change the throw of the eccentric in the least and can stop and reverse almost instantly.

Having thus described my invention, what I claim, and desire to secure by Letters Patent, is—

1. In a cylindrical steam-engine, a steam-chest having a valve-seat, the inlet-ports for supplying steam to the cylinder and the exhaust-port, for carrying off the dead steam from the cylinder, the bifurcated inlet for supplying steam to the chest, the bridge-piece and the cylindrical **D** slide-valve adapted to fit the chest and slide between the seat and bridge, said valve being longer than said

bridge-piece substantially as shown and described.

2. In a steam-engine, the cylinder and steam-chest, the inlet-ports O and O′, and exhaust-port P, the inlet-passages M, and M′, and the bridge-piece N, the cylindrical D slide-valve p^5, longer than bridge-piece N, and having a recess p, and end portions p' and p^2, all of said parts being arranged substantially as shown and described.

HARKER MULLEN.

Witnesses:
ELZIE E. ROSE,
GEORGE E. DUTTON.