No. 821,553. PATENTED MAY 22, 1906.

H. L. TOWLE.

BALANCED ENGINE.

APPLICATION FILED NOV. 20, 1905.

2 SHEETS—SHEET 1.

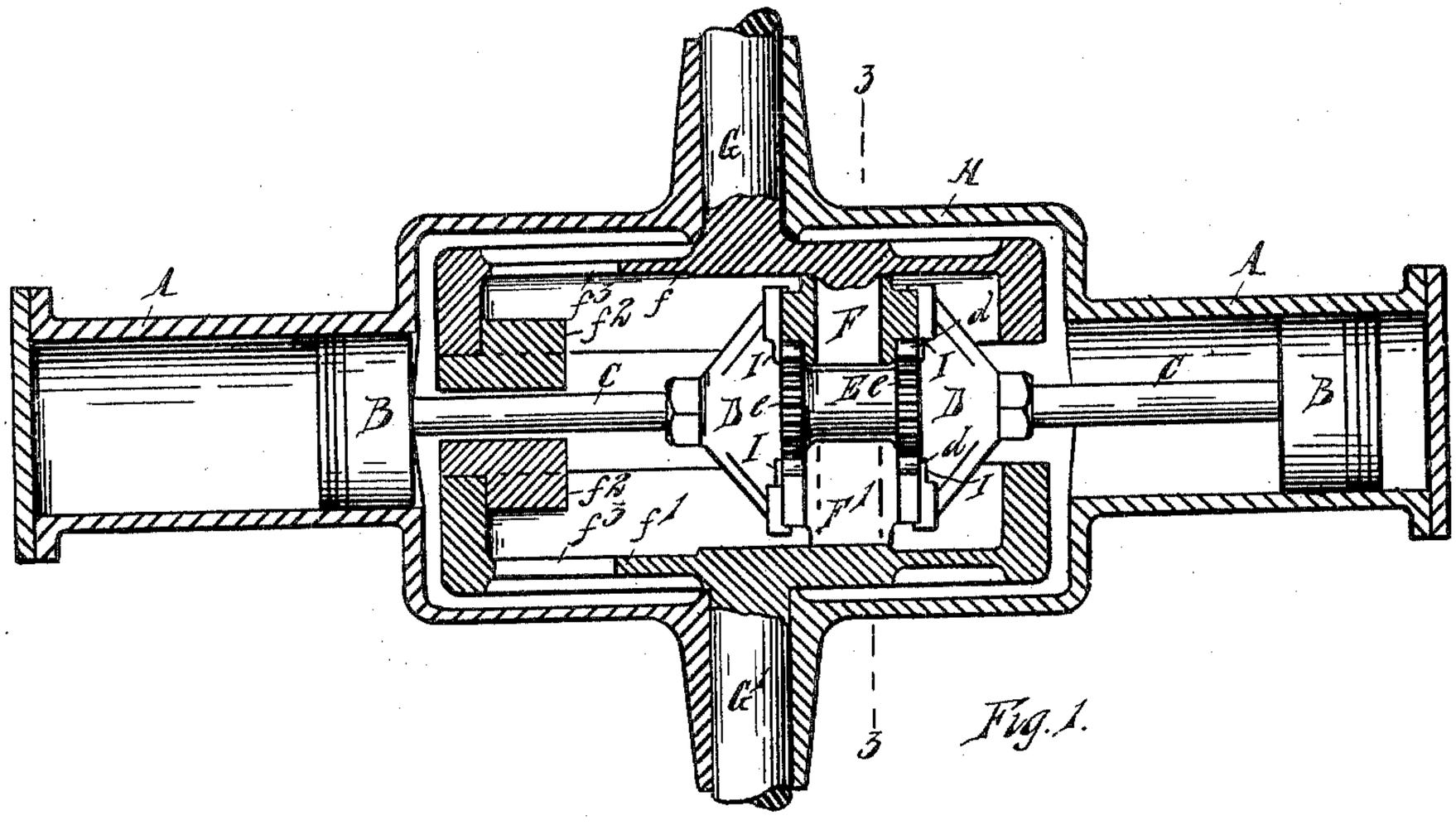

Fig. 1.

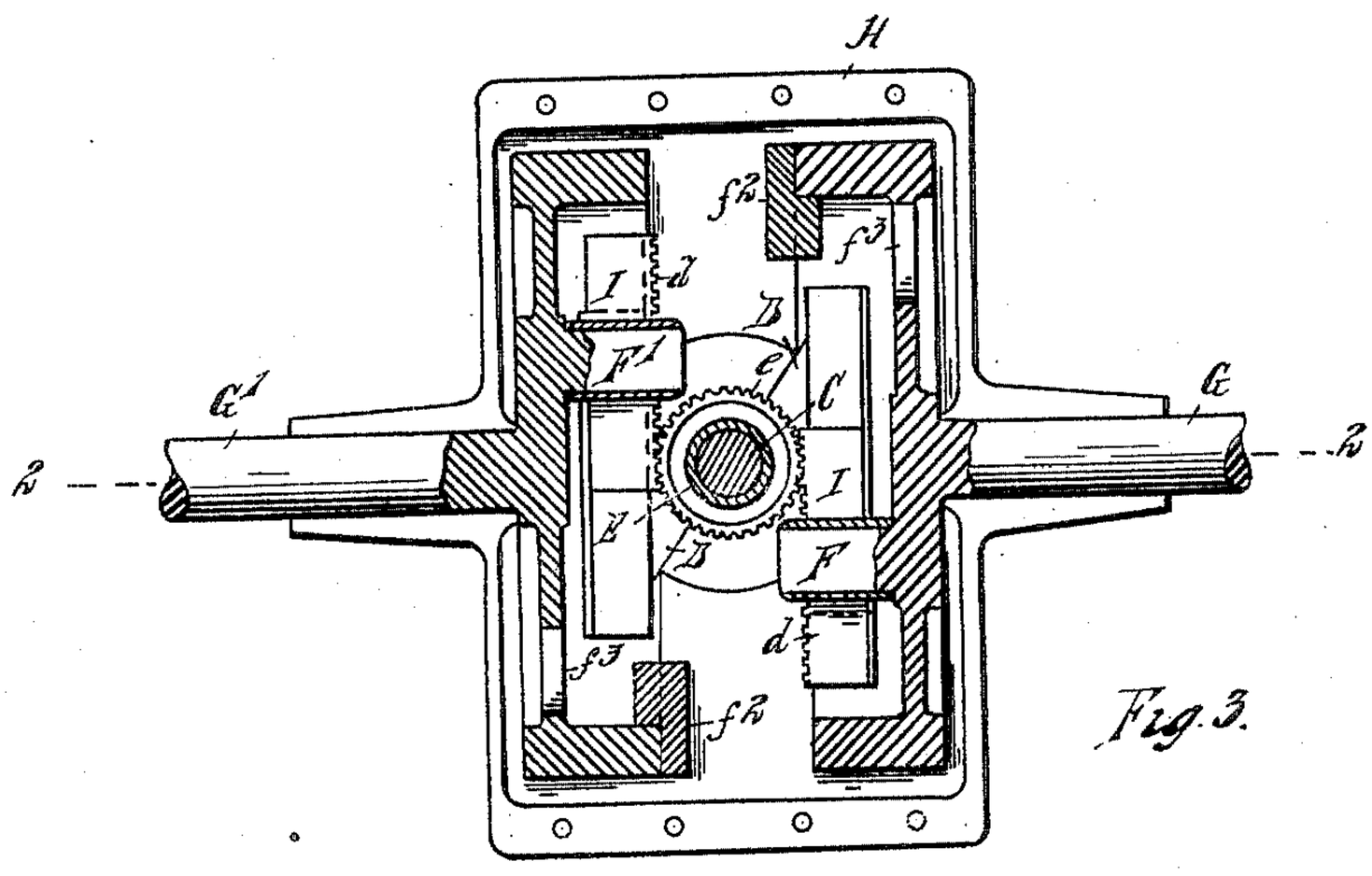

Fig. 3.

WITNESSES
C. E. Day
May E. Kott.

INVENTOR
Herbert L. Towle
By Parker & Burton
Attorneys.

No. 821,553. PATENTED MAY 22, 1906.

H. L. TOWLE.

BALANCED ENGINE.

APPLICATION FILED NOV. 20, 1905.

2 SHEETS—SHEET 2.

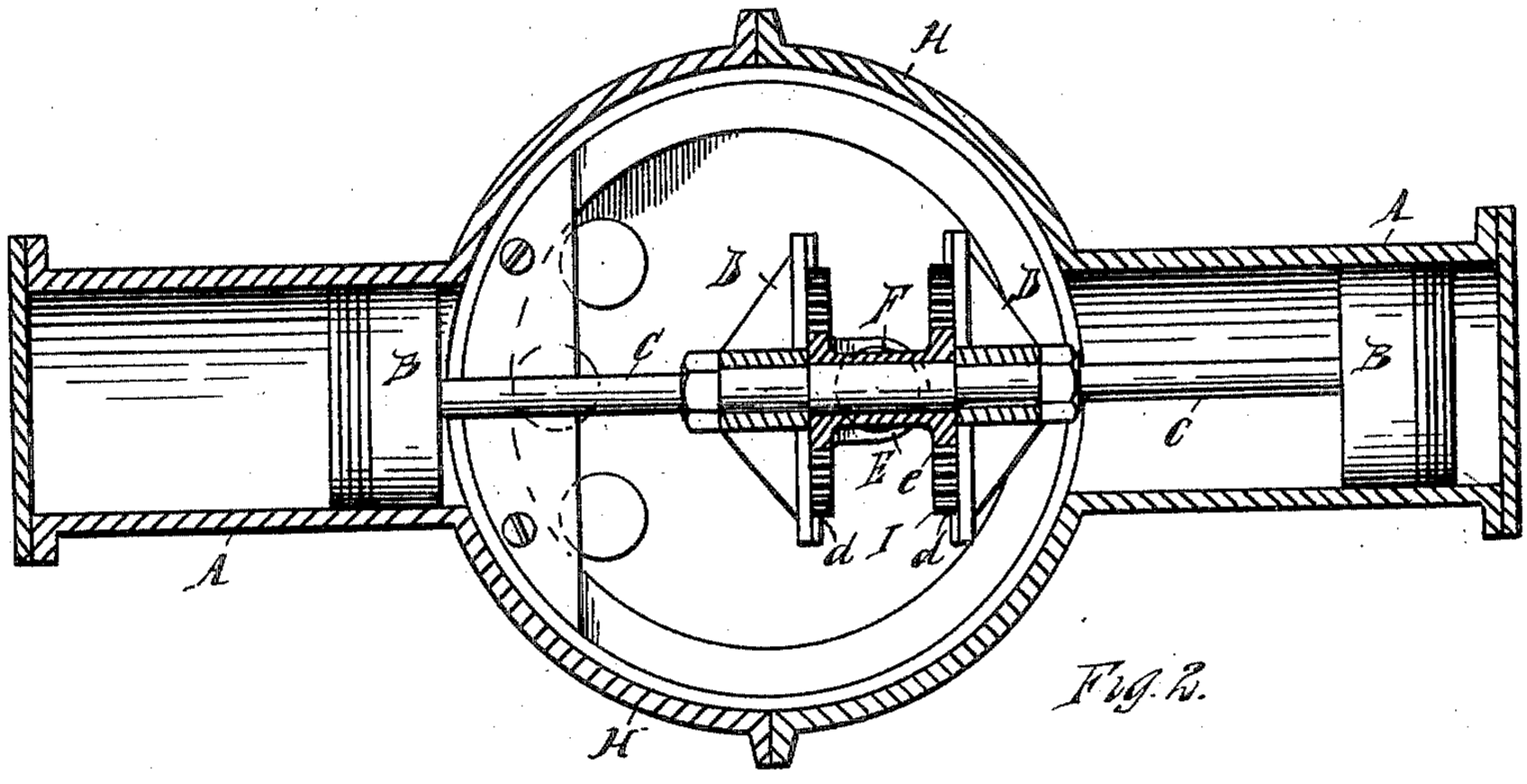

Fig. 2.

WITNESSES
C. E. Day.
May E. Kott.

INVENTOR
Herbert L. Towle.
By Parker & Burton.
Attorneys.

UNITED STATES PATENT OFFICE.

HERBERT L. TOWLE, OF RICHMOND HILL, NEW YORK, ASSIGNOR TO THE WATERBURY TOOL COMPANY, OF WATERBURY, CONNECTICUT, A CORPORATION.

BALANCED ENGINE.

No. 821,553. Specification of Letters Patent. Patented May 22, 1906.

Application filed November 20, 1905. Serial No. 288,126.

To all whom it may concern:

Be it known that I, HERBERT L. TOWLE, a citizen of the United States, residing at Richmond Hill, county of Queens, State of New York, have invented a certain new and useful Improvement in Balanced Engines; and I declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it pertains to make and use the same, reference being had to the accompanying drawings, which form a part of this specification.

My invention relates to reciprocating engines; and the object of my improvements is to provide a reciprocating engine that shall occasion little or no vibration while working. I accomplish this object in the engine illustrated in the accompanying drawings, in which—

Figure 1 is a sectional plan view of an engine embodying my invention. Fig. 2 is a sectional longitudinal elevation of the same, the section being taken on the line 2 2, Fig. 3. Fig. 3 is a cross-sectional elevation, the section being taken on the line 3 3, Fig. 1.

I have shown an engine having two cylinders A A, opposed to each other, and pistons B B therein secured to opposite ends of the same piston-rod.

H is a crank-case uniting the two cylinders.

D D are cross-heads forming a scotch yoke upon the piston-rod C.

E is a sleeve having spur-wheels *e e* at each end. The sleeve E is pivoted upon the piston-rod C between the cross-heads D D.

F F′ are crank-pins secured, respectively, upon the cranks or disks *f f′* upon the shafts G G′. Upon the crank-pins F F′ are pivoted blocks I, having racks *d* formed upon them. The racks *d* mesh with the gear-wheels *e e*. The blocks I are adapted to reciprocate at right angles to the piston-rod C between guides upon the cross-heads D.

The reciprocating motion of pistons B and piston-rod C is communicated to the blocks I through the cross-heads D D and from said blocks to the crank-pins F F′ and shafts G G′. The gear-wheels *e e*, meshing with the racks *d*, constrain the disks *f f′* to turn in opposite directions with equal angular velocities.

f^2 f^2 are counterweights secured upon the disks *f f′*, of sufficient weight and so located upon the disks as to respectively balance the centrifugal force of the crank-pins F F′ and blocks I on said pin and to also by their centrifugal force balance or counteract the inertia of the pistons B and connected parts.

It will be noticed that there is a tendency of the centrifugal forces of the blocks I I and crank-pins F F′ to cause a rocking motion of the engine in the position shown in Fig. 3 and in position adjacent thereto, the pin F′ and the block I thereon having a vertical tendency upward by reason of its centrifugal force, and the pin F and the block thereon a downward force, so that they would occasion a torque or turning moment about an axis coincident with the axis of the piston-rod C. To counteract this effect, the balance-weights f^2 f^2 are located close to the vertical plane through the axis of the piston-rod C and at such a distance therefrom that the product of their centrifugal forces into their distance from said plane is equal to the product of the centrifugal forces of the crank-pins and attached blocks multiplied by their distances from said plane. Thus the torques of the centrifugal forces of the balance-weights is equal and opposite to and completely balances the torque or turning moment of the pins and attached blocks. The webs of the disks *f f′* are cut away, as indicated at f^3 f^3, so that the more weight may be put into the counterweights f^2 f^2, which are nearer the plane through the axis of the piston-rod.

What I claim is—

1. In an engine, two cranks arranged to turn in opposite directions, crank-pins thereon, a reciprocating part adapted to actuate said cranks, counterweights connected with said cranks adapted to balance the inertia of the reciprocating parts, said weights being so located that the turning moment due to their centrifugal forces shall be substantially equal to the turning moment due to the centrifugal forces acting on the crank-pins.

2. In an engine, two cranks arranged to turn in opposite directions, crank-pins thereon, a reciprocating part adapted to actuate said cranks, counterweights connected with

said cranks adapted to balance the centrifugal force of the crank-pins, and attached revolving parts, and also to balance the inertia of the reciprocating parts, said weights being so located that the turning moment about the axis of the reciprocating part due to their centrifugal forces, shall be substantially equal to the turning moment about the same axis due to the centrifugal forces acting on the crank-pin.

In testimony whereof I sign this specification in the presence of two witnesses.

HERBERT L. TOWLE.

Witnesses:

HARRY A. ANDERSON,

ELIZABETH W. TOWLE.