

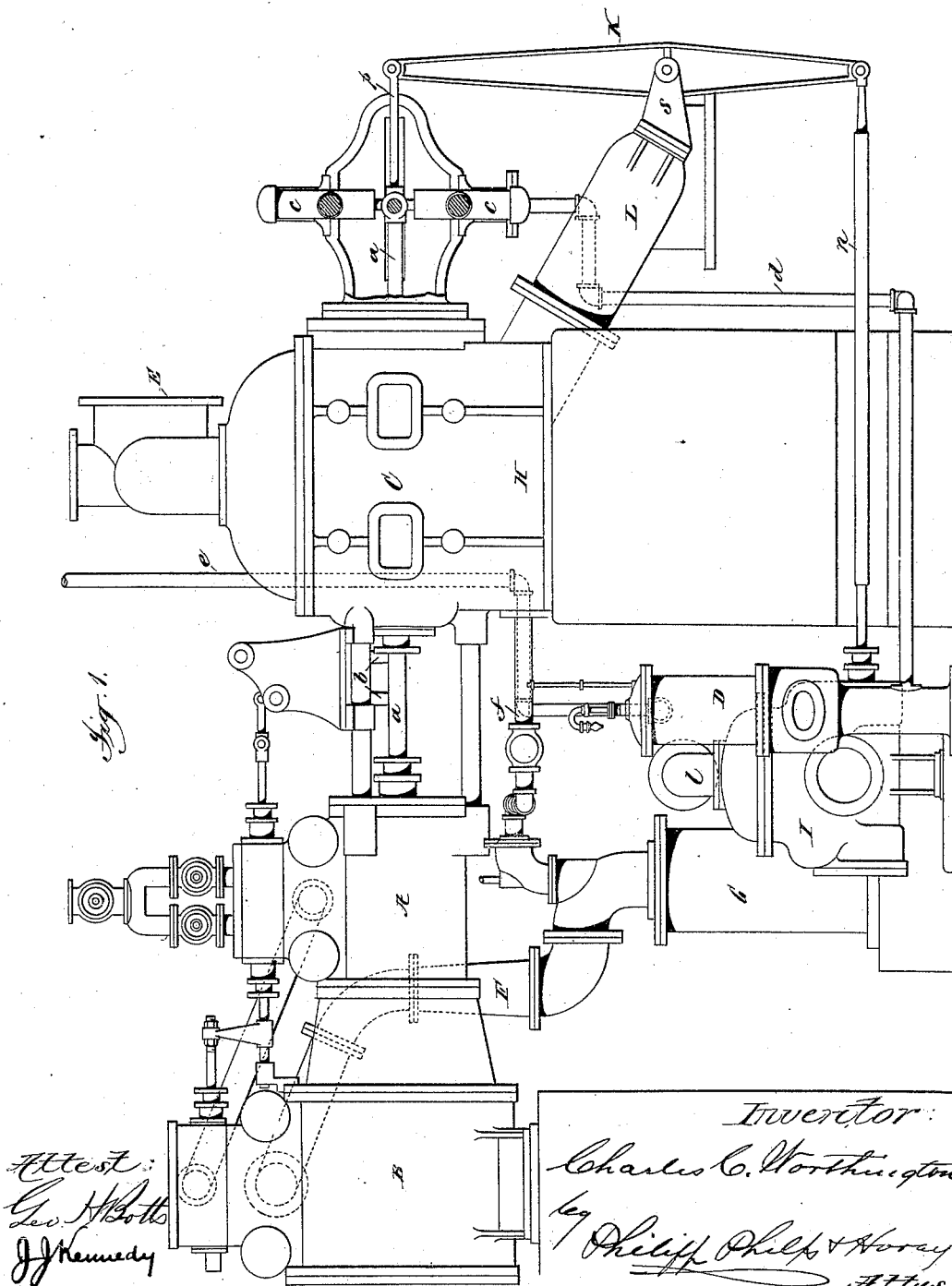
(No Model.)

2 Sheets—Sheet 1.

C. C. WORTHINGTON.
DIRECT ACTING ENGINE.

No. 422,680.

Patented Mar. 4, 1890.



Attest:
Geo. H. Bots
J. Kennedy

Inventor:
Charles C. Worthington
by Philip Phelps & Horay
Attys.

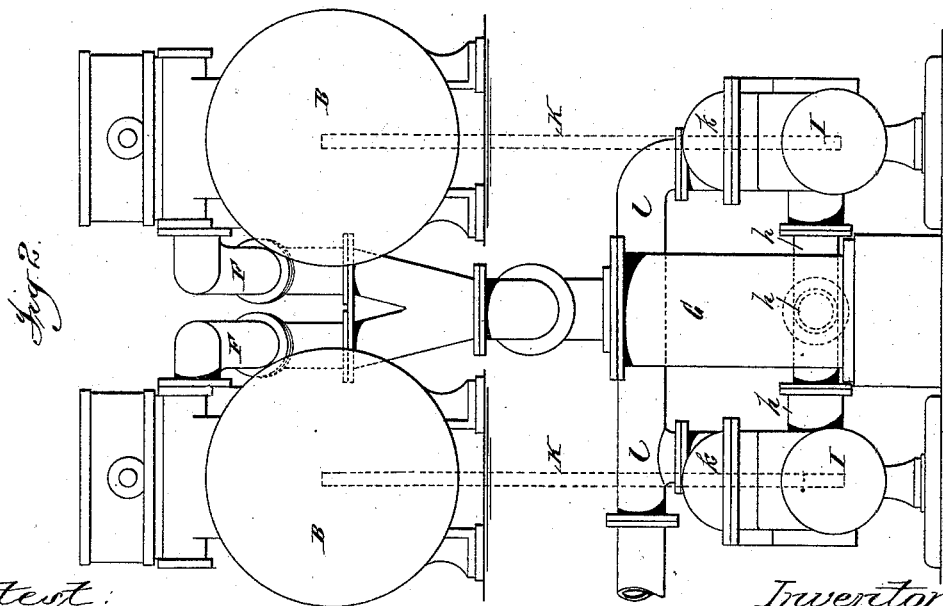
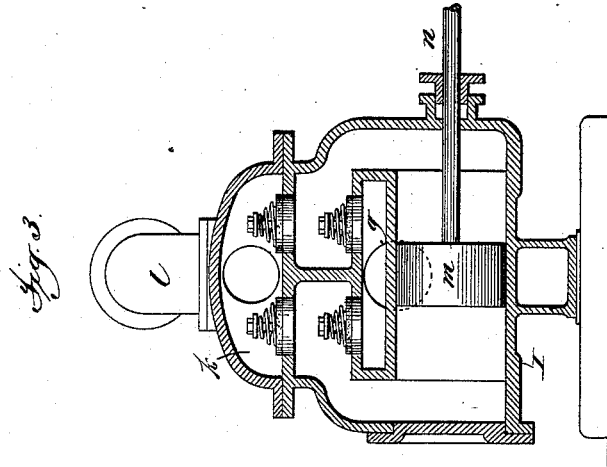
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DIRECT ACTING ENGINE.

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Geo. A. Rott
J. Kennedy

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UNITED STATES PATENT OFFICE.

CHARLES C. WORTHINGTON, OF IRVINGTON, NEW YORK.

DIRECT-ACTING ENGINE.

SPECIFICATION forming part of Letters Patent No. 422,680, dated March 4, 1890.

Application filed March 24, 1888. Serial No. 268,364. (No model.)

To all whom it may concern:

Be it known that I, CHARLES C. WORTHINGTON, a citizen of the United States, residing at Irvington, county of Westchester, and State of New York, have invented certain new and useful Improvements in Direct-Acting Engines, fully described and represented in the following specification and the accompanying drawings, forming a part of the same.

This invention relates to improvements in that class of engines known as "direct-acting condensing-engines;" and the invention consists in certain features in the construction and organization of the engine, whereby the use of a connecting rod or rods for operating the air pump or pumps of the condenser is avoided, whereby the beam or beams through which the air pump or pumps is or are operated is or are fulcrumed directly upon the main castings of the engine, and whereby the breaking of a piston or plunger rod operates to destroy the effectiveness of the condenser and thus check the engine and prevent it from operating violently so as to damage itself.

A full understanding of the invention can be best given by an illustration and a detailed description of an organized engine embodying the same. All further preliminary description will therefore be omitted and a full description given, reference being had to the accompanying drawings, in which—

Figure 1 is a side elevation of a compound direct-acting duplex engine embodying the invention. Fig. 2 is an end elevation of the same, looking from the left of Fig. 1. Fig. 3 is a vertical section of one of the air-pumps which operate to exhaust the condenser.

Referring to said figures, it is to be understood that each side of the steam end of the duplex engine is composed of a high-pressure cylinder A and a low-pressure cylinder B, which operate upon the compound principle. Each side of the water end of the engine consists of a water-cylinder C, having a piston or plunger which is connected directly to the piston-rod *a* of the steam end of the engine.

The two sides of the engine are provided with the usual connections by which the

valves of each side are operated from the other side, as is common in duplex engines. The piston-rods *a* are extended through and beyond the water-cylinders, and are each connected to the piston-rods of a pair of compensating cylinders *c*, which operate in the manner described in my prior Letters Patent Nos. 292,525, 309,676, and 332,857. The rock-arms *b*, through which the valves are operated, may be connected to the piston-rods *a* between the steam and water cylinders, but will preferably be connected by means of connecting-rods which pass between the cylinders, as shown in my prior Letters Patent, No. 332,857. The pressure of the motor fluid which acts upon the pistons of the compensating cylinders is in the case illustrated derived from an accumulator D, which is connected with the trunnions of the compensating cylinders by means of a pipe *d*, the initial pressure of the accumulator being derived from the force-main E either directly or through a volume of air which communicates with the accumulator through a pipe *e*, as shown in my prior Letters Patent, No. 341,534. The engine, being provided with the compensating cylinders *c*, is adapted to use steam expansively, and may therefore be provided with any suitable form of cut-off apparatus—such, for example, as shown in my prior Letters Patent, No. 342,669. This apparatus is not, however, illustrated in the present case, as it forms no part of the present invention.

The operation of the engine thus organized is well known and is fully set forth in the Letters Patent referred to, and need not, therefore, be herein described in detail.

The steam, after performing its work in the cylinders A B, is exhausted from the latter into exhaust-pipes F, and passes thence into a condenser G, which may be of any suitable form, but as herein illustrated is of the well-known jet type. The injection-water is supplied to the condenser G through a pipe or pipes *f*, which communicate with the suction-chamber H of the water end of the engine. The air and water are exhausted from the condenser by means of two air-pumps I, the suction-chambers *g* (see Fig. 3) of which communicate through pipes *h* with the bottom of the condenser. The force-chambers *k* of the

pumps I communicate with the common discharge-pipe *l*, through which the water and air are discharged. The pistons *m* of the pumps I are provided with long and slightly-flexible piston-rods *n*, which are connected to the lower ends of a pair of rocking beams K, the upper ends of which are connected by means of links *p* with those portions of the piston-rods *a* which project through and beyond the water-cylinders. The beams K are fulcrumed upon supports *s*, which are secured directly to the suction-main L, which is in turn of course connected rigidly to the main castings of the water end of the engine. By this means any slight settling or displacement of the engine after it is placed in position, which may occur owing to the great weight of the engine, does not destroy the relation between the beams K and the other parts of the engine, and thus prevent the proper operation of the pumps I, which would be the case if the beams K were fulcrumed upon supports disconnected from the engine.

By operating the air-pumps from beams located in the rear or outside of the water end of the engine it becomes possible to extend the piston-rods *n* and connect them directly to the beams without the interposition of the usual connecting-rods, as the length of the piston-rods *n* is sufficient to allow them to spring sufficiently to accommodate themselves to the different positions of the beams, caused both by the rocking of the beams in the regular operation of the engine and by a change in the position of the fulcrums of the beams, due to the settling or displacement of the engine.

In engines of this class it is important to provide means by which, in case of the breaking of a piston-rod, which would operate to suddenly relieve the engine of its load, the engine will be checked before it can operate violently so as to damage itself. This result is to a great extent accomplished by connecting the rock-arms *b*, which operate the valves of the engine, with the piston-rods *a* outside

the water-cylinders, as described in the Letters Patent before referred to. The checking of the engine is, however, still further provided for in the present case by operating the air-pumps which exhaust the condenser from those portions of the piston-rods which extend through the water-cylinders.

From this arrangement it will readily be seen that in case of the breaking of either one of the piston-rods *a* the pump I which is operated from that rod will be immediately stopped, thus destroying the vacuum in the condenser and creating a back-pressure upon the pistons of the cylinders B, which will operate to check the engine.

Although the invention is herein illustrated as applied to a compound duplex engine, it is to be understood that the invention may be and is intended to be applied to simple as well as compound engines and to single as well as duplex. It is also to be understood that the invention may be applied to those engines which are not provided with the compensating cylinders.

What I claim is—

1. The combination, with a pumping-engine having its piston-rod extended through its water-cylinder, of a condenser for said engine and an air-pump for exhausting said condenser, having its piston-rod connected to the piston-rod of the engine at a point beyond the water-cylinder, substantially as described.

2. The combination, with a duplex condensing-engine having its piston-rods extended through the water-cylinder, of air-pumps for exhausting the condenser, having their piston-rods connected to the piston-rods of the engine beyond the water-cylinders, substantially as described.

In testimony whereof I have hereunto set my hand in the presence of two subscribing witnesses.

CHAS. C. WORTHINGTON.

Witnesses:

CHAS. A. HAGUE,
H. G. H. TARR.