4 Sheets--Sheet 1.

H. DAVEY.
Steam-Engine.

No. 167,509. Patented Sept. 7, 1875.

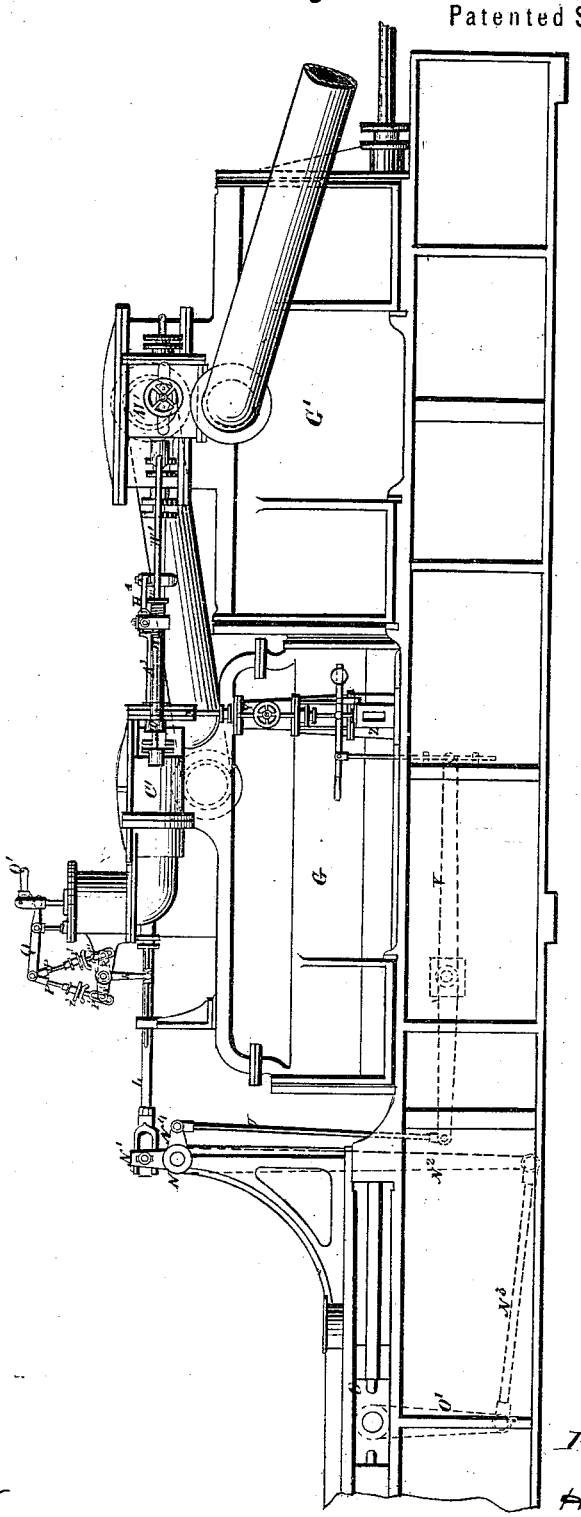

Fig 1.

Attest:
A. S. Parris
C. J. Tully 2d

Inventor:
H. Davey by
Chas. S. Whitman
attorney

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Steam-Engine.

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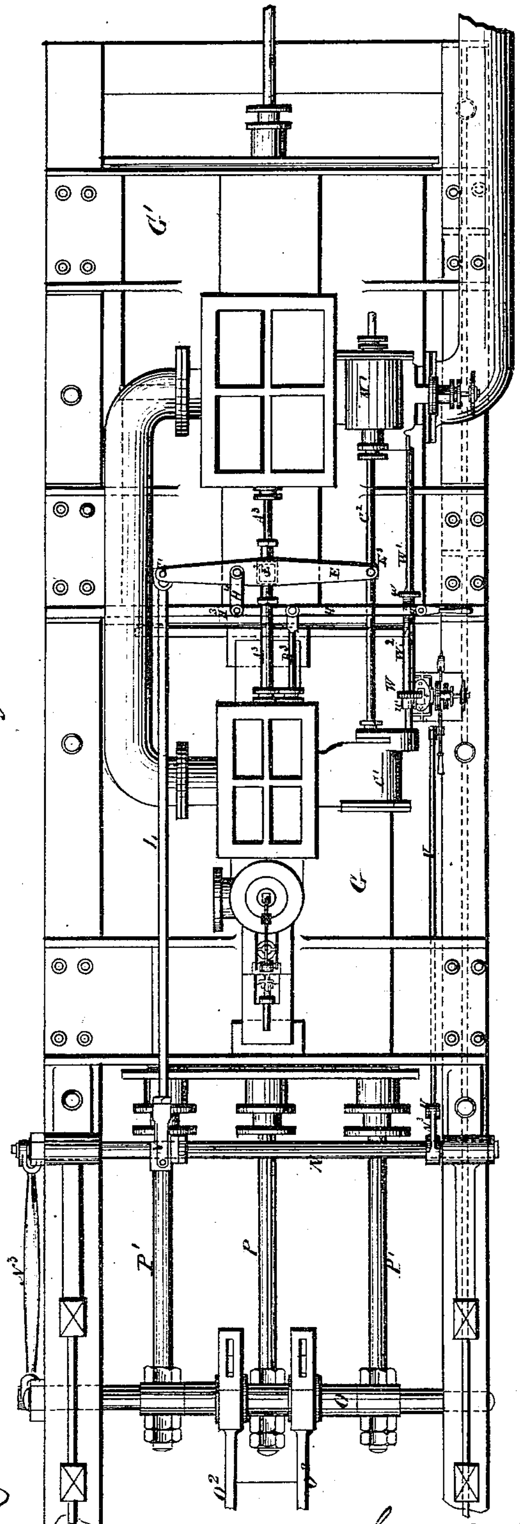
Fig. 2.



Attest:
A. K. Parris
C. J. Frelly

Inventor:
H Davey by
Chas. S. Whitman.
attorney.

4 Sheets--Sheet 3.

H. DAVEY.
Steam-Engine.

No. 167,509.

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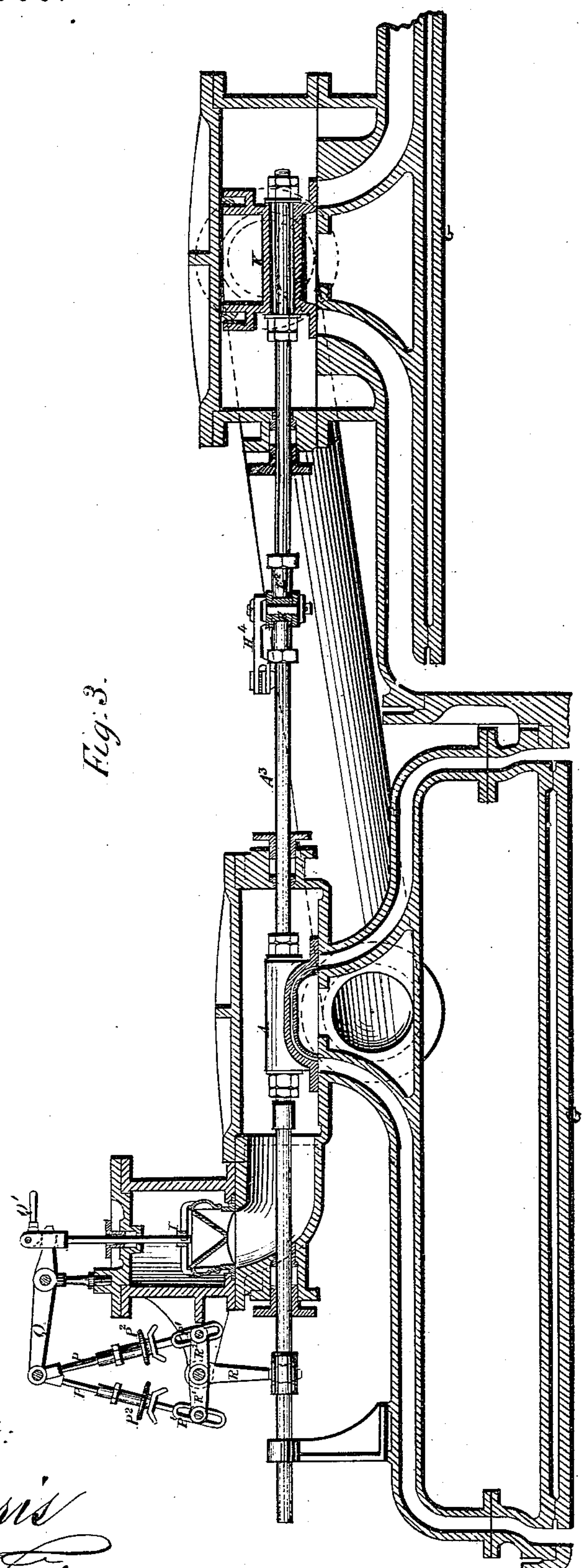

Attest:

A. K. Parris

C. F. Pretty

Inventor:

Henry Davey

by

C. S. Whitman atty

N. PETERS. PHOTO-LITHOGRAPHER, WASHINGTON, D. C.

H. DAVEY.
Steam-Engine.

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Fig. 5.

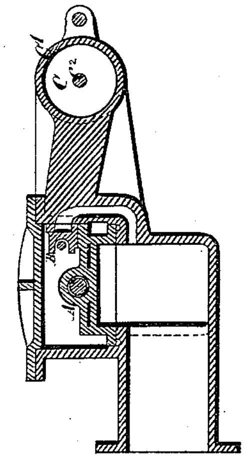


Fig. 6.

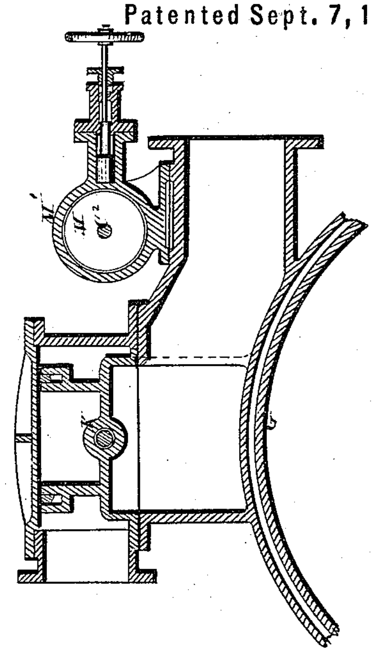
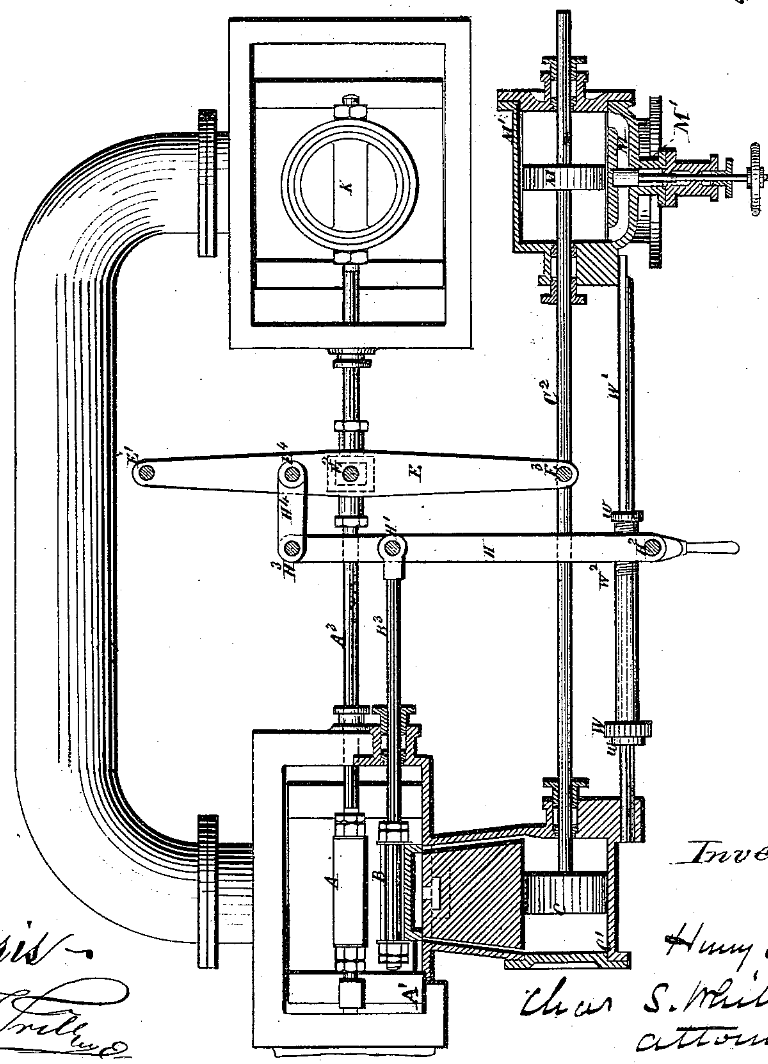


Fig. 4.



Attest:

A K Parris

C J Fritz

Inventor:

Henry Davey

Chas S. Whitman
attorney

N. PETERS, PHOTO-LITHOGRAPHER, WASHINGTON, D. C.

UNITED STATES PATENT OFFICE.

HENRY DAVEY, OF LEEDS, ENGLAND.

IMPROVEMENT IN STEAM-ENGINES.

Specification forming part of Letters Patent No. **167,509**, dated September 7, 1875; application filed August 1, 1874.

To all whom it may concern:

Be it known that I, HENRY DAVEY, of Leeds, in the county of York, England, have invented an Improved Method of Working the Slides of Steam-Engines and Water-Pressure Engines; and do hereby declare that the following description, taken in connection with the accompanying drawings, hereinafter referred to, forms a full and exact specification of the same, wherein I have set forth the nature and principles of my said improvement, by which my invention may be distinguished from others of a similar class, together with such parts as I claim and desire to secure by Letters Patent—that is to say:

This invention relates to a method of working the slides of steam or water pressure engines, without the use of eccentrics, cams, or other rotating parts, the movement of the main piston being employed to move the main slide through a part of its stroke, and also to move the slide of a subsidiary cylinder, and the rest of the stroke of the main slide being effected by the movement of the piston of the said subsidiary cylinder. The speed with which the stroke of the main slide is completed or effected is governed by a "cataract"—that is, the resistance of a liquid in a cylinder to a piston moving therein. This mode of working the slide, although peculiarly applicable to direct-acting engines, such as are employed to work pumps without connecting-rods, cranks, or fly-wheels, is applicable also to engines working rotating shafts, and either to simple or compound engines, and either in combination with or without expansion valves or slides.

In order that my improvement may be the better understood, I will refer to the accompanying drawings, and to the figures and letters marked thereon. These drawings represent several modified forms in which my invention may be carried into practical effect, the same letters being employed in the several figures to indicate corresponding parts of the apparatus.

The figures on Sheets I, II, III, and IV represent a form of the apparatus adapted to work the slides of a compound pumping-engine, having a high-pressure and a low-pressure cylinder, with means of effecting a pause at the termination of each stroke of the engine, and of working a double-beat expansion-valve for the high-pressure cylinder. In those sheets Figure 1 represents a side view, and Fig. 2 a plan of the two cylinders with the adjacent parts. Fig. 3 is a longitudinal section through the slides of the two cylinders. Fig. 4 is a plan of the two slide-levers and their connections, the subsidiary cylinder and its slide, and the cataract-cylinder, being shown in sectional plan. Fig. 5 is a transverse section through the subsidiary cylinder; and Fig. 6 is a transverse section through the cataract-cylinder. The Figs. 4 to 6, inclusive, are drawn to an enlarged scale.

The piston-rod P of the front or high-pressure cylinder G, and the two piston-rods P^1 of the hinder or low-pressure cylinder G′ are secured to one cross-head, O, connected by connecting-rods O^2 to the levers for working the pump-rods. An arm, O^1, projecting down from the cross-head O, is connected by a rod, N^3, to a long arm, N^2, of a rocking shaft, N, mounted in bearings on the framing of the engine. A short arm, N^1, on this rocking shaft is connected by a rod, L, to the end E^1 of a pair of horizontal levers, E, which have their common fulcrum at E^3 on a rod, C^2, connecting the piston C of the subsidiary cylinder C^1 with the piston M of the cataract-cylinder M^1. At E^2, about the middle of the levers E, they are jointed to the rod A^3, which connects the steam-slides A and K of the two cylinders G and G′. A pin, E^4, secured in the levers E, is connected by a link, H^4, to the end H^3 of a lever, H, having its fulcrum at H^2, which is capable of being moved by means of a worm, as will hereafter be described; but which fulcrum may be considered as being stationary during the ordinary working of the engine. The lever H is connected at H^1 to the rod B^3 of the slide B, commanding the ports of the subsidiary cylinder C^1.

It will be seen that the connections from the cross-head O to the lever E are such that the end E^1 of the latter is made to move in time with the former and with the main pistons, but always in the opposite direction, and through a considerably shorter stroke. As the pistons make their outstroke or toward the left, the lever E is caused to oscillate to-

ward the right hand. The secondary lever H is thus caused also to oscillate toward the right, drawing the slide B in the same direction, so as to uncover the left-hand port of admission to the subsidiary cylinder C^1. Steam then enters this cylinder from the jacket A^1, and, pressing on the piston C, propels it toward the right with a speed which is controlled by the resistance offered to the piston M by the liquid in the cataract-cylinder M^1. This resistance is regulated by adjusting a screw-plug, M^3, so as to interrupt more or less the passage M^2 from the one end of the cylinder M^1 to the other. The movement of the piston C, carrying the end E^3 of the lever E toward the right, causes the middle E^2 of that lever also to move toward the right, and thus the slides A and K are moved so as to admit steam to the left-hand ends of the main cylinders G and G′. The pistons of those cylinders being now propelled backward, the lever E is caused to oscillate toward the left, moving the slide B in that direction, whereby the piston C is caused to make its back-stroke, shifting the points E^3 and E^2 toward the left, and moving back the slides A and K. In order to work the high-pressure cylinder G expansively, a double-beat valve, I, in the steam supply of the jacket A^1 is worked in accord with the movement of the slide in the following manner: The slide-rod A^3, prolonged through a stuffing-box beyond the front of the slide-jacket, works a lever, R, having two arms, R^1 and R^2, which have pins working in slots P^1 of two oblique rods, P. These rods are jointed to one arm of a lever, Q, the other arm of which is jointed to the rod of the valve I. When the slide A is moved, as above described, either to the right or to the left, the pin of R^1 or of R^2, being brought to bear on the lower end of the slot P^1, in which it is engaged, draws down the rods P, and thereby causes the valve I to be raised for the admission of steam to the jacket A^1. When, however, by the retreat of the slide A, effected by the backward movement of the lever E during the stroke of the main pistons, the pin of R^1 or of R^2 is made to rise, the valve I closes and cuts off the steam supply. The length of the rods P can be adjusted by screw-handles P^2, so as to regulate the lift of the valve I. An eccentric lever, Q′, mounted on the valve-rod can be turned up by hand, so as to render the stroke of the lever Q ineffective for raising the valve I, and the valve in that case remaining closed, the engine is stopped.

Having thus described the nature of my invention, and the best means I know of carrying the same into practical effect, I claim—

1. The combination, with the main valve-rod of the lever E, one end of which is connected by intermediate mechanism with the main piston, and the other end with the piston-rod of the subsidiary cylinder, substantially as and for the purposes described.

2. The combination of the lever E, connected to the main piston, the rod C^2, piston C, valve B, lever H, link H^4, and the cataract-cylinder M^1, substantially as and for the purpose described.

In testimony whereof I have signed my name to this specification in the presence of two subscribing witnesses this 20th day of June, 1874.

HENRY DAVEY.

Witnesses:

THOS. E. CROCKER,

JONATHAN DAVEY.