No. 744,342. PATENTED NOV. 17, 1903.

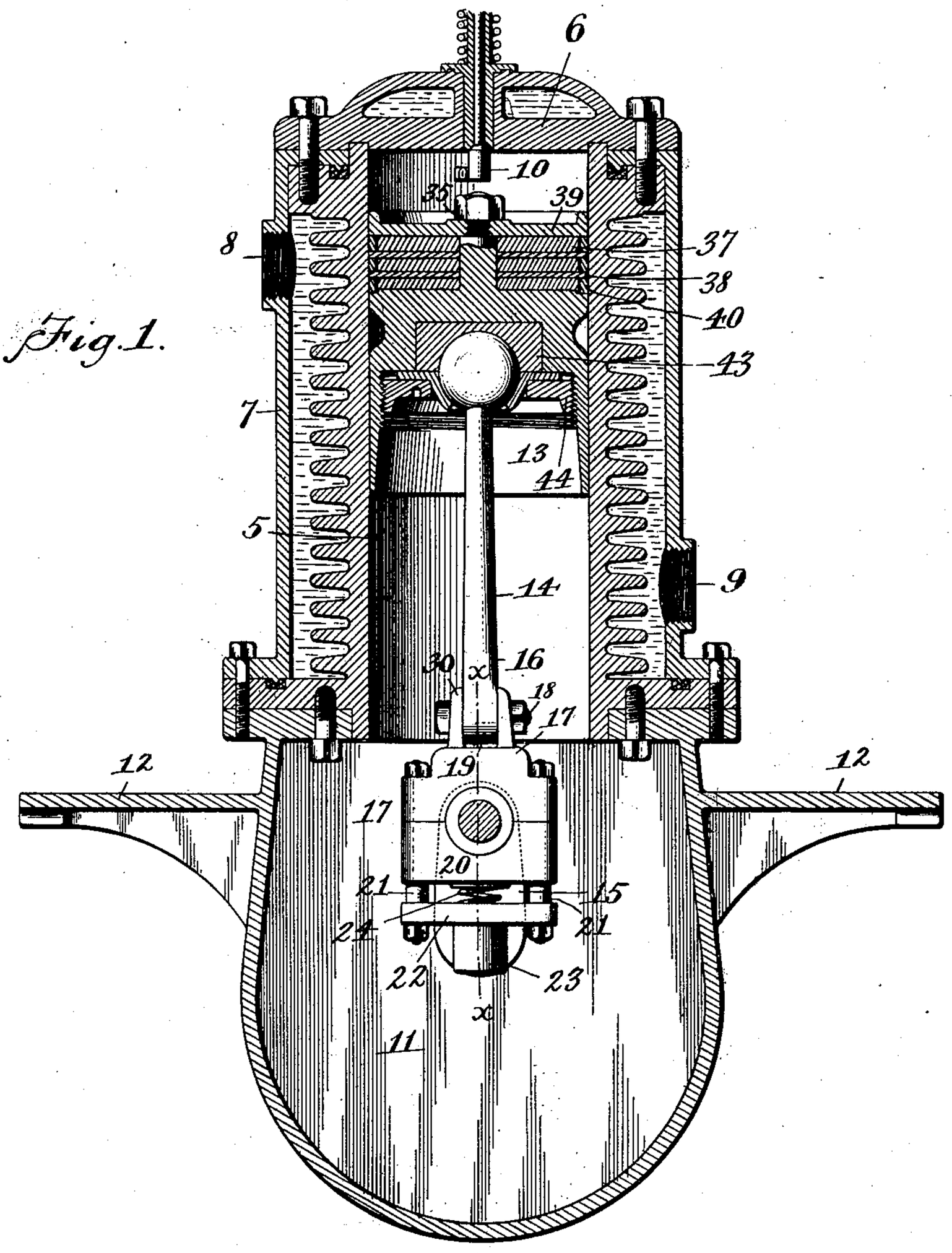
B. G. HOLZ.

EXPLOSIVE ENGINE.

APPLICATION FILED JAN. 29, 1903.

NO MODEL. 3 SHEETS—SHEET 1.

Fig. 1.



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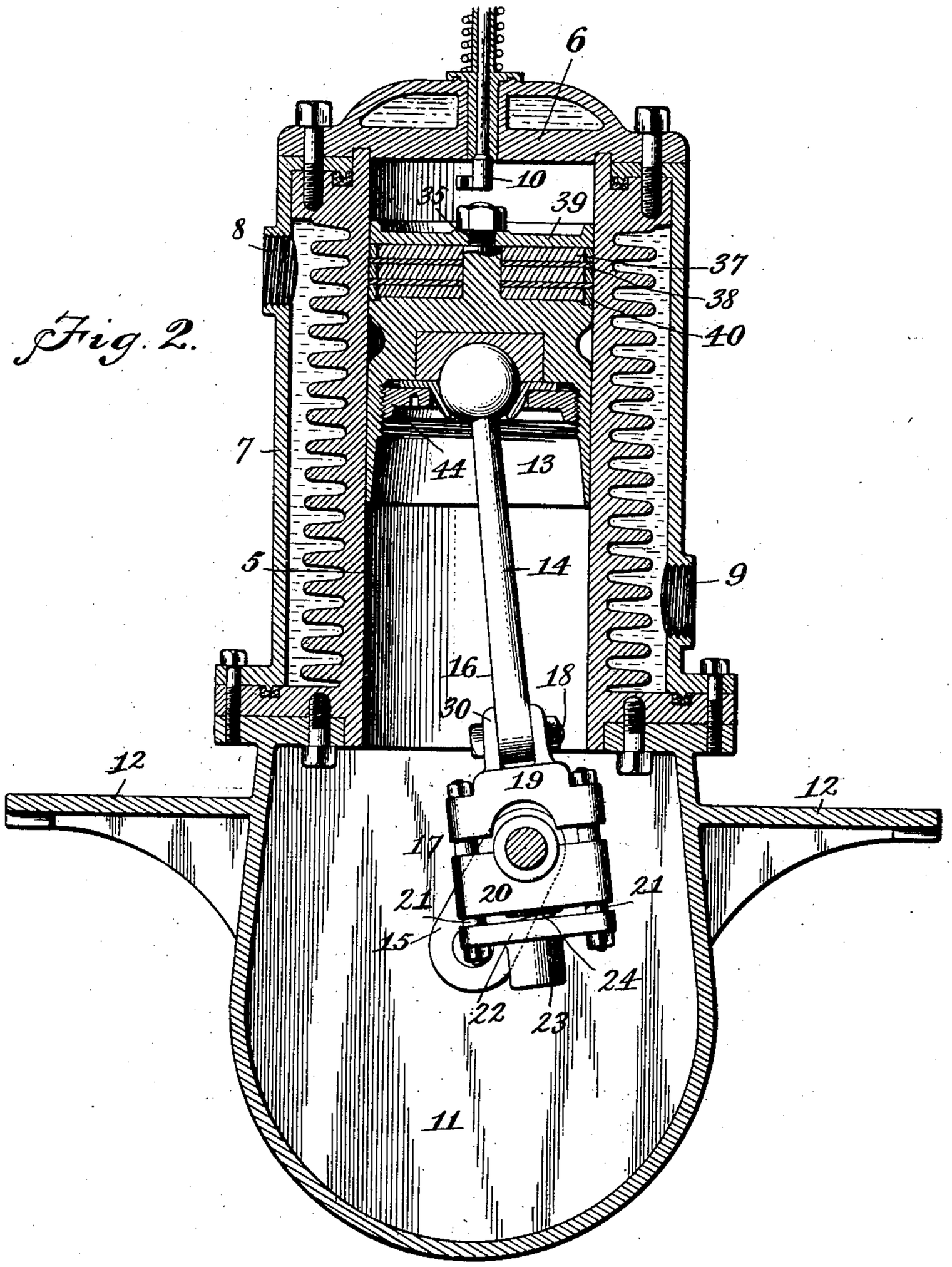
NO MODEL. 3 SHEETS—SHEET 2.

Fig. 2.



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NO MODEL. 3 SHEETS—SHEET 3.

Fig. 3.

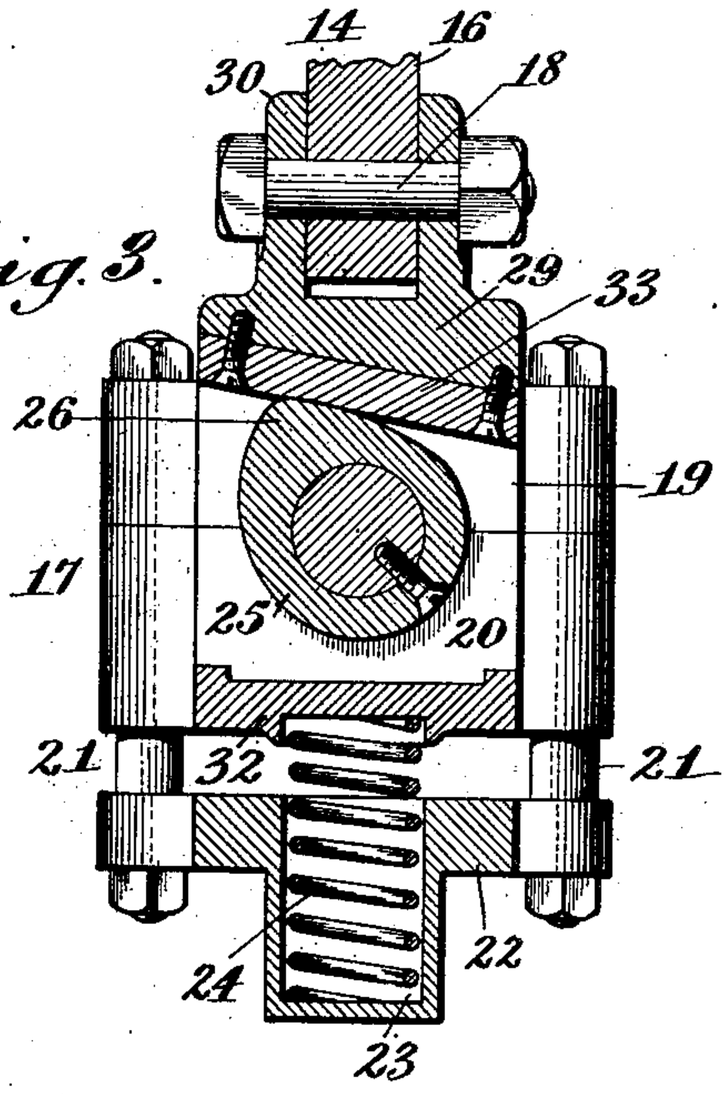


Fig. 4.

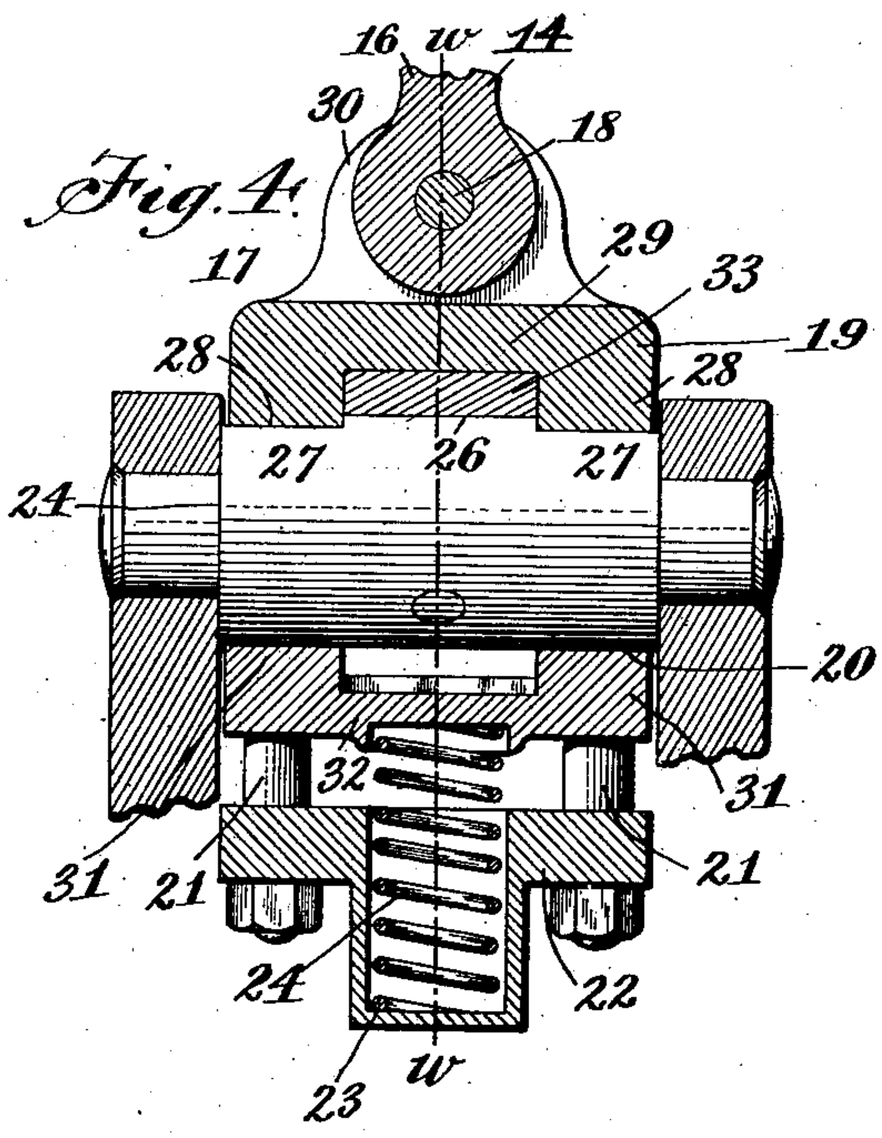


Fig. 5.

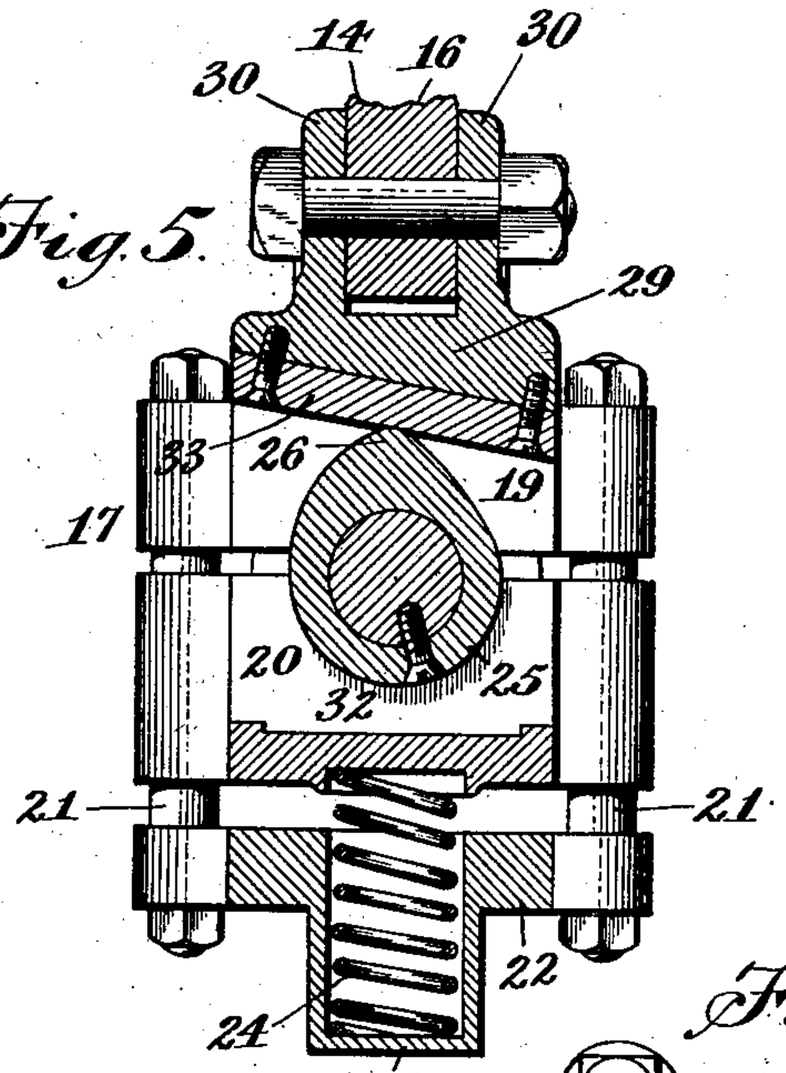


Fig. 6.

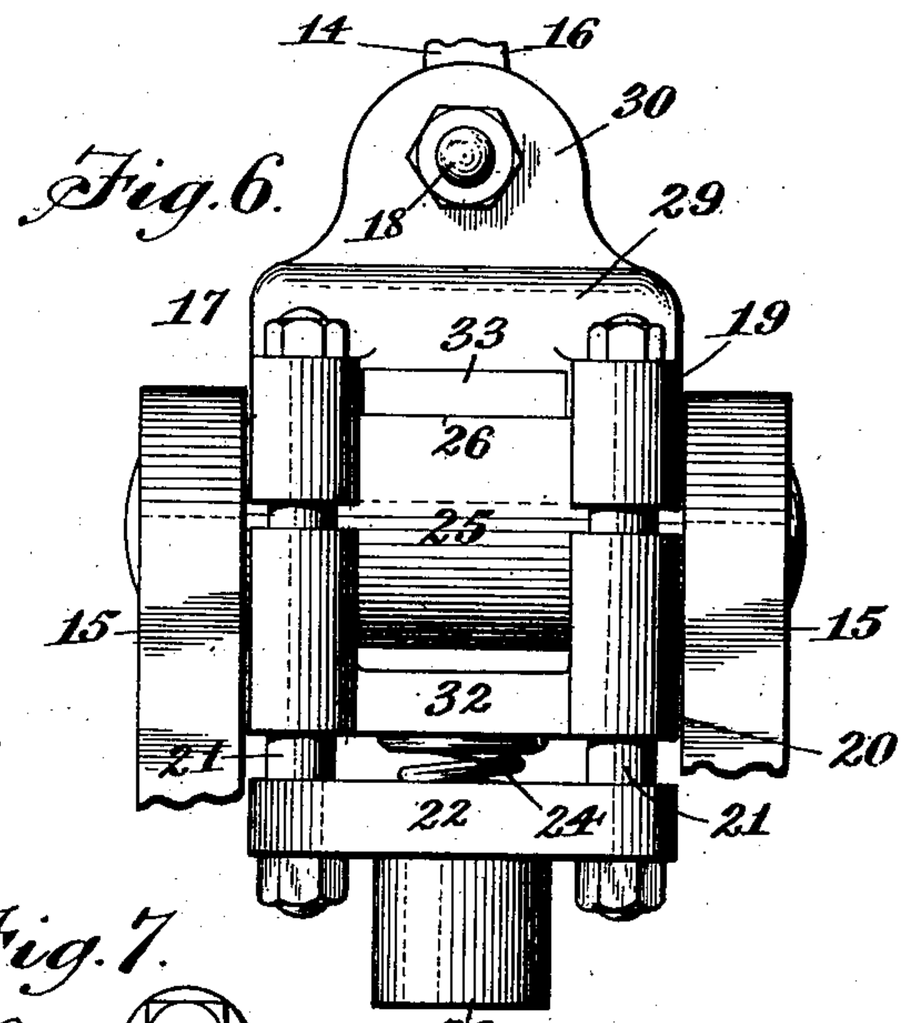
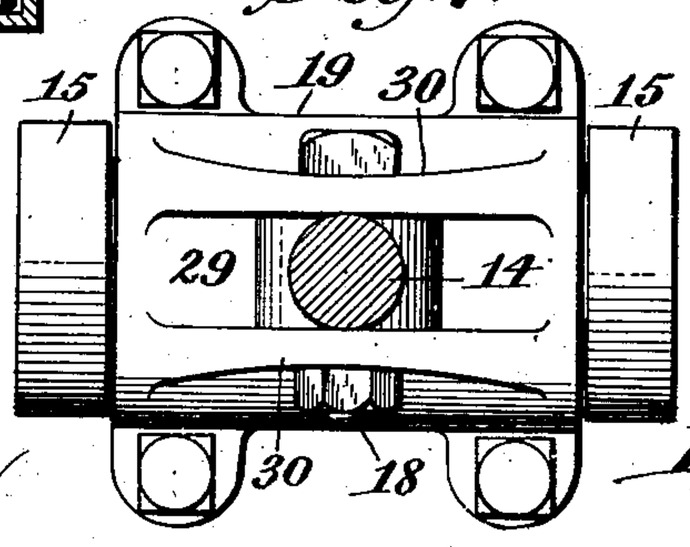


Fig. 7.



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No. 744,342. Patented November 17, 1903.

UNITED STATES PATENT OFFICE.

BERNHARD G. HOLZ, OF BUFFALO, NEW YORK.

EXPLOSIVE-ENGINE.

SPECIFICATION forming part of Letters Patent No. 744,342, dated November 17, 1903.

Application filed January 29, 1903. Serial No. 140,988. (No model.)

To all whom it may concern:

Be it known that I, BERNHARD G. HOLZ, a citizen of the United States, and a resident of Buffalo, in the county of Erie and State of New York, have invented certain new and useful Improvements in Engines, of which the following is a specification.

My invention relates to engines, but more particularly to explosive-engines. It is, however, applicable to any other style of engine whether operated explosively, by expansion of the motive power, or by direct pressure.

The object of my invention is to provide means for causing the piston to remain momentarily in its innermost position in the cylinder as the crank to which it is connected leaves the "dead-center." This is particularly desirable in explosive-engines, for the reason that the gases are then at their highest compression and produce greatest power, and as the ignition occurs just as the piston starts its outward stroke it causes the full force of the explosion to be imparted to the crank-shaft as the crank thereof is at its most effective point. This also prevents reversing of the engine when starting and aids materially in the free and easy running of the same.

Another object is to construct an engine in which the greater portion of the force of the explosion and the vibration of the engine are taken up at the point of connection of the piston-rod to the crank-shaft.

To these ends the invention consists of the new and novel construction, arrangement, and combination of parts, as will be hereinafter described, and particularly pointed out in the subjoined claims.

My invention can be applied to steam, air, or hydraulic engines or to engines operated by any other motive power; but in order that the principles of my invention may be understood I have shown them applied to an explosive-engine, using the same as an illustration of the use of my invention without the intention of limiting its use to such an engine.

This invention is susceptible to many changes in the construction, form, arrangement, and combination of the various parts without departing from the spirit or sacrificing any of the advantages thereof.

Referring to the drawings, Figure 1 is a central vertical section of an engine, showing my invention embodied therein and the piston at its innermost point with the crank on the dead-center. Fig. 2 is a similar view showing the crank moved beyond the dead-center and the piston still retained at its innermost point preparatory to being forced outwardly by the force of the explosion. Fig. 3 is a vertical section taken on line *w w*, Fig. 4. Fig. 4 is an enlarged vertical section taken on line *x x*, Fig. 1. Fig. 5 is a view similar to Fig. 3, showing the position of the crank-cam as it leaves the dead-center. Fig. 6 is a side elevation showing the parts in the position illustrated in Fig. 5. Fig. 7 is an enlarged plan view of the crank connection, showing the piston-rod in section.

Like numerals of reference refer to like parts in the several figures.

In the engine illustrated the numeral 5 designates the cylinder, provided with a head 6 and having a water-jacket 7, with which explosive-engines are usually provided. A water-inlet 8 and an outlet 9 are provided for the water-jacket, and in the head 6 the usual igniter 10 is arranged. To the lower end of the cylinder the crank-chamber 11 is bolted and has cast integrally therewith the supporting extensions 12. A gas inlet and exhaust must of course be provided in addition to means for operating the same; but as these parts of the engine do not appear in the drawings no further reference need be made to them. These parts of the engine form no part of my invention and refer only to one common type of explosive-engine for which any other type of engine may be substituted; but I will now proceed to describe my invention in detail.

The numeral 13 designates my improved piston, which is held for reciprocation in the engine-cylinder and is connected by means of a piston-rod 14 to the crank 15 of the engine-shaft. The piston-rod is formed in two sections 16 and 17, respectively, pivotally connected together by a bolt 18, disposed at right angles to the engine or crank shaft. The lower section 17 of the piston-rod forms the crank-box and comprises an inner half-bearing 19 and a yielding outer half-bearing 20, movable toward and from the inner half-bearing. Bolts 21 project outwardly from the four corners of the inner half-bearing and are con-

nected together at their outer end by a cross-bar 22, provided with a pocket 23, which receives one end of a spiral spring 24, interposed between said cross-bar and the outer half-bearing, which latter is guided in its movements on the four corner-bolts 21 in any suitable manner. The crank-pin has secured thereon a cam-sleeve 25, which is provided mid-length with a cam-face 26 and end portions 27, arranged concentric with the crank-pin and serving as journals to support the outer terminal of the piston-rod. The outer half-bearing is held against the crank-pin journals 27 at all times by the spring 24. The inner half-bearing of the crank-box comprises sides 28, each of which is provided with a semicircular cavity, said sides being connected by a bridge portion 29, having upwardly-projecting lugs 30, between which the lower end of the upper piston-rod section is secured. The yielding outer half-bearing comprises sides 31, each of which is provided with a semicircular cavity which coöperate with the cavities of the upper half-bearing to receive the crank-pin of the crank-shaft. The sides of the outer half-bearing are connected together by a lower connecting-bar 32, against the under face of which the spiral spring 24 bears. The under face of the bridge portion 29 is inclined and preferably faced with a steel wearing-plate 33, which is secured thereto in any suitable manner. The said wearing-plate is inclined downwardly in the direction in which the crank-shaft revolves, and the cam is secured to the crank in such position that the working portion thereof is brought into action against the inclined bridge portion 29 when the piston reaches the end of its inward movement, the function of the cam being to hold the piston in its innermost position while the crank moves from the dead-center, which causes the outer half-bearing 20 of the crank-box to lower against the spring-pressure, and as the working portion of the cam leaves the inclined coacting face of the crank-box the spring forces the said outer half-bearing up to abut against the inner half-bearing. The piston reaches its innermost point when the crank reaches its dead-center, and when in such position the gases in the combustion-chamber are under the highest compression. The cam is so positioned on the crank that it comes into action against the inclined bridge portion of the inner half-bearing just as the crank reaches the dead-center, and as it leaves the dead-center the outer half-bearing of the crank-box yields under the action of the cam and allows the crank to revolve a certain distance without causing the slightest movement of the piston, or, in other words, the piston is held in its innermost position until the working portion of the cam leaves the said inclined bridge portion, when the force of the explosion, the occurrence of which is properly timed, is imparted to the crank at the most effective point of its stroke.

Having thus described my invention, what I claim is—

1. In an engine, the combination with the cylinder, of a piston held therein, a crank-shaft, means for connecting said crank-shaft and piston, and means for causing said piston to be held momentarily at the innermost point of its travel as the crank of the crank-shaft leaves the "dead-center."

2. In an engine, the combination with the cylinder, of a piston held therein, a crank-shaft, means for connecting said crank-shaft and piston, and means for causing said piston to start its outward movement when the crank of said crank-shaft is off the "dead-center."

3. In an engine, the combination with the cylinder, of a piston held therein, a crank-shaft, means for connecting said crank-shaft and piston, and means for causing the relative position of the piston and the crank of the crank-shaft to be such that the piston is at the innermost point of its travel when the said crank is at a point beyond the "dead-center."

4. In an engine, the combination with the cylinder, of a piston held therein, a crank-shaft, a rod connecting the piston with the crank-shaft, and means engaging the outer terminal of said rod for causing the same and the piston to be held momentarily from movement endwise as the crank of the crank-shaft leaves the "dead-center."

5. In an engine, the combination with the cylinder, of a piston held therein, a crank-shaft, a rod connecting the piston with the crank of said crank-shaft, and a cam secured to the crank-pin and being adapted to engage the adjacent end of the said rod to cause the piston to be held momentarily in its innermost position, as the crank of the crank-shaft leaves the "dead-center."

6. In an engine, the combination with the cylinder, of a piston held therein, a crank-shaft, a rod connecting the piston with the crank of said crank-shaft and having an inclined contacting face, and a cam secured to the crank-pin and being adapted to coact with said inclined contacting face to cause the piston to be held momentarily in its innermost position through the agency of said rod.

7. In an engine, the combination with the cylinder, of a piston held therein, a crank-shaft, a rod connecting the piston with the crank of said crank-shaft and having a crank-box comprising a fixed inner and a yielding outer half-bearing in which the crank-pin of the crank revolves, and a cam secured to said crank-pin and acting against the inner half-bearing to cause the outer half-bearing to be forced away from said inner half-bearing and permit the piston to be held momentarily in its innermost position.

8. In an engine, the combination with the cylinder, of a piston held therein, a crank-shaft, a rod connecting the piston with the crank of said crank-shaft, and having a crank-

box in which the crank-pin of the crank revolves and which comprises a fixed inner half-bearing provided with semicircular concavities at opposite sides and an inclined portion between said concavities and a yielding outer half-bearing, and a cam secured to said crank-pin and acting against said inclined portion of the inner half-bearing to cause the outer half-bearing to be forced away from the inner half-bearing and to cause the piston to be held momentarily in its innermost position.

9. In an engine, the combination with the cylinder, of a piston held therein, a crank-shaft, a rod connecting the piston with the crank of said crank-shaft, a crank-box in which said crank-pin revolves and which comprises a fixed inner half-bearing having outwardly-extending guides connected by a cross-bar and an outer half-bearing movable on said guides, a spring interposed between said cross-bar and the outer half-bearing, and a cam secured to the crank-pin and acting against the inner half-bearing to cause the piston to remain momentarily in its innermost position and also to cause the outer half-bearing to move from the inner half-section.

10. In an engine, the combination with the cylinder, of a piston movable therein, a crank-shaft operatively connected with said piston, and means for momentarily holding the piston against movement at a certain point in the revolution of the crank-shaft.

In testimony whereof I have affixed my signature in the presence of two subscribing witnesses.

BERNHARD G. HOLZ.

Witnesses:
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M. SEWERT.