





# UNITED STATES PATENT OFFICE.

GEORGE S. STRONG, OF NEW YORK, N. Y., ASSIGNOR TO JOHN P. MURPHY,  
OF PHILADELPHIA, PENNSYLVANIA.

## CRANK-SHAFT.

SPECIFICATION forming part of Letters Patent No. 637,300, dated November 21, 1899.

Original application filed December 15, 1898, Serial No. 699,312. Divided and this application filed May 5, 1899. Serial No. 715,695. (No model.)

*To all whom it may concern:*

Be it known that I, GEORGE S. STRONG, a citizen of the United States of America, residing in the city, county, and State of New York, have invented a certain new and useful Improvement in Crank-Shafts and Fly-Wheels, of which the following is a true and exact description, reference being had to the accompanying drawings, which form a part thereof.

My invention relates to the construction of fly-wheels and the method of securing them to crank-shafts, and is especially designed for use in connection with gas-engines and for the purpose of relieving the crank-shaft from the weight of the fly-wheel and carrying it directly on a bearing in the frame of the machine.

The nature of my improvements will be best understood as described in connection with the drawings, in which they are illustrated in connection with a gas-engine, which, as shown, is one forming the subject-matter of my application for Letters Patent filed December 15, 1898; Serial No. 699,312, of which application the present one is a division.

My invention is also shown in connection with a fly-wheel and adjustable crank-pin moving therein, which forms the subject-matter of another pending application—to wit, that filed by me December 8, 1898, Serial No. 698,623.

Referring now to the drawings, in which my invention is illustrated, Figure 1 is a plan view of the engine provided with my improvements, shown partly in section; and Fig. 2 is a cross-section on the line 2 2 of Fig. 1.

A and A' indicate cylinders of the gas-engine, in which move pistons B and B', coupled through connecting-rods D and D' with cranks C' and C<sup>2</sup> of the crank-shaft C.

F indicates a casing thrown around the cranks of the engine, and F' an extension from the casing, forming a bearing for the stud-shaft of the fly-wheel, as will hereinafter be described. Another somewhat similar extension F<sup>6</sup> forms a bearing at the other side of the engine for the crank-shaft.

F<sup>2</sup> is an annular chamber formed in the extension F' for a worm-wheel, (indicated at K.)

F<sup>3</sup> and F<sup>15</sup> are bearings for the shaft K<sup>2</sup>, and F<sup>13</sup> and F<sup>14</sup> bearings for the shaft I<sup>4</sup>. The shaft K<sup>2</sup> is actuated through gearing (not shown) by the worm-wheel K and working through a universal joint (indicated at K<sup>3</sup>) actuates a shaft, the end of which is indicated at K<sup>4</sup> and to which are attached cams arranged to actuate the valves of the engine. The shaft I<sup>4</sup> has attached to it a hub, (indicated at I<sup>3</sup>), from which extend arms I<sup>2</sup> I<sup>2</sup>, engaged with a ring I, which in turn is actuated by a governor H, secured on and operated by the shaft C of the engine. The motion thus imparted to the shaft I<sup>4</sup> is communicated by a lever (indicated at I<sup>5</sup>) to a rod I<sup>6</sup>, which enters the valve-box N and regulates the adjustment of certain cams, (not shown,) which are actuated by the shaft K<sup>4</sup>.

P indicates the head proper of the gas-engine cylinders.

E is the fly-wheel of the engine, which is formed with a transverse cylindrical channel, in which moves the piston, (indicated at E<sup>2</sup>), to which in turn is secured the crank-pin E', which pin is adjusted to and from the center of the fly-wheel by the movement of the piston, while the movement of the piston is effected by fluid under pressure introduced to its end through a channel e, which communicates, as shown, with a channel c in the crank-shaft and through said channel in the crank-shaft with a pump or other device, by which the fluid is introduced or withdrawn in order to shift the crank-pin.

Referring now to the features which constitute the subject-matter of my present invention, the fly-wheel E is formed with a centrally-projecting stud-shaft E<sup>3</sup>, having near the wheel a threaded perforation E<sup>4</sup>, which near the outer side of the stud-shaft opens into an enlarged unthreaded perforation E<sup>5</sup>. The end of the shaft C enters and fits in the unthreaded perforation E<sup>5</sup> and is provided, as shown, with a threaded extension C' of smaller diameter, which screws into the threaded perforation E<sup>4</sup>, thus securing the shaft and the stud-shaft of the fly-wheel together. The bearing F' surrounds the stud-shaft E<sup>3</sup> and forms directly a bearing for this stud-shaft and only indirectly a bearing for the shaft

C, and in this way I carry the weight of the fly-wheel directly on the bearing instead of making the bearing act directly on the shaft and carrying the weight of the fly-wheel on  
5 the shaft.

Preferably I construct the bearing, as shown, with a hardened-steel liner (indicated at F<sup>7</sup>) and provide a similar hardened-steel liner f<sup>7</sup> for the stud-shaft E<sup>3</sup>, placing between  
10 these liners a series of rollers F<sup>8</sup>, so as to provide a roller-bearing to diminish friction.

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

15 1. In a gas-engine, a crank-shaft in combination with a fly-wheel, as E, a hollow stud-

shaft E<sup>3</sup> extending from the center of said fly-wheel, said shaft extending over and being secured to the end of the crank-shaft, and a shaft-bearing for said stud-shaft in the  
20 framing of the engine.

2. In a gas-engine, a crank-shaft in combination with a fly-wheel, as E, a hollow stud-shaft E<sup>3</sup> extending from the center of said fly-wheel, said stud-shaft extending over and  
25 being secured to the end of the crank-shaft, and a roller-shaft bearing for said stud-shaft in the framing of the engine.

GEORGE S. STRONG.

Witnesses:

CHAS. F. MYERS,  
D. STEWART.