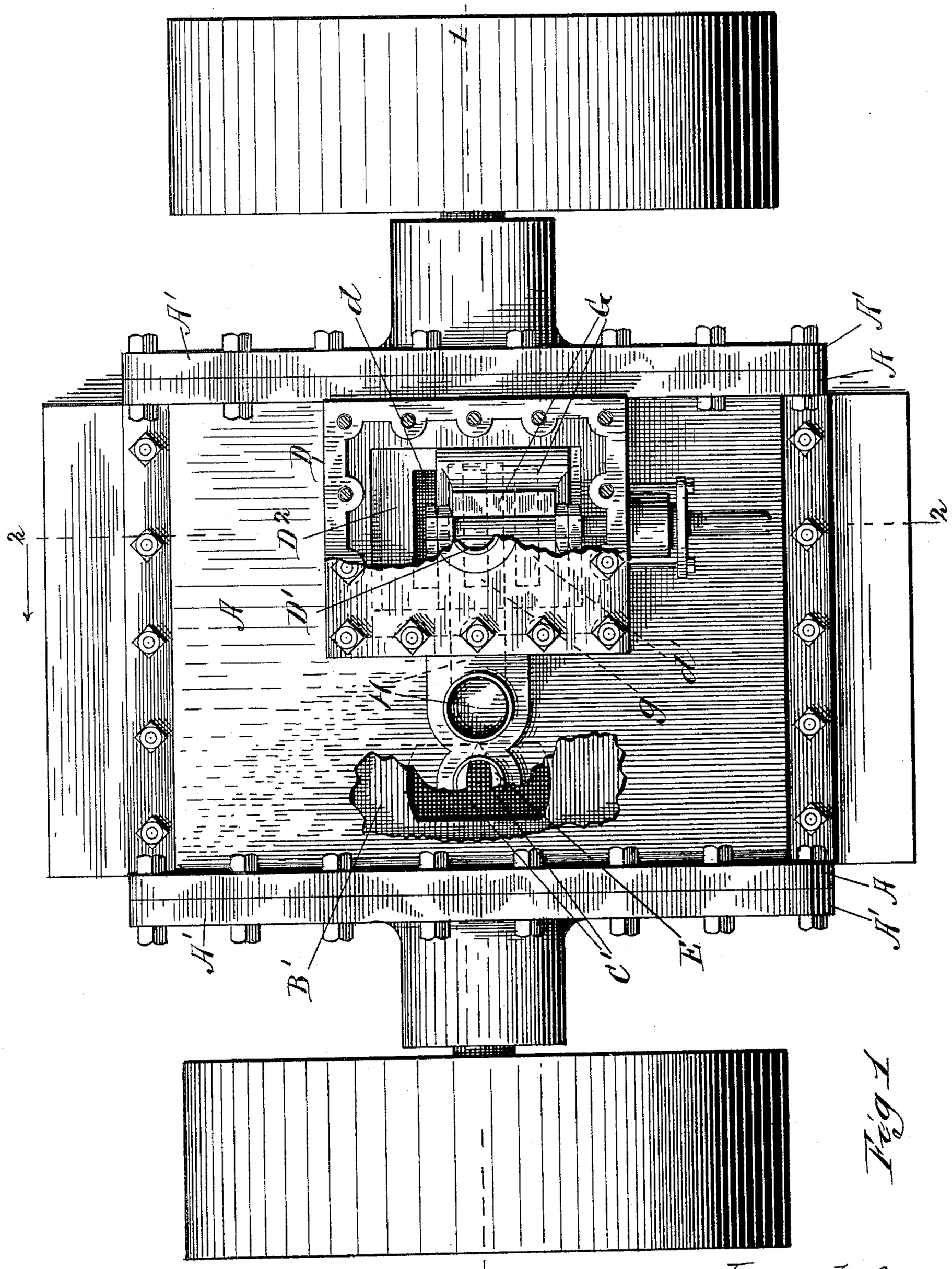
(No Model.) 4 Sheets—Sheet 1.

D. D. HARDY.

VIBRATING ENGINE.

No. 399,327. Patented Mar. 12, 1889.



Witnesses,
W. C. Curtis
W. J. Faulkner

Inventor
Dexter D. Hardy
By E. C. Crawford.
Attorney

(No Model.)

4 Sheets—Sheet 2.

D. D. HARDY.

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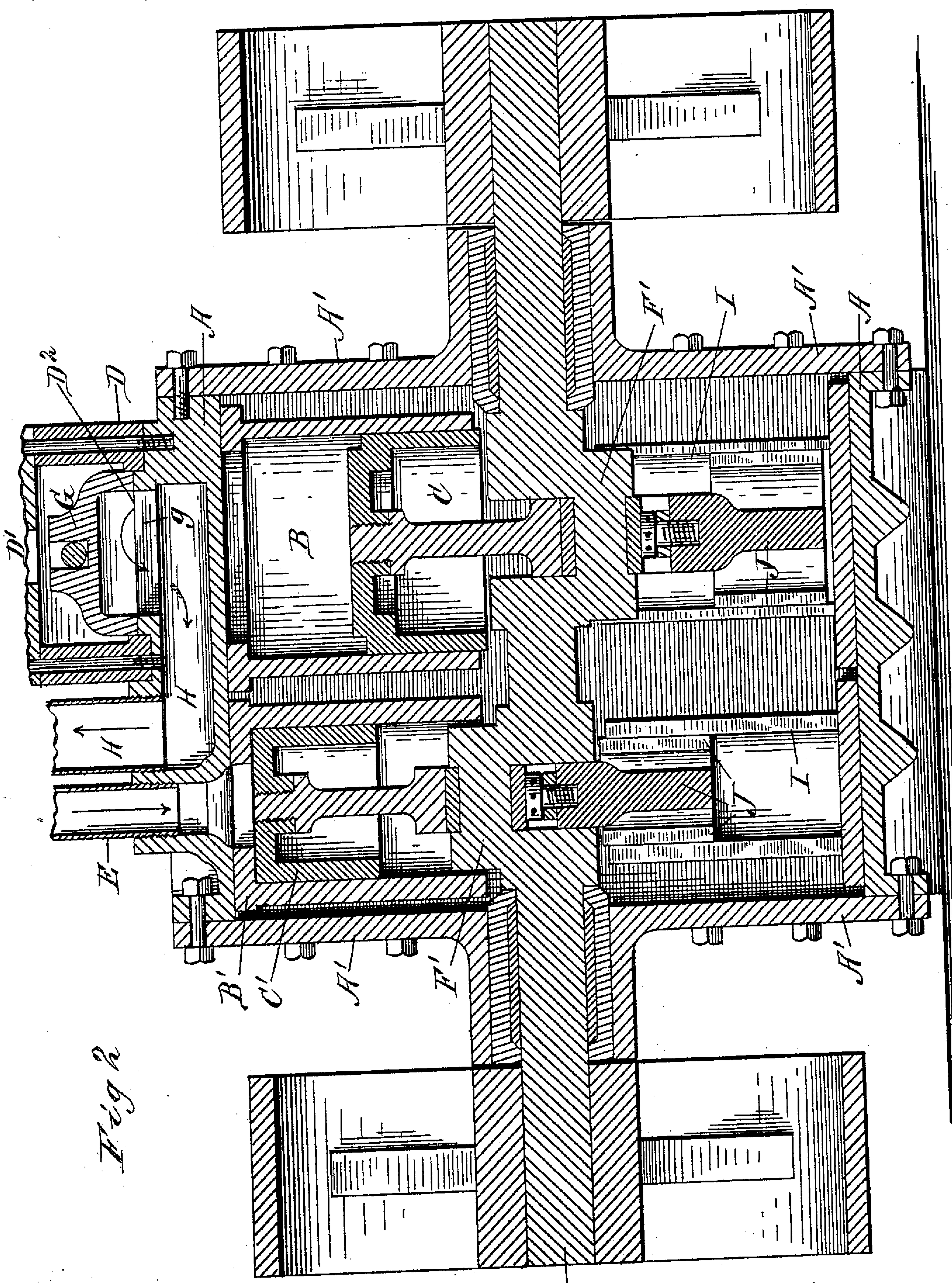

Fig 2

Witnesses,
W. C. Corliss.
[illegible]

Inventor
Dexter D. Hardy
By E. E. Crawford.
Attorney.

N. PETERS, Photo-Lithographer, Washington, D. C.

(No Model.)

4 Sheets—Sheet 3.

D. D. HARDY.

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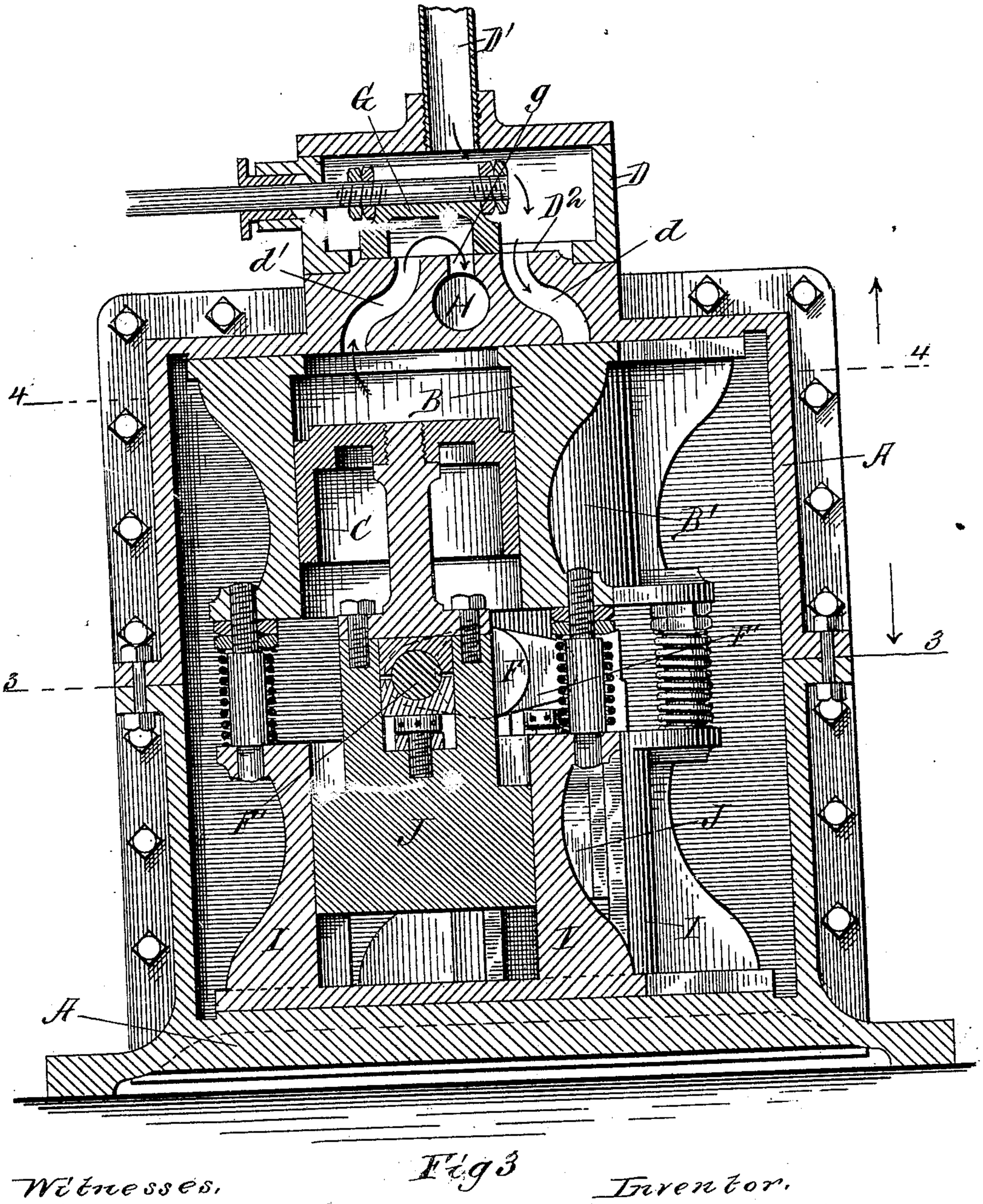

Fig 3

Witnesses.
W. C. Curtis.
W. A. Faulkner.

Inventor.
Dexter D. Hardy.
By E. C. Crawford.
Attorney.

(No Model.) 4 Sheets—Sheet 4.

D. D. HARDY.

VIBRATING ENGINE.

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Fig 5

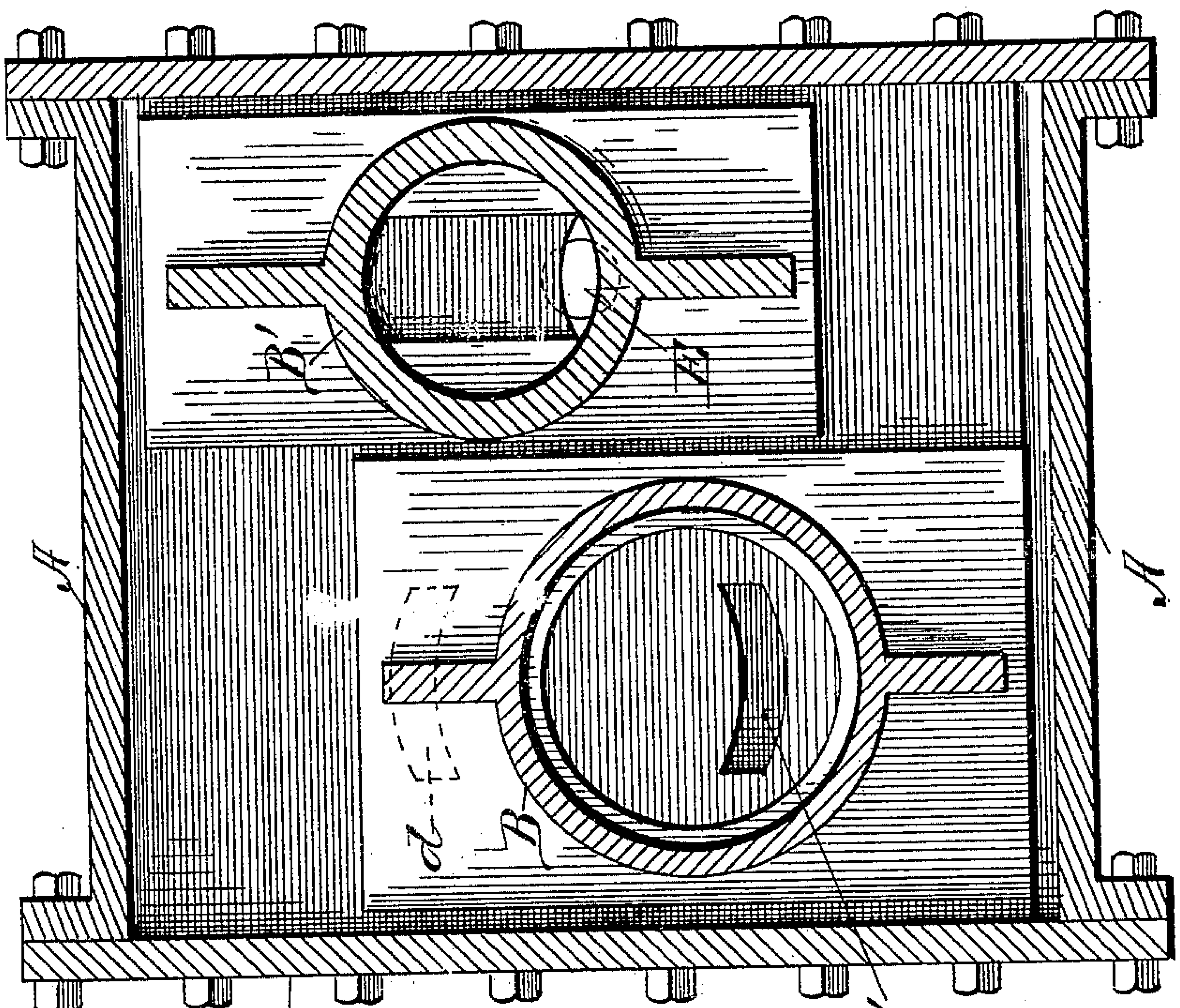
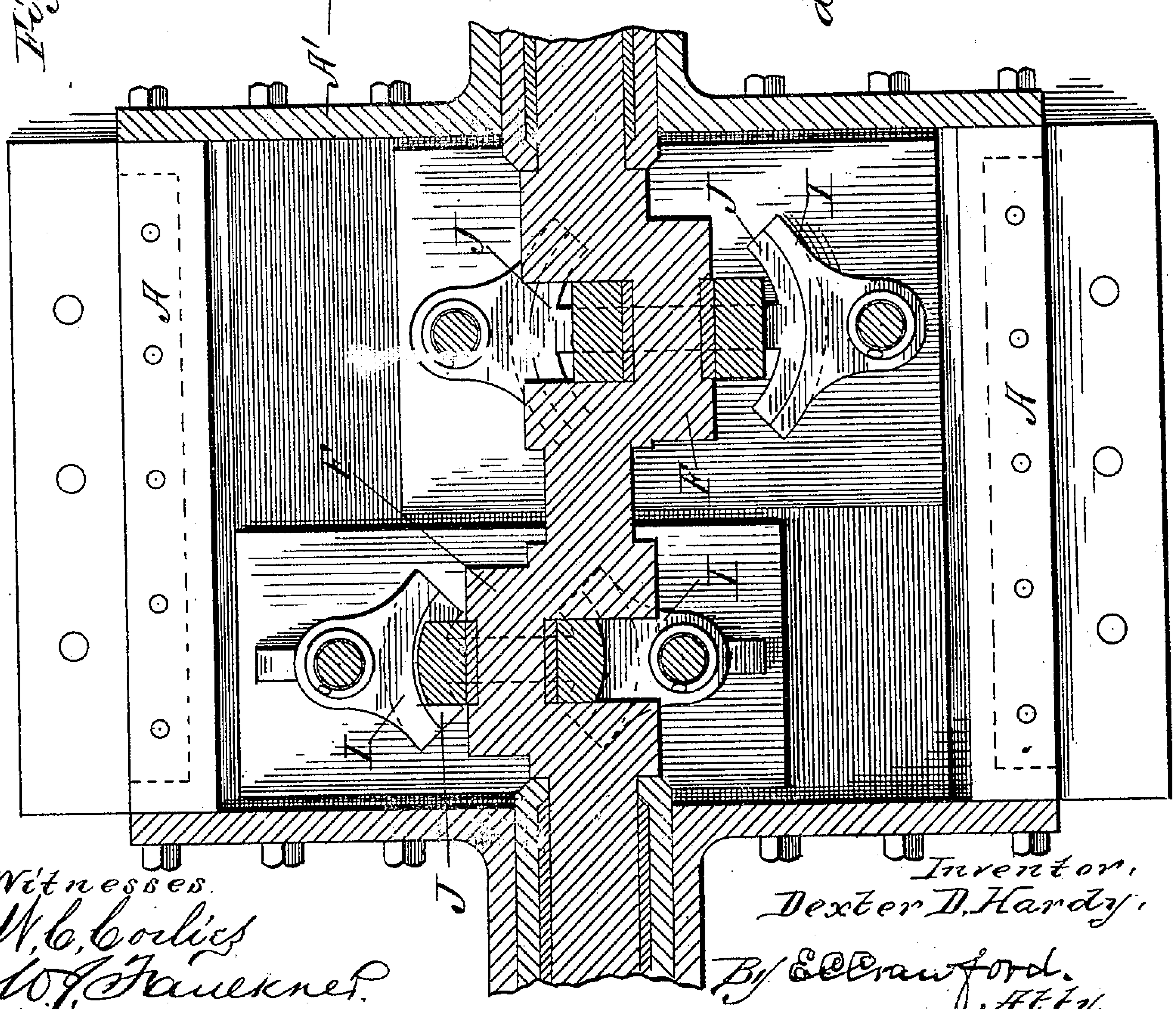


Fig 4



Witnesses.
W. C. Corliss
W. J. Faulkner

Inventor,
Dexter D. Hardy,
By E. E. Crawford.
Atty.

N. PETERS, Photo-Lithographer, Washington, D. C.

UNITED STATES PATENT OFFICE.

DEXTER D. HARDY, OF CHICAGO, ILLINOIS.

VIBRATING ENGINE.

SPECIFICATION forming part of Letters Patent No. 399,327, dated March 12, 1889.

Application filed May 3, 1888. Serial No. 272,686. (No model.)

To all whom it may concern:

Be it known that I, DEXTER D. HARDY, a citizen of the United States, residing at Chicago, in the county of Cook and State of Illinois, have invented certain new and useful Improvements in Vibrating Engines, of which the following is a specification.

My present invention relates to vibrating engines; and it consists of improvements upon certain devices in such engines hitherto patented to me—to wit, by Letters Patent of the United States Nos. 373,287 and 373,288, both dated November 15, 1887.

The object of my present invention is to make such an engine reversible, and at the same time to maintain its simplicity of construction. I attain such object by the machinery illustrated in the accompanying drawings, in which—

Figure 1 represents a top plan view of a vibrating engine, with a part of the steam-chest and upper part of the casing broken away to show the slide-valve and steam-ports. Fig. 2 is a vertical longitudinal section taken on the line 1 1 of Fig. 1, with the cranks and pistons in their extreme vertical positions. Fig. 3 is a vertical cross-section taken on the line 2 2 of Fig. 1, looking in the direction of the arrow, with the cranks turned a quarter-revolution and the cylinders in their extreme horizontal positions. Fig. 4 is a plan section taken on the line 3 3 of Fig. 3, looking in the direction of the arrow. Fig. 5 is a bottom plan view of the top of the casing, taken on the line 4 4 of Fig. 3, looking in the direction of the arrow.

Like letters refer to like parts in all the drawings.

In the drawings, A is the casing designed to contain the cylinders, pistons, and slides.

B and B′ are cylinders. The former is about twice as large as the latter. C and C′ are pistons working in these, respectively.

D is a steam-chest, and D′ a pipe leading to it from the boiler.

d and *d′* are steam-ports leading from the steam-chest to the end of the cylinder B opposite to the main shaft.

g is an exhaust-port passing through the valve-seat D^2 into the exhaust-passage H. The inner sides of the lower ends of the steam-ports are distant from each other by a space somewhat greater than the caliber of the cylinder, and the inner sides of their upper ends are separated from each other by a distance a little greater than the length of the cavity in the slide-valve G.

E is a pipe leading from the steam chest or boiler to the end of the cylinder B′ opposite to the main shaft F.

F′ F′ are cranks forming part of the main shaft. The pistons are journaled to the crank-pins in any suitable manner.

A′ A′ are the heads of the casing A. Bearings are formed in these for the main shaft. The pistons take hold of the crank-pins directly without the use of any connecting-rods.

G is a slide-valve of the ordinary type.

I I are slides in which the cross-heads J J work.

The machinery above described is operated as follows: Adjust the slide-valve G so that its cavity will open into the steam-port *d′*. Admit steam into the cylinder B′. It is obvious that the engine will now begin to act, the piston C′ moving toward the main shaft and the piston C in the opposite direction. At the same time the cylinder B vibrates, its opening is brought beneath the steam-port *d*, steam rushes through this, and on account of the greater area of pressure on the piston C it moves toward the main shaft and the piston C′ in the opposite direction. The cylinder B vibrating back on the completion of a semi-revolution of its crank, steam is cut off by an end flange of the cylinder passing beneath the end of the steam-port *d*, the opening of the cylinder is brought beneath the end of the steam-port *d′*, and the steam escapes through this, whereupon the above operation is repeated. To reverse the action of the engine, move the slide-valve G so that its cavity will open into the steam-port *d*.

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

1. In a vibrating engine, the combination of two cylinders having different calibers, one of said cylinders having steam therein constantly, the other receiving and exhausting steam by its own movement, whereby the steam-ports are opened and closed, substantially as stated.

2. In a vibrating engine, the combination

of the cylinder B′, opening directly into the pipe E, leading from the steam chest or boiler, the cylinder B, having a caliber greater than that of the cylinder B′, the exhaust-port *g*, the exhaust-passage H, and the steam-ports *d* and *d′*, whereby steam is received and exhausted intermittently by the movement of said cylinder B, and the pistons C′ and C, moving in said cylinders, respectively, and connected with the main shaft by cranks placed thereon diametrically opposite to each other, substantially as and for the purposes stated.

3. In a vibrating engine, the combination of the steam-chest D, the valve-seat D^2, the system of steam-ports *d* and *d′*, passing through said valve-seat and opening into the end of the cylinder B opposite to the main shaft, at a distance from each other greater than the caliber of said cylinder, and the slide-valve G, having a cavity in its base shorter than the distance between said steam-ports, said slide-valve being designed to produce by its movement, either by hand or automatically, a reversal of the action of the engine, substantially as stated.

4. A vibrating engine consisting of two or more vibrating cylinders, said cylinders being of different calibers, with steam constantly in the cylinder of less caliber, and having single-acting pistons journaled directly to the cranks F′ F′, at equal angular distances apart on the main shaft F, the casing A, inclosing said cylinders, pistons, and cranks, and the slides I and cross-heads J, substantially as set forth.

DEXTER D. HARDY.

Witnesses:
W. J. FAULKNER,
W. C. CORLIES.