(No Model.)

D. D. HARDY.

VIBRATING ENGINE.

No. 373,288. Patented Nov. 15, 1887.

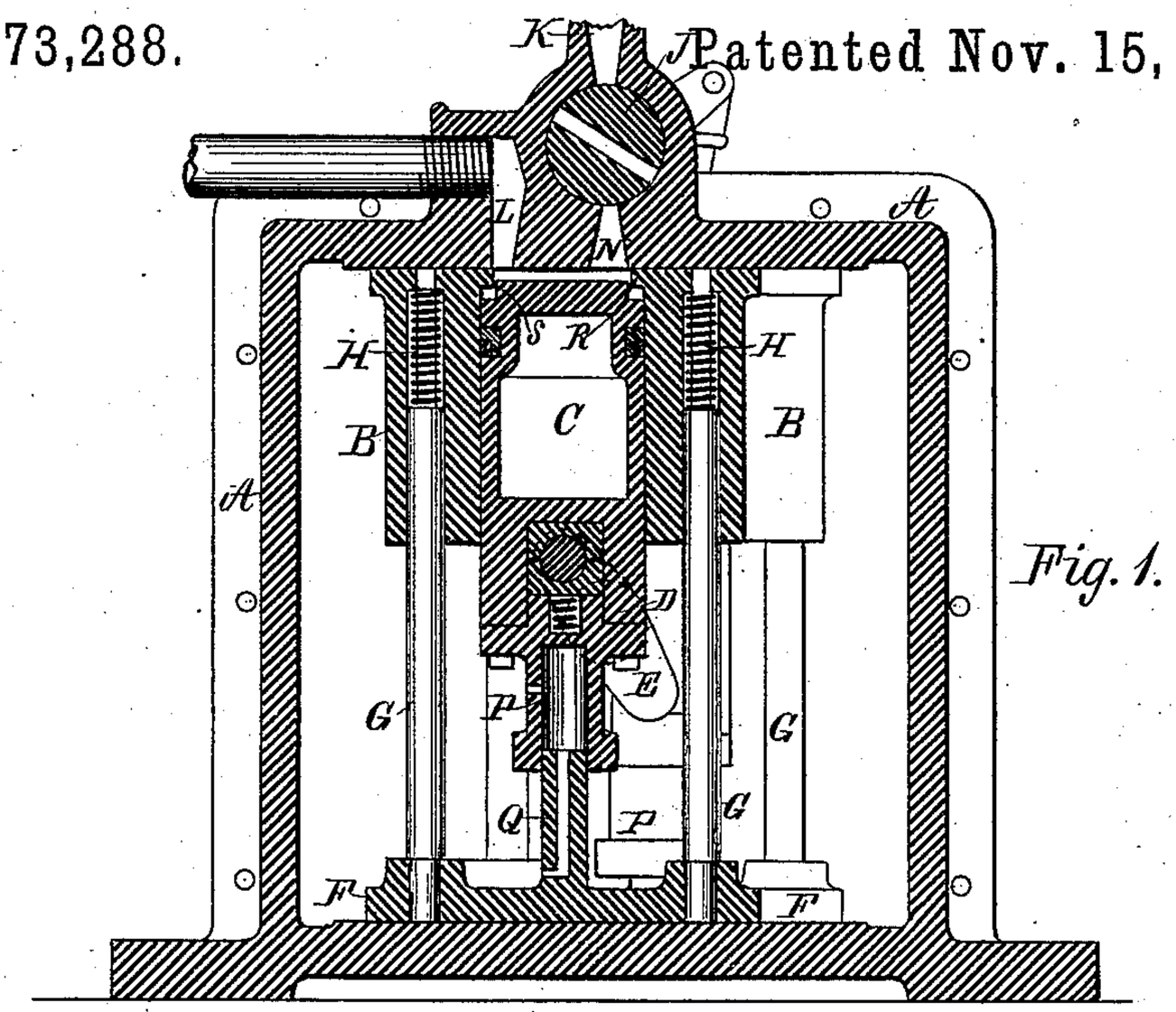

Fig. 1.

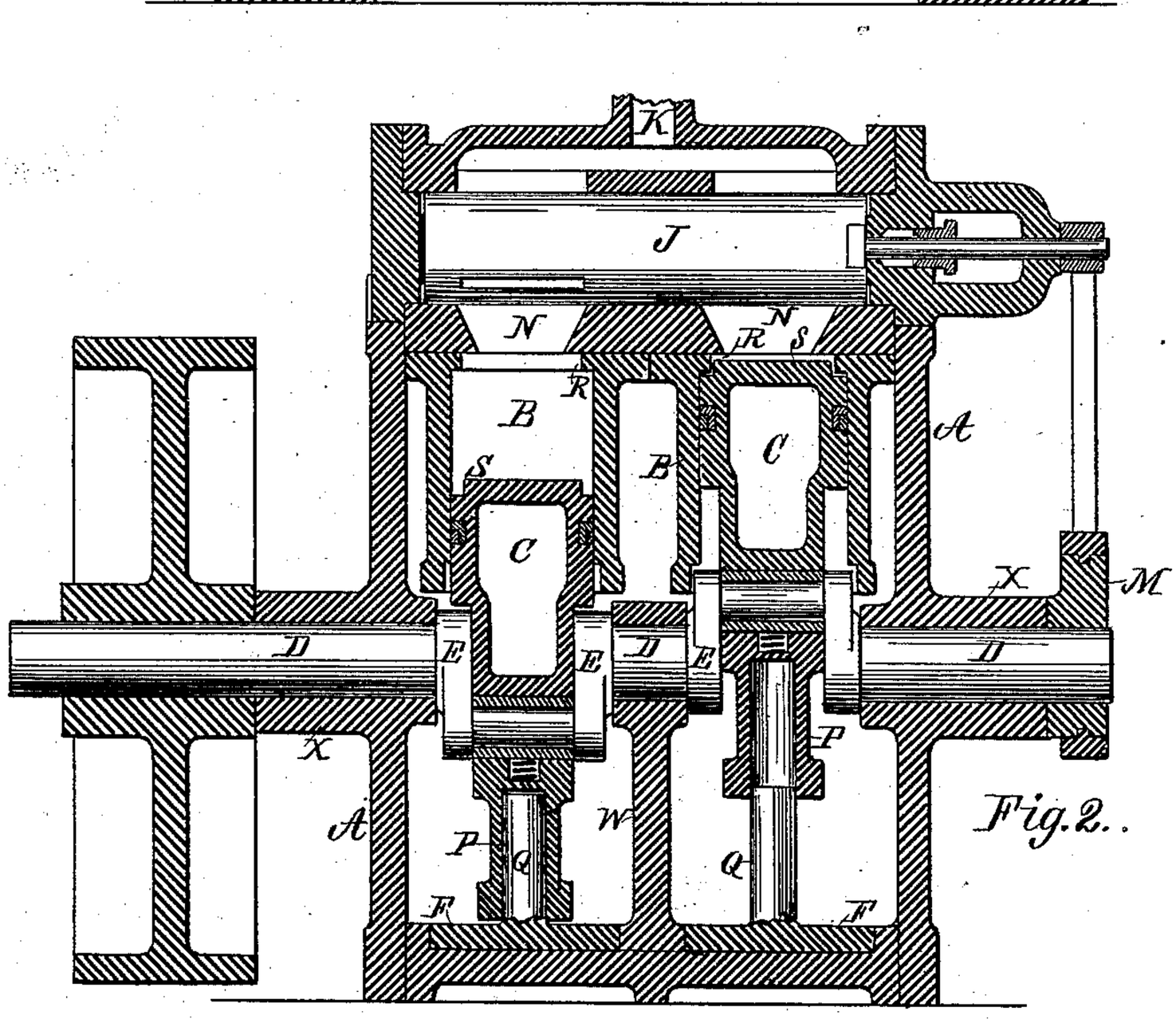

Fig. 2.

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VIBRATING ENGINE.

SPECIFICATION forming part of Letters Patent No. 373,288, dated November 15, 1887

Application filed May 3, 1887. Serial No. 236,914. (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 a new and useful Improvement in Vibrating Engines, of which the following is a specification.

My invention relates to improvements in vibrating engines; and the objects of my improvements are to produce a more perfectly steam-tight joint between the cylinder and the face against which it slides; to make a more perfect running-balance of such engines; to make the action of the exhaust independent of any automatic or other change in the action of the steam-valve, and, in general, to add to the efficiency of such machines.

Referring to the drawings which form part of this specification, Figure 1 is a vertical cross-section on a plane passing through the axis of one of the cylinders, and Fig. 2 is a vertical longitudinal section through the axes of both cylinders.

A is the casing of the engine.

B B are the steam-cylinders; C C, the pistons; D, the main shaft; E E, the main-shaft cranks; F F, sliding plates carrying the standards G G, which enter at their top ends sockets in the cylinders B B and act against springs H H in said sockets.

J is the steam-valve, which governs the admission and discharge of the steam to and from the cylinders. Steam is admitted to the valve-chambers at K and exhausted from the cylinders at L.

M is the eccentric operating the valve. The pistons C C take hold of the crank-pins directly, and are journaled thereto in any suitable manner. Each piston carries a cylinder or guide, P, at its lower end, which is fitted to slide on the standard or upright Q, attached to the plate F. While the pistons reciprocate vertically the steam-cylinders reciprocate in a horizontal direction, which admits of a circular movement of the cranks. The springs H H, acting on the cylinders on one side and on the standards G G on the other side, and through them on the sliding plates F F, tend to force said plates and cylinders away from each other. This is to force the cylinders to bear firmly against the inside surface of the casing, which is properly prepared to maintain a steam-tight joint. In addition to this, shoulders R are formed in the top of the cylinders, which reduce the area of opening of the cylinders at their ends, thereby producing an upward pressure when steam is in the cylinders, tending to force the cylinders still harder against their seat. This upward pressure is that due to the difference between the area of the main part of the cylinder and that of its end opening. The pistons are shouldered at S, to agree with the shoulder R, so as to reduce clearance-space.

The piston-guides P are fitted to slide on the uprights Q, to relieve pistons and cylinders of side strain and wear.

I make the weights of the pistons alike, and the weights of the cylinders also alike. Moreover, I make that part of each piston which is above its crank-pin exactly balance in static balance that part which is below, and, considering the plates F and rods G as a part of the cylinders, I apply the same principle to the cylinders. This is in order that the inertia of the rapidly-moving parts shall be the same on each side of the crank-pins, to destroy any tendency of these parts to revolve about their crank-pins.

Placing the crank-pins one hundred and eighty degrees apart makes the running-balance complete, for the inertia of the equal-weight cylinders and equal-weight pistons is equal and acts in opposite directions on the shaft.

The exhaust-ports L open directly into the cylinders or are closed by the sliding faces of the cylinders, while the steam-ports N are opened and closed by the valve J. This construction enables the admission of steam to be adjusted or automatically governed, while the exhaust is not affected thereby.

I inclose cylinders and pistons within the tight casing A and partly fill it with oil or other lubricant, which, being splashed about by the running parts, is thrown onto all the interior running faces.

W is a central support for the shaft, which may or may not be used.

X X are bearings for the shaft, formed in the sides of the casing.

I do not confine myself to two cylinders and pistons, for any number above two may be used and a similar balance of parts produced

by placing the corresponding cranks at equal angular distances apart. The cylinders may be placed below or beside the shaft or in any radial direction therefrom, in any case being beside each other and corresponding to separate cranks, E.

If preferred, the exhaust may be operated by a separate valve, or all steam-valves may be dispensed with and the movement of the cylinders may be made to control admission as well as exhaust.

What I claim as my invention is—

1. In a vibrating engine, the shoulder R, formed by reducing the size of the cylinder at its end, in combination with open-end rectilinear vibrating cylinder B and casing A, having a suitable surface for the cylinder to slide against, substantially as set forth.

2. In a vibrating engine, the combination of open-end rectilinear vibrating cylinder B, with its internal shoulder, R, piston C, journaled directly to the crank-pin, shaft D, and casing A, having a surface for the cylinder to vibrate against, substantially as set forth.

3. In a vibrating engine, the combination of two or more rectilinear vibrating cylinders, B, with pistons journaled directly to separate cranks, E, the crank-shaft D, having two or more cranks at equal angular distances apart, and the casing A, having the exhaust-ports leading directly into the cylinders B, and the steam-ports N, operated by the valve J, substantially as set forth.

4. A vibrating engine consisting of two or more rectilinear vibrating cylinders, B, having single-acting pistons C, journaled directly to cranks E at equal angular distances apart on the shaft D, the casing A, inclosing said cylinders, pistons, and cranks, the rods G, springs H, and plates F, and the guide-cylinders P and posts Q, substantially as set forth.

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Witnesses:
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