(No Model.) 2 Sheets—Sheet 1.

J. D. DAVIES.

PUMPING ENGINE.

No. 307,443. Patented Nov. 4, 1884.

FIG. 1.

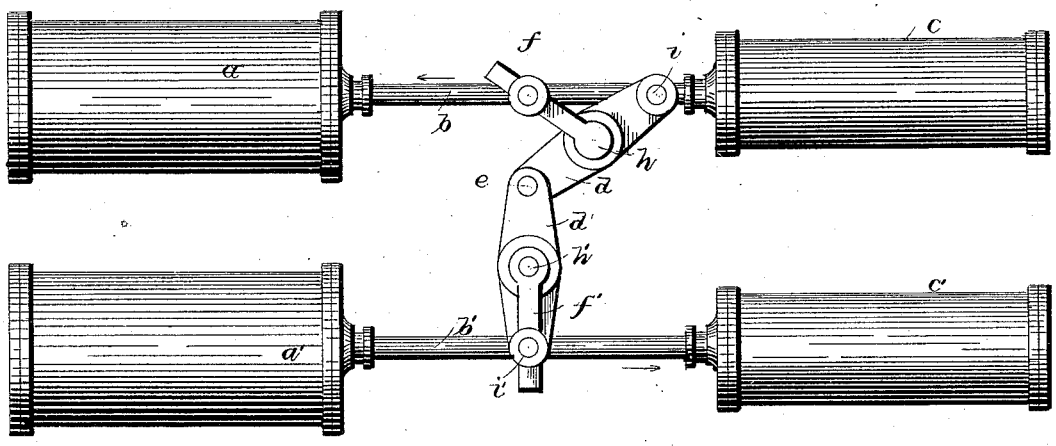


FIG. 2.

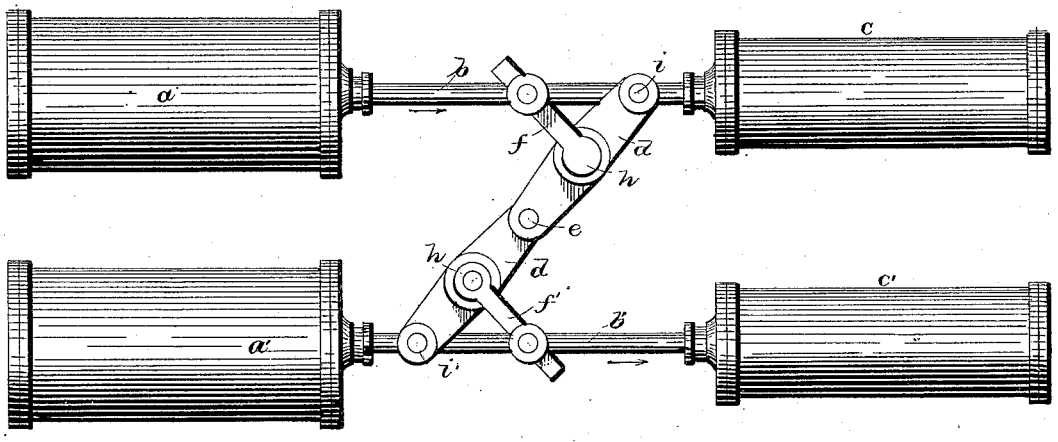
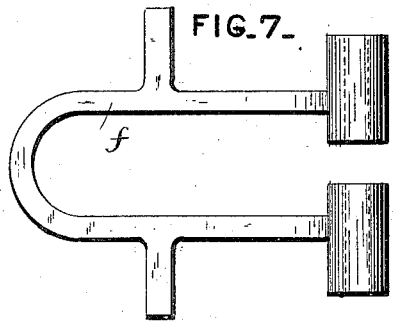


FIG. 7.



WITNESSES

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(No Model.) 2 Sheets—Sheet 2.

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PUMPING ENGINE.

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FIG. 3.

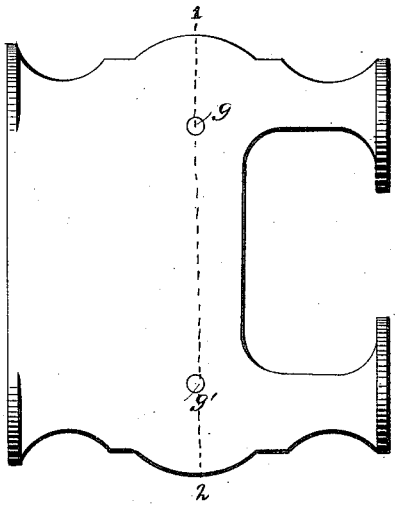


FIG. 4.

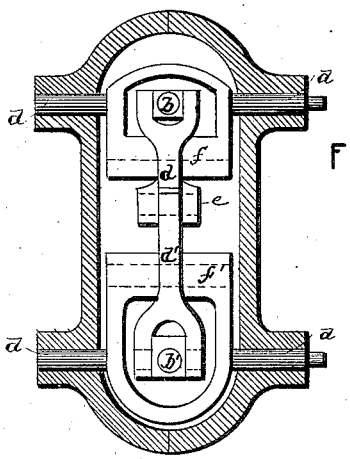


FIG. 9.

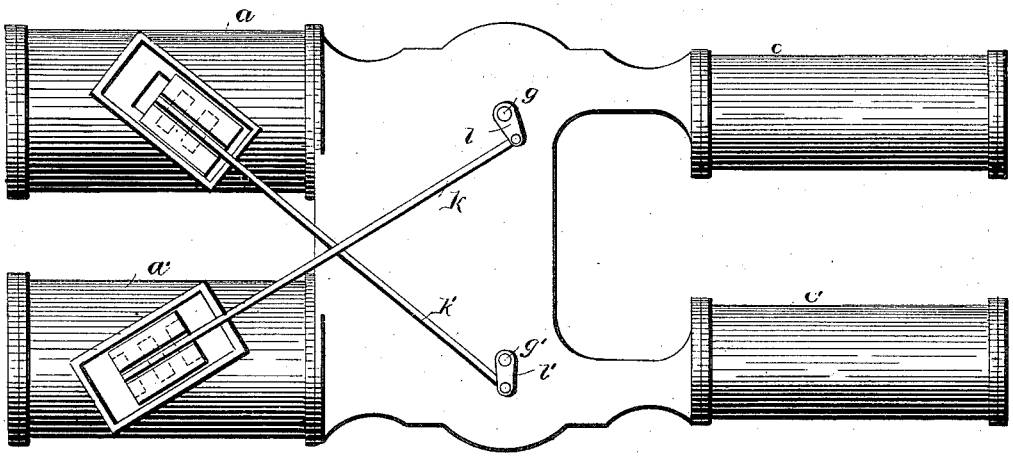


FIG. 5.

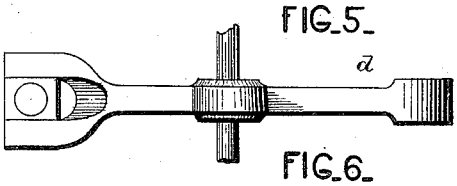


FIG. 6.

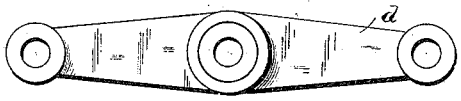
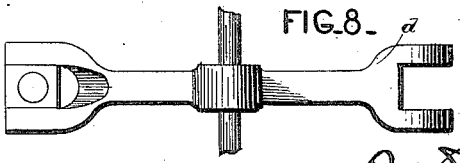


FIG. 8.



WITNESSES

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UNITED STATES PATENT OFFICE.

JOSEPH DANKS DAVIES, OF NATCHEZ, MISSISSIPPI.

PUMPING-ENGINE.

SPECIFICATION forming part of Letters Patent No. 307,443, dated November 4, 1884.

Application filed June 28, 1884. (No model.)

To all whom it may concern:

Be it known that I, JOSEPH DANKS DAVIES, of Natchez, in the county of Adams and State of Mississippi, have invented certain new and useful Improvements in Pumping-Engines; and I do hereby 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 appertains to make and use the same.

My invention relates to an improvement in pumping-engines, the object of the same being to provide a connection uniting the piston-rods of two reciprocating engines, whereby their movement relative to each other shall be positive and the length of the stroke be determined and controlled by said connection, a further object being to provide improved mechanism for controlling the movement of the valves.

With these ends in view my invention consists in certain features of construction and combinations of parts, as will be hereinafter described, and pointed out in the claims.

In the accompanying drawings, Figure 1 is a plan view of a pair of direct-acting pumping-engines with my improvement attached thereto. Fig. 2 is a similar view showing the connection in a different position. Fig. 3 is a plan view of a convenient supporting-frame. Fig. 4 is a transverse section through the line 1 2 of Fig. 3. Figs. 5, 6, 7, and 8 are detached views of parts, and Fig. 9 is a plan view showing the valves and valve-operating mechanism.

a and *a'* represent cylinders, and *b b'* piston-rods connected with the pistons in said cylinders. The opposite ends of the rods *b b'* are represented as connected with the pistons in the pumps *c c'*. Beams *d* and *d'* are journaled at one end at *i i'* to the piston-rods *b b'*, respectively, while their other ends are pivotally united by a pin, *e*. Arms *f f'* are journaled in stationary bearings *g g'* on opposite sides of each piston-rod, and have their ends pivotally secured to the beams *d* and *d'* at *h* and *h'*. The centers of the journals resting in the stationary bearings *g* and *g'* and the centers of the journals connecting the beams *d* and *d'* to the piston-rods should lie in the plane of the axis of the piston-rods *b* and *b'*, respectively. The distances from *h* to *i* and from *h* to *g* should be equal, and the arms *f* sufficiently far apart to allow the beam *d* to pass between them. The distances from *h'* to *i'* and from *h'* to *g'* should also be equal, but not necessarily be equal to the distance from *h* to *i*.

The beams *d* and *d'* may be constructed as shown in Figs. 5, 6, and 8, or in any other desired form, and the journals connecting the beams to the rods *b* and *b'* and to the arms may be formed integral with the rods and arms or with the beams, or made separately and secured to either the one or the other, as found most convenient. So, also, the journals which support the arms *f f'* may be formed integral therewith, as shown in Fig. 7, or may be set stationary in the frame and the arms swing thereon, or may be constructed in other ways, as found desirable in practice.

The valves represented in Fig. 9 are of the ordinary construction, and are operated by the rods *k k'*, connected with crank-arms *l l'*, on the ends of the journals in the stationary bearings *g g'*, the journals in this case being rigidly secured to the arms *f f'*, and caused to rock as the arms vibrate. It is necessary that the crank-arms *l l'* should have the same general direction, although the direction of both may be reversed, the direction which the arms occupy determining which shall be the leading engine.

The operation of the connection is as follows: Suppose all the joints to move freely, and suppose the distances *h* to *i*, *h* to *g*, and *h* to *e* to be equal, and the distances *h'* to *i'*, *h'* to *g'*, and *h'* to *e'* to be equal, the distance *h* to *i* may or may not be equal to the distance *h'* to *i'*, and suppose the bearings *g g'* to be located in the stationary frame A. If, now, the steam be put on to drive the piston in cylinder *a*, Fig. 1, in the direction of the arrow, it could not move when the connection occupied the position shown, on account of the arm *f'* and beam *d'* being on center with respect to the pressure of the beam *d*, and the stationary bearings *g'* now stand the force of the thrust; but the piston in cylinder *a* is now at mid-stroke, and is supposed to have steam-pressure in the direction of the arrow, and as soon as beam *d'* is moved ever so little out of line with the arm *f'* the beam *d* is free to move and will increase in force exerted upon

the pin *e* until it reaches mid-stroke, at which moment the piston in cylinder *a'* has completed its stroke in the direction of the arrow and the beam *d* and arm *f* are on center with respect to the pressure of the beam *d'*; but, as noted, the piston of cylinder *a* is now at mid-stroke, and its maximum force will be repeated as the two engines continue to move, and there will be no possible dead-point with regard to the force exerted upon the pin *e*, and said pin will be reciprocated in a line at right angles to the piston-rods, and will operate an air-pump, liquid-pump, or any machine which a reciprocating motion is adapted to operate without any cross-strain on the piston-rods.

Fig. 2 shows the position of the connection when the piston in *a* is just completing its stroke in the direction of the arrow and piston in *a'* is just beginning its stroke in direction of arrow, both pistons at this moment moving in the same direction. In Fig 9 the piston in cylinder *a* is at mid-stroke and the port *m* is open. The position of the rock-arms *f'* and beam *d'* are shown in dotted lines. The piston in cylinder *a'* being at the end of its return-stroke as the piston in cylinder *a* passes mid-stroke, the swing of arm *f* will open the port *m'*, and the piston in *a'* will now close the port *m*, and as the same passes mid-stroke will open port *n*, and the piston in cylinder *a* will begin its return. It is quite important that more or less play be allowed for the journals at *i i'* and *g g'*, as the distances *h* to *i*, *h* to *g*, and *h'* to *i'*, *h'* to *g'* are liable to become slightly unequal because of wear or from an imperfect construction. There are various ways of meeting this. For example, the journal at *i* may be allowed a limited sliding motion in a slot formed in the piston-rod *b*, or the beams may be connected to the piston-rods by short links.

The above-described connection affords all the advantages of the crank-engine working duplex or at right angles, but requires no main shaft, and is one of the most, if not the most, compact connected engine ever made for pumping purposes. If the valves be constructed to cushion, the connection will always be under compression. It also permits greater degrees of expansion than the uncoupled duplex without resorting to equalizers, and, working as a vertical engine, the reciprocating parts may be balanced by a beam, thus doubling the inertia of the reciprocating parts.

I have explained the engine as connected to drive double-acting pumps, and have described the action or movement of the engine when the bearings *g g'* of arms *f f'* are located at mid-stroke; but for different classes of work it is desirable to alter the location of the connection, as when constructed to drive single-acting pumps, &c., it is necessary to locate the bearings *g g'* of arms *f f'* at one end of the stroke, in order to make the delivery constant, or as an ordinary double-acting pump by causing the pistons to always travel in opposite directions but with varying relative velocities. The connection affords the advantage, when located at the end of the stroke, of working two double-acting steam-cylinders to drive single-acting pumps. This connection may also be attached to any reciprocating parts of the two engines that are connected with the piston or rods, as in some forms of engines it may be desirable to place the said connections in more convenient or desirable positions than between the engines and pumps.

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

1. The combination, with two reciprocating piston-rods and two sets of arms journaled in stationary bearings in the planes of the axes of the piston-rods, of beams connecting the piston-rods and arms, said beams having their approaching ends pivoted on a pin, substantially as set forth.

2. The combination, with two reciprocating piston-rods and two beams pivotally connected to each other and to the piston-rods, of arms journaled in a stationary frame and pivotally connected to the beams, whereby the pivotal point of connection of the beams is caused to reciprocate at right angles to the piston-rods, substantially as set forth.

3. The combination, with two reciprocating piston-rods and rock-arms journaled in a stationary frame and operated by beams pivotally secured to the piston-rods, arms, and each other, of cut-off valves connected with and operated by crank-arms secured to the journals by the said rock-arms, substantially as set forth.

In testimony whereof I have signed this specification in the presence of two subscribing witnesses.

JOSEPH DANKS DAVIES.

Witnesses:
H. C. GRIFFIN,
A. H. FOSTER.