(No Model.) 2 Sheets—Sheet 1.

G. S. STRONG.

VALVE MOTION FOR STEAM ENGINES.

No. 304,971. Patented Sept. 9, 1884.

FIG. 2.

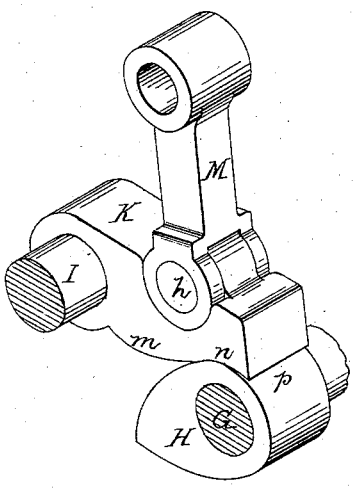
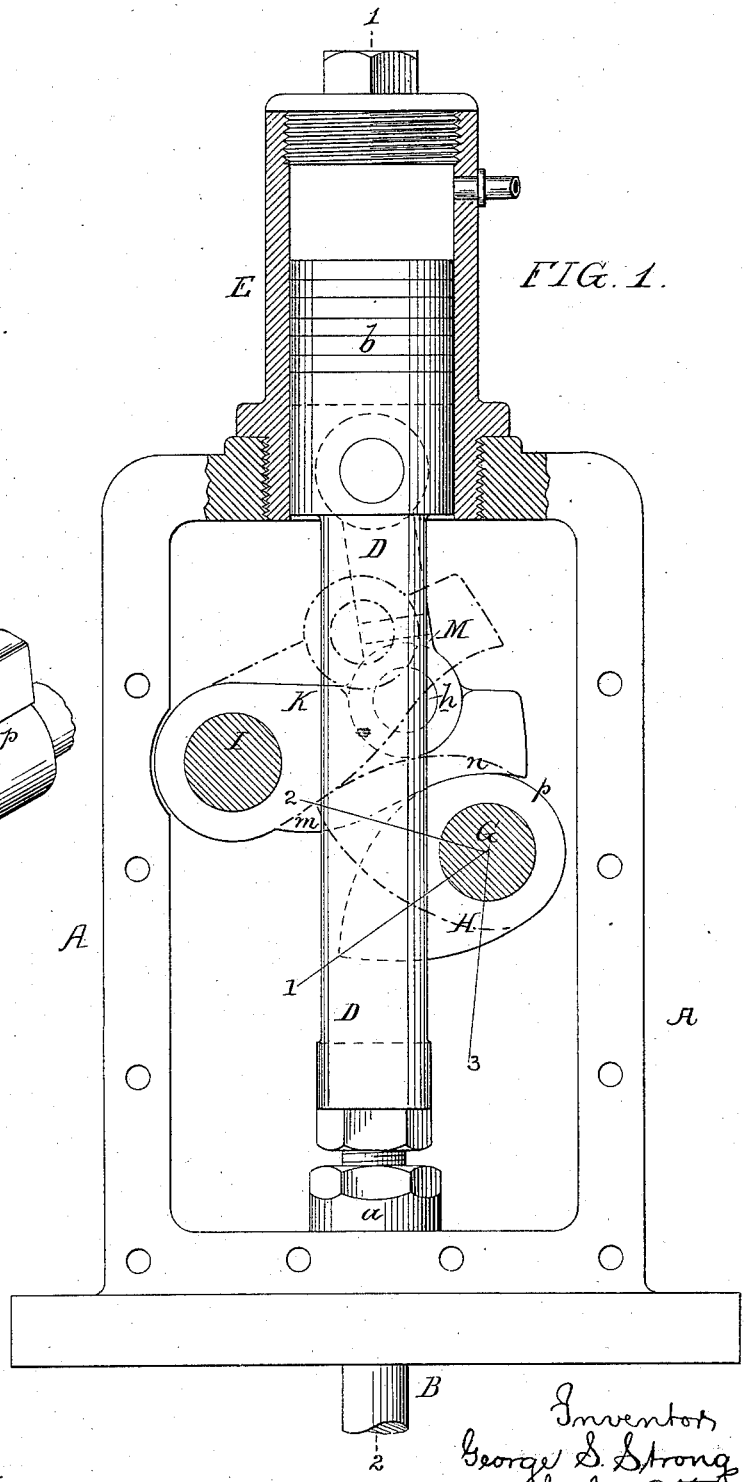


FIG. 1.



Witnesses
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James F. Tobin.

Inventor,
George S. Strong
By his Attys
Hoseon & Sons

(No Model.) 2 Sheets—Sheet 2.

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FIG. 4

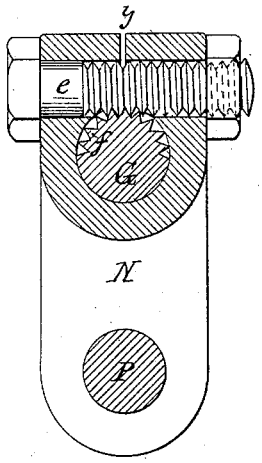

FIG. 3.

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UNITED STATES PATENT OFFICE.

GEORGE S. STRONG, OF PHILADELPHIA, PENNSYLVANIA, ASSIGNOR TO JOHN T. MORRIS, TRUSTEE, OF SAME PLACE.

VALVE-MOTION FOR STEAM-ENGINES.

SPECIFICATION forming part of Letters Patent No. 304,971, dated September 9, 1884.

Application filed January 19, 1884. (No model.)

To all whom it may concern:

Be it known that I, GEORGE S. STRONG, a citizen of the United States, and a resident of Philadelphia, Pennsylvania, have invented certain Improvements in Valve-Gear for Steam-Engines, of which the following is a specification.

My invention relates to mechanism for operating the valves of that class of steam-engines in which the steam-valves are separate from the exhaust-valves; and the main object of my invention, which is fully described hereinafter, is to cause a quick opening and quick closing of the steam-valves.

In the accompanying drawings, Figure 1, Sheet 1, is a side view, partly in section, of my improved valve-operating mechanism, contained in the present instance in a chest from which the cover has been removed; Fig. 2, a perspective view of part of Fig. 1; Fig. 3, a vertical section on the line 1 2, Fig. 1; and Fig. 4, a transverse section on the line 3 4, Fig. 3.

A chest, A, for each valve is bolted to the main valve-chest, and through a stuffing-box, *a*, screwed in the bottom of the chest A, passes the valve-spindle B, which is adjustably secured to the lower end of a slotted rod, D, the latter terminating at its upper end in a piston, *b*, adapted to a small cylinder, E, which is screwed into or otherwise secured to the top of the said chest A, and into which steam or air under pressure may be introduced. A rock-shaft, G, has one bearing in a projection, *d*, of the chest A, and another bearing in the removable cover A′ of the said chest, and on this shaft, and preferably forming part of the same, is a cam, H, a portion of which projects into the vertically-elongated slot of the rod D. A pivot-pin, I, has also bearings—one in the chest and the other in the cover of the same—and on this pin, and forming part of the same, is the tappet-lever K, which is, in the present instance, connected by a link, M, to the rod D at the piston end of the same, and which is mainly contained in the elongated slot of the said rod. The location of the rod D, which may be termed a continuation of the valve-rod, between the pivot-pin I and rock-shaft G permits the adoption of a cam which will act on the tappet-lever at a point near its pivot-pin, and thus insure a quick opening of the valve, as explained hereinafter.

On the shaft G is the forked arm N, carrying the pin P for receiving the end of the rod—an eccentric-rod, for instance—through the medium of which the said arm and rock-shaft are vibrated. In order that the forked arm N may be adjusted to different positions circumferentially on the rock-shaft G, the hub portion of the said arm is severed, as shown at *y* in Fig. 4, and a bolt, *e*, passing through the said hub portion, serves to clamp the latter tightly to the shaft, in which are a number of grooves, *f*, adapted to the screw-thread of the bolt. After loosening the nut of the bolt, the latter may be used as a worm to adjust the arm, which may be secured after adjustment by tightening the nut of the said bolt, such portions of the thread of the latter as fit in the grooves of the shaft rendering the arm immovable thereon.

In the present instance the spindle B is supposed to be attached to a slide or gridiron valve devoted solely to the steam-ports of a steam-engine, there being a separate valve or valves for the exhaust. A constant pressure of air or steam on the piston end of the rod D tends to depress the valve and close the ports, the raising of the valve, and consequent opening of the ports, being effected through the medium of the cam H and tappet-lever K from the the rock-shaft G. It will be observed that the lower edge of this lever is of peculiar shape, a portion, *n*, of this edge being concave, and adapted to that portion *p* of the cam which is concentric with the rock-shaft, the other portion, *m*, of the lower edge of the lever, which portion I term the "swell," being rounded. The object of this can be best explained by reference to the dotted lines in Fig. 1. Supposing the full vibration of the cam to be that indicated by the lines 2 to 3, it will be seen that during the movement of the cam from the line 1 to the line 2 there will be a lift of the valve-rod to the extent indicated by the distance between the centers of the two dotted circles shown in Fig. 1, and this is the extent of the desired movement of the valve. While the cam is

moving from the line 1 to the line 3 and back again, however, there will be no movement of the tappet-lever, and the valve will remain closed. This quick movement of the valve is effected partly by causing the cam to act on the pivot-lever at a point near the pivot and between the pivot-pin I and link-pin *h*, and partly by the swell *m* on the under side of the said cam-lever. An approximately quick movement may be brought about without the swell, but the latter is in all cases preferred.

By making the portion *n* of the under edge of the pivot-lever concave an extended surface is presented to bear on the portion *p* of the cam, and hence there will be but little wear at these points. There is another advantage of the peculiar shape of the under edge of the tappet-lever in respect to that of the cam, and this is the rolling action of the cam against the lever, which is like the action of the well proportioned tooth of one cog-wheel against that of another wheel, in which there is comparatively little rubbing of one tooth against another, and consequently but little friction.

When a double-beat or balanced valve arranged to fall by its own weight is used, no small cylinder and piston will be required, and the tappet-lever will be free from contact with the cam when the valve is on its seat. In this case the rod *b* may be guided in any suitable manner.

In carrying out the main feature of my invention it is not essential that the precise construction of the parts shown should be adhered to. A plain rod, D, for instance, may be used in place of the slotted rod, in which case the tappet-lever and cam, as well as the link M, will be one side of the rod; but the construction shown of the several parts is preferred, for reasons which will be readily understood by expert mechanics. A spring may be used in place of the small cylinder and piston. Any appropriate frame may be substituted for the chest A, but the latter has the advantage of protecting the operating parts from dust and dirt, and, if desired, the chest may be filled or nearly filled with oil or other lubricant.

I claim as my invention—

1. Valve-operating mechanism in which the following elements are combined, namely: first, a valve-spindle and means for moving the same in one direction; second, a pivoted tappet-lever connected to the said spindle; and, third, a vibrated cam, the parts bearing the relation described to each other, so that the cam during part of its movement shall act on the tappet-lever at a point between the pivot of the latter and the center of the rod D, substantially as described.

2. The combination of the valve-spindle, the cam, and the tappet-lever K, connected to the valve-spindle, and having on one edge a swell, *m*, merging into the concave portion *n*, substantially as specified.

3. The combination of the rock-shaft G, the slotted rod D, tappet-lever K, connected to the said rod, and the cam H on the said shaft, substantially as described.

4. The combination of the spindle B, tappet-lever K, and cam H with the chest A, inclosing the said parts, substantially as set forth.

5. The combination of the spindle B and piston *b*, tappet-lever and cam with the chest or frame A, and cylinder E, adapted to the said parts, substantially as specified.

6. The combination of the rock-shaft G, having grooves *f*, a lever having a severed hub fitted to the said shaft, and a bolt, *e*, the thread of which is adapted to the grooves, and which serves to clamp the said hub to the shaft, all substantially as set forth.

In testimony whereof I have signed my name to this specification in the presence of two subscribing witnesses.

GEO. S. STRONG.

Witnesses:
JOHN M. CLAYTON,
HARRY SMITH.