(No Model.) 2 Sheets—Sheet 1.

A. V. SANFORD.

LOW PRESSURE ENGINE.

No. 346,502. Patented Aug. 3, 1886.

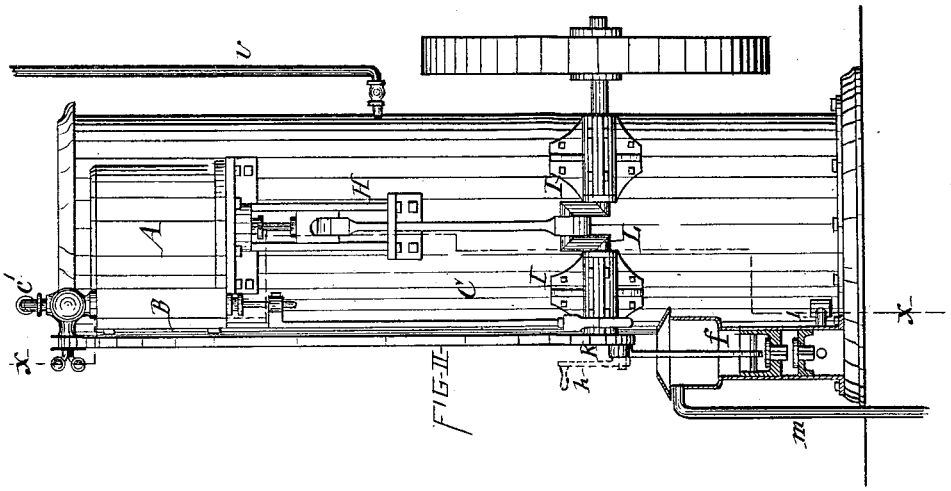

FIG. II.

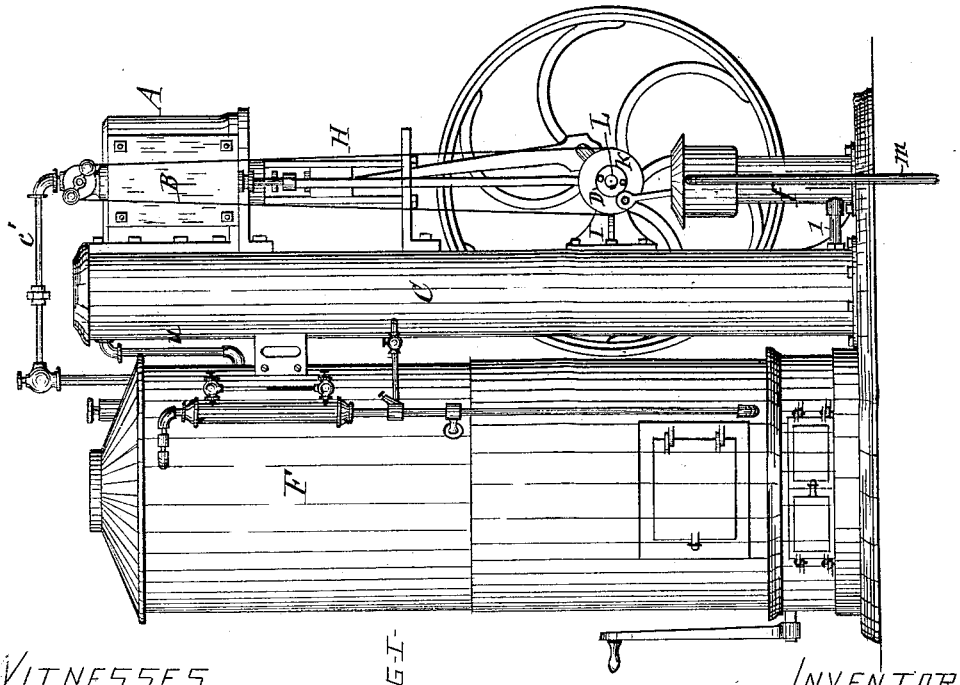

FIG. I.

WITNESSES

C. Bendixon

A. F. Walz

INVENTOR

Addison V. Sanford

per Dodd, Laass & Dodd

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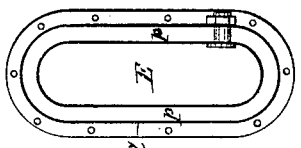

FIG. IV.

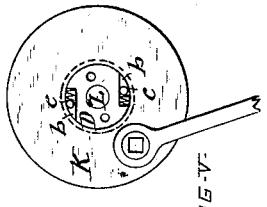

FIG. V.

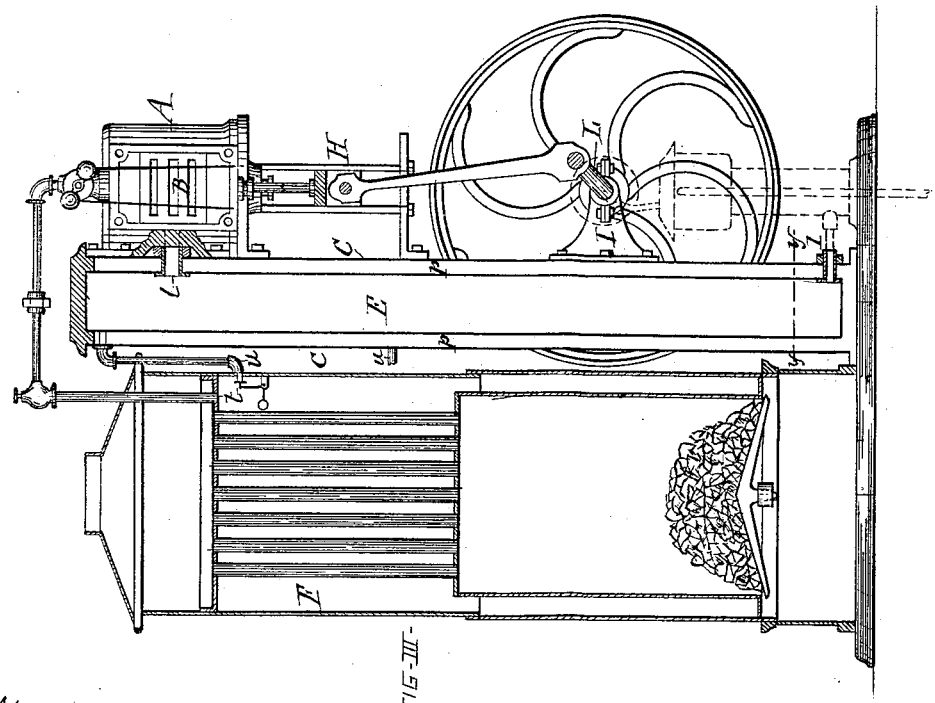

FIG. III.

WITNESSES

C. Bendixon

A. F. Walz

INVENTOR

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per Dull, Laass & Hay

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UNITED STATES PATENT OFFICE.

ADDISON V. SANFORD, OF ELMIRA, NEW YORK, ASSIGNOR TO THE CRONK HANGER COMPANY, OF SAME PLACE.

LOW-PRESSURE ENGINE.

SPECIFICATION forming part of Letters Patent No. 346,502, dated August 3, 1886.

Application filed January 18, 1886. Serial No. 188,855. (No model.)

To all whom it may concern:

Be it known that I, ADDISON V. SANFORD, of Elmira, in the county of Chemung, in the State of New York, have invented new and useful Improvements in Low-Pressure Engines, of which the following, taken in connection with the accompanying drawings, is a full, clear, and exact description.

This invention relates to the class of low-pressure steam-engines in which the exhaust-steam from the cylinder enters a condenser, to which latter is connected a pump, by means of which the air and water are drawn from the condenser, and thus creates a vacuum in the same and in the exhaust portion of the cylinder; and the invention consists in the improved construction and combination of parts, as hereinafter fully explained, and specifically set forth in the claims.

In the annexed drawings, Figures I and II are respectively front and side elevations of a low-pressure engine embodying my invention, with the pump shown in section in one of said figures to illustrate the construction of said pump. Fig. III is a vertical transverse section of the condenser, taken on line *x x* in Fig. II, showing its connection with the steam-cylinder, feed-water pipe, boiler, and exhaust-pump. Fig. IV is a horizontal transverse section of the condenser on line *y y*, Fig. III; and Fig. V is an enlarged detail view of the clutch-connection of the pump-operating crank with the driving-shaft.

Similar letters of reference indicate corresponding parts.

F represents the steam-boiler, which may be of any suitable and well-known construction.

A denotes the steam-cylinder of the engine, and B the steam-chest, in which is arranged the valve which controls the flow of live steam to and exhaust-steam from the cylinder.

C′ represents the steam-pipe which conducts the steam from the boiler to the steam-chest.

In order to render the apparatus compact, and at the same time isolate the cylinder A, and, in fact, the entire engine, from the boiler F sufficiently to protect the former from the heat radiating from the boiler, I attach the cylinder A, cross-head guides H, and driving-shaft pillow-blocks I to the exterior of the jacket C of the condenser E. Said condenser is isolated from the boiler and supported in an upright position independently of the boiler. The aforesaid jacket C completely surrounds the vertical sides of the condenser, with a water-tight space, *p*, between them. The upper end of the condenser communicates with the exhaust-port of the cylinder by a tube, I, extending through the shells of the condenser and its jacket, and secured thereto with air-tight joints, as shown in Fig. III of the drawings, so as to insure the passage of the exhaust-steam to the interior of the condenser. The space *p* around the condenser is charged with cold water, which is admitted thereto by gravity from an elevated tank or reservoir (not shown in the drawings) through a pipe, *v*, tapping the jacket C. This water is fed from the space *p* to the boiler F by another pipe, *u*, extending from the upper part of the jacket C to the boiler, in which latter the influx of water is regulated automatically by a suitable float-valve, *t*, which rises and falls with the water in the boiler, and is thereby caused to close and open the inlet of water. Said feed-water absorbs the heat from the condenser, and while promoting the condensation of the exhaust-steam in said condenser, it at the same time has its temperature raised before it enters the boiler, and thus facilitates its vaporization or conversion into steam.

f represents the pump by means of which the water of condensation and air are drawn out of the condenser. Said pump I prefer to place vertically under the end of the driving-shaft L, which latter is journaled horizontally in the pillow-blocks I I, secured to the condenser-jacket C, as hereinbefore stated.

The pump-barrel is provided internally with the usual valve, beneath which the pump communicates with the condenser E by a pipe, *l*. Above the upper valve the pump-barrel is provided with an overflow or waste pipe, *m*, which carries the water off to a suitable place of deposit.

Heretofore the piston-rod of the pump has been connected with a crank which was rigidly attached to the driving-shaft L, and consequently the pump could not be operated without setting the engine in motion; and inasmuch as it is essential to the operation of the engine to form a vacuum in the condenser

and its connection with the cylinder, it is exceedingly difficult to start the engine when the crank of the piston-rod of the pump is rigidly connected to the driving-shaft, as aforesaid. To obviate this defect, I mount on the driving-shaft a suitable clutch, of any ordinary and well-known construction, adapted to engage and release the driving-shaft, and connect the pump piston-rod with a crank-pin on said clutch. By loosening the said clutch on the driving-shaft, and connecting to the clutch a hand-crank by which to turn it, I am enabled to operate the pump independently of the engine, and thus produce the requisite vacuum in the condenser before starting the engine. The construction of said clutch is susceptible of many modifications, and I therefore do not limit myself in this respect. However, the style of clutch which I prefer to employ is illustrated in Fig. V of the drawings, and consists of a collar, D, which is rigidly attached to the driving-shaft, and is provided with recesses or ways *b b*, which are sunken in the periphery of said collar, and are deep at one end and intersect at their opposite end the periphery of the collar at an acute angle, and are thus wedge-shaped. Upon the collar D is mounted loosely a wheel, K, and in the recesses *b b* are placed rollers *c c*, which are retained therein by a plate secured to the side of said wheel and covering the ends of the rollers. When the engine is in motion, the centrifugal force of the collar D throws the rollers *c c* from the deep end of the recesses *b b* to the shallow end of the same, and at the latter position the rollers become bound between bearings in the collar and the inner periphery of the wheel K, and thereby fasten said wheel on the collar, so as to compel the former to rotate with the latter and transmit motion to the piston-rod of the pump. By connecting the hand-crank *h* to the wheel K, and turning the same in a direction opposite that in which it is turned by the engine, the rollers *c c* are thrown out of the wedging end of the recesses *b b*, and thus the wheel K is liberated to turn on the driving-shaft, thereby allowing the pump to be operated independently of the engine and produce the requisite vacuum in the condenser before starting the engine.

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

1. The combination of the boiler, the upright condenser isolated from and supported erect independently of the boiler, and the engine secured to the condenser at the side farthest from the boiler and supported thereby, substantially as described and shown.

2. In a low-pressure engine, the combination, with the condenser and driving-shaft of the engine, of a pump having its suction-pipe connected with said condenser, a crank mounted loosely on the driving-shaft, the piston-rod of the pump connected with said crank, a clutch between the crank and shaft, and adapted to fasten said parts together when turned in one direction, and to release the same when turned in the opposite direction, and a hand-crank for turning the aforesaid crank independently of the shaft, all constructed and combined to permit of exhausting the condenser before starting the engine, substantially as set forth.

In testimony whereof I have hereunto signed my name and affixed my seal, in the presence of two attesting witnesses, at Elmira, in the county of Chemung, in the State of New York, this 23d day of December, 1885.

ADDISON V. SANFORD. [L. S.]

Witnesses:
WILL E. HART,
E. H. MEAD.