(No Model.)

3 Sheets—Sheet 1.

S. H. RATHBURN.

STEAM ENGINE.

No. 495,516. Patented Apr. 18, 1893.

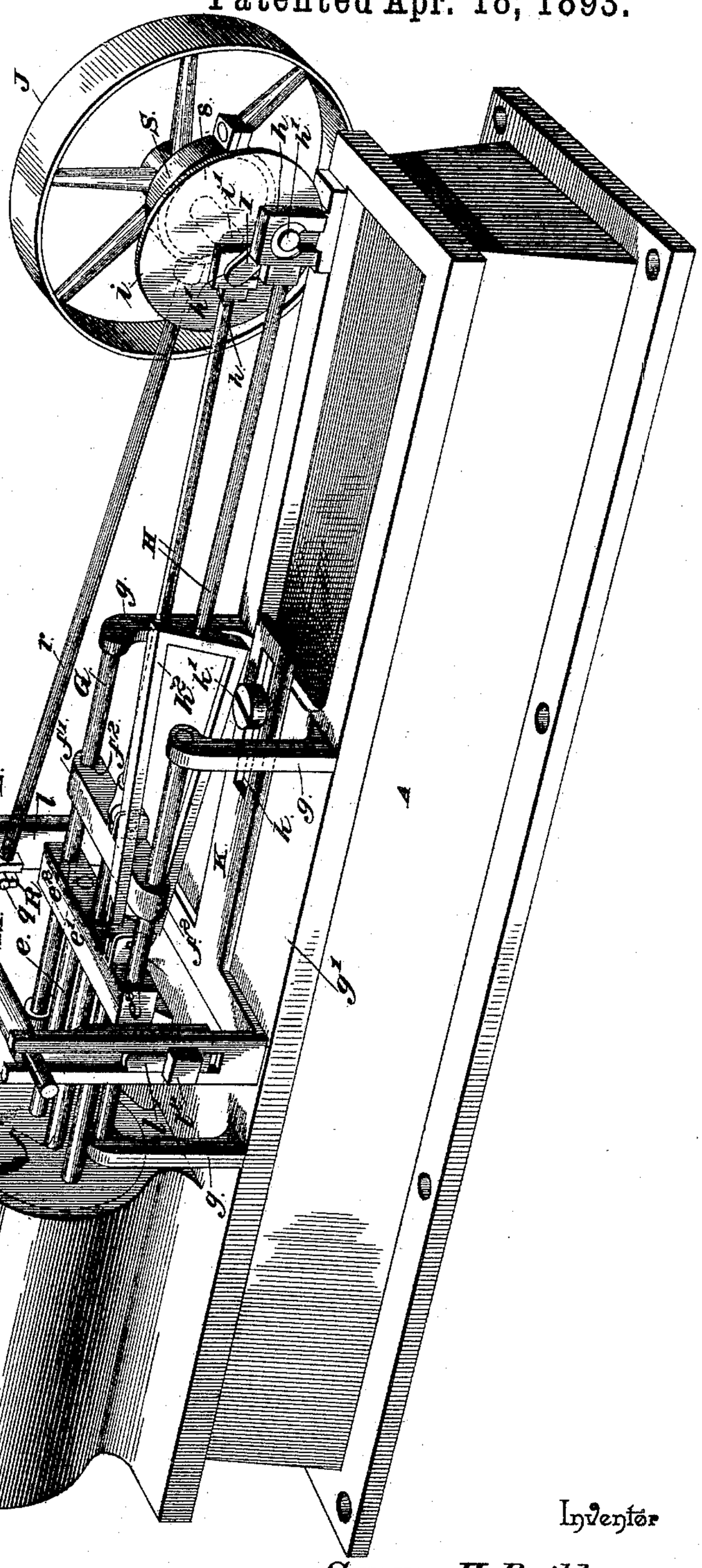

Fig. 1.

Witnesses

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(No Model.)

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Fig. 2.

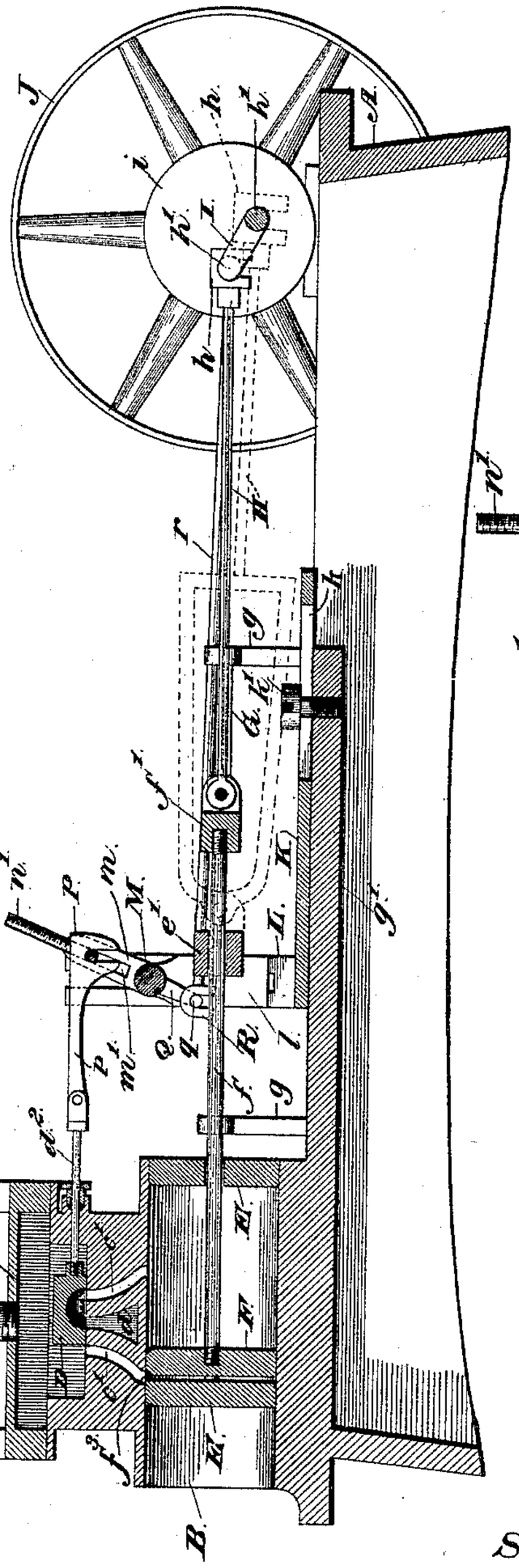
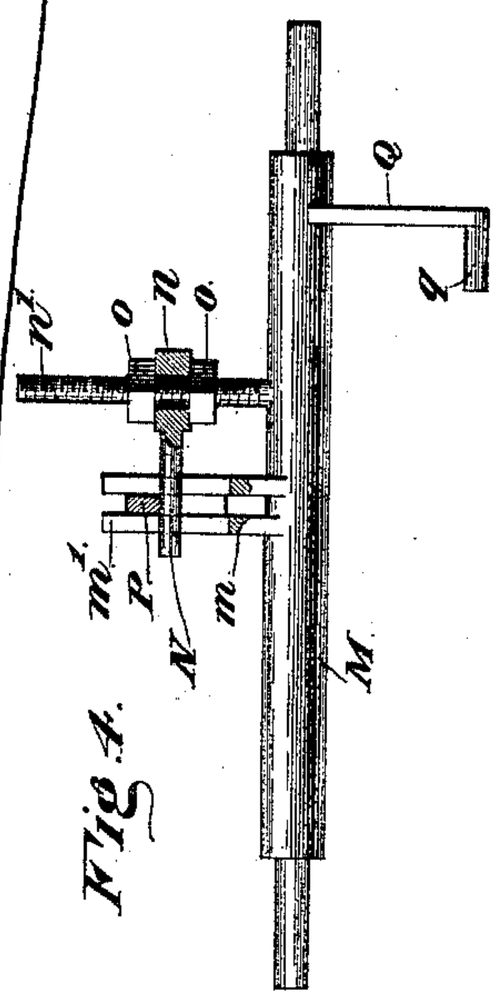


Fig. 4.



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3 Sheets—Sheet 3.

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Fig. 3.

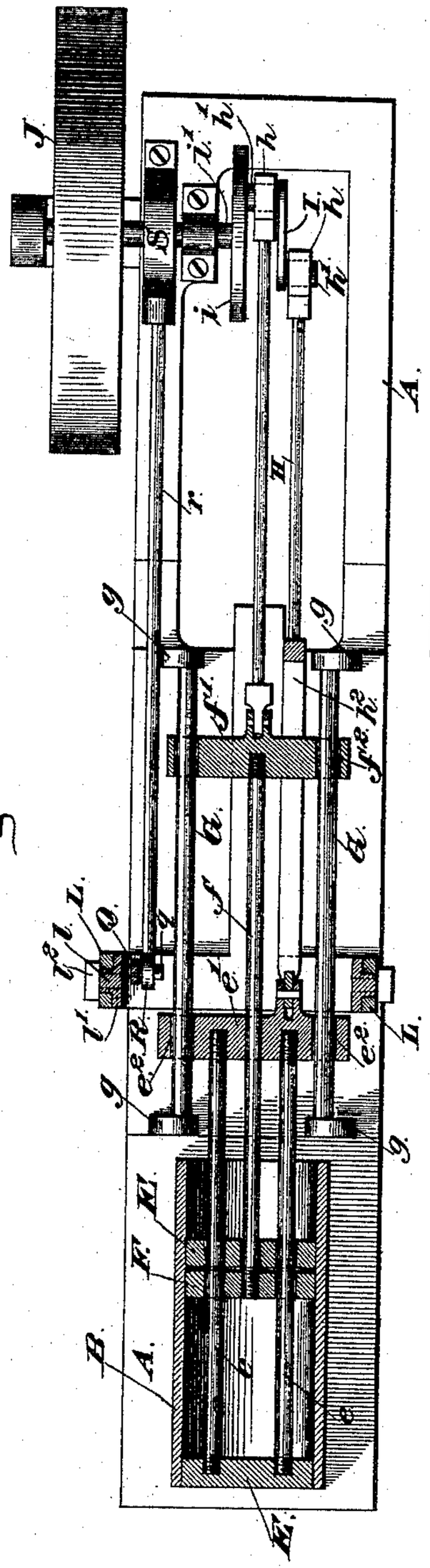
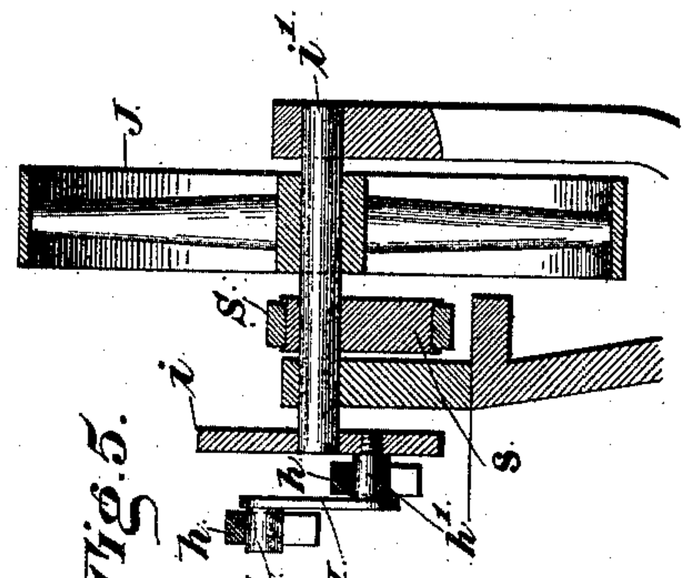


Fig. 5.



Witnesses

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UNITED STATES PATENT OFFICE.

SERENO H. RATHBURN, OF STANBERRY, MISSOURI.

STEAM-ENGINE.

SPECIFICATION forming part of Letters Patent No. 495,516, dated April 18, 1893.

Application filed May 7, 1892. Serial No. 432,181. (No model.)

To all whom it may concern:

Be it known that I, SERENO H. RATHBURN, a citizen of the United States, residing at Stanberry, in the county of Gentry and State of Missouri, have invented a new and useful Steam-Engine, of which the following is a specification.

This invention relates to steam engines; and it has for its object to provide certain improvements in direct acting engines in which the power of the steam is utilized to its fullest extent, while at the same time the many disadvantages of closed cylinders are avoided, and improved means for adjusting the valve actuating mechanism used in connection with the machine are provided.

To this end it is the main object of the invention to generally improve upon the construction and render more efficient engines of this type.

With these and many other objects in view which will readily appear as the nature of the invention is better understood, the same consists in the novel construction, combination and arrangement of parts hereinafter more fully described, illustrated and claimed.

In the accompanying drawings;—Figure 1 is a perspective view of a steam engine constructed in accordance with the present invention. Fig. 2 is a vertical longitudinal sectional view of the same. Fig. 3 is a horizontal sectional view. Fig. 4 is a detail vertical sectional view through the valve controlling rock shaft. Fig. 5 is a similar view through the drive shaft.

Referring to the accompanying drawings;—A represents a suitable bed or frame upon which are mounted the various parts of the engine.

Located at one end of the supporting bed or frame A, and rigidly secured thereto, is the steam cylinder B open at each end and having the upper valve or steam chest C, to which is connected the supply *c*, led from the boiler to conduct the steam to said steam chest. The said cylinder B is further provided with the centrally located steam ports *c'*, opening from the bottom of the steam chest C into the cylinder at a central point therein, and are designed to alternately carry the steam to and from the cylinder, one of the ports feeding live steam to the cylinder while the other port carries off the exhaust under the slide valve D, through the central exhaust *d* and out through the exhaust pipe *d'*. The said slide valve D is of the ordinary construction and snugly slides within the valve chamber or steam chest over the steam and exhaust ports, and is carried upon one end of the valve stem d^2, projecting beyond one end of the open cylinder and through said steam chest, the same being reciprocated to open one steam port for live steam and connect the other port with the exhaust port alternately as already noted.

Working from the open ends of the cylinder B up to the central steam ports nearest the ends and from such points back to the open ends of the cylinder are the regularly spaced pistons E, securely connected to the parallel piston rods *e*, connected at their outer ends without the cylinder to the sliding cross head *e'*, having the opposite perforations e^2 for the purpose to be presently described. It will be seen that when one of said pistons E upon the rods *e* is within the cylinder at a point directly under one of the steam ports *c'*, the other piston upon the same rods is farthest away from the other steam port, and at one of the open ends of the cylinder, so that the said pistons, of course, move in the same direction, while only one at a time is under the impulsion of the steam.

Sliding loosely over the parallel piston rods *e*, between the spaced pistons E, is the central auxiliary piston head F, which travels between the opposite central steam ports *c'*, and is carried upon one end of the single piston rod *f*, working through one of the pistons E and the sliding cross-head *e*, and connected at its outer end to an independent cross-head *f'*, having perforated ends f^2, and working in front of the main cross-head *e'*. Now it will be observed that when one of the regularly spaced pistons E has reached its inner limit of travel and is next to or directly under the nearest steam port *c'*, the auxiliary piston F is also adjacent to and directly under the same steam port, so that as the live steam passes through said port, the same passes between the auxiliary piston and said spaced piston and quickly forces the same apart, throwing the auxiliary piston to the other steam port and the spaced piston to the open end of the

cylinder. This motion draws the single piston rod *f* into the cylinder and forces the parallel piston rods *e* out of the same, thereby moving the other piston, which is exhausting, in to and under the exhausting steam port to which the auxiliary piston has been driven. The positions of the spaced pistons have now become reversed, and the slide valve turns the steam in between the auxiliary piston and the other spaced piston, which forces the same apart and drives the auxiliary piston back to the same port from which the operation just described commenced, and the same operation is repeated. The top edges of the auxiliary piston F are beveled as at f^3, so that when the spaced pistons E come closely adjacent thereto, the steam from the port directly over the meeting or closely adjacent pistons, easily passes between the same to force them apart to secure the movement described, which is simultaneously driving the spaced piston rods and the single piston rods in opposite directions and under the same pressure of steam. The sliding cross-heads *e'* and *f'*, slide over the horizontal parallel guide rods G, arranged parallel to each other adjacent to one end of the cylinder and having their ends secured in the upper ends of the opposite inwardly curved bracket arms *g*. The said opposite bracket arms *g* rise from opposite sides of the bracket plate *g'*, secured upon the bed A, adjacent to the cylinder B.

To each of the sliding cross heads *e'*, and *f'*, are pivotally connected the driving pitmen H, arranged side by side with each other, and provided at their outer ends with the slotted wrist heads *h*, which engage the inner and outer crank pins *h'*, of the double crank arm I, connected to one face or side of the driving crank wheel *i*. The said crank wheel *i*, is securely mounted upon one end of the horizontal drive shaft *i'*, mounted in suitable boxes supported above the bed of the machine, and carrying the drive wheel J from which motion is communicated to the machinery driven by the engine. The pitman H connected to the main cross-head *e'* working over the parallel guide rods back of the cross head *f'*, is provided with a slotted end or yoke h^2, which embraces the cross head *f'* and works over the same so that the reciprocations of the pitmen will not interfere with each other and thereby dispensing with two pitmen, which would otherwise have to be employed to connect the cross-heads to the cranks. The said pitmen can thus work side by side and in opposite directions to drive the crank wheel in the same direction and thus transmit motion to the drive shaft of the engine.

Mounted upon the bracket plate *g'*, is the T-shaped supporting plate K. The said T-shaped supporting plate is provided in the tail thereof with the longitudinally disposed slot *k*, through which passes the binding screw *k'* which provides for conveniently attaching said plate in its proper position near to the adjacent cylinder and valve chamber. Arising from opposite ends of the head of said supporting plate on opposite sides of the guide rods G, are the integral vertical slotted bearing arms L, which receive the sliding bearing blocks *l*, working in said slotted arms and vertically adjustable therein. The said sliding bearing blocks *l*, are provided with threaded perforations *l'* which receive the adjusting screws l^2, working therethrough and against the outer sides of said bearing arms, so as to provide means for adjusting said bearing blocks to a proper position. The said bearing blocks *l* form bearings or journals for the ends of the horizontal valve rock shaft M. The said rock shaft M is provided with the upwardly extending valve arm *m*, provided with the vertical cross slots *m'*, one of which receives the vertically adjustable connecting pin N, projecting from the adjustable block *n*, working over the threaded pin *n'* projecting from said rock shaft, adjacent to said valve arm, and said sliding block is vertically adjustable on said threaded pin by means of the adjusting nuts O, working above and below said block on said threaded pin, so as to adjust the connecting and supporting pin N up and down within the cross slotted valve arm *m*. The said supporting pinM loosely receives the slotted head P of the connecting hook *p*, the other end of which is pivotally connected to the outer end of the valve stem d^2, so as to communicate motion to the slide valve D as the rock shaft is oscillated by the engine. It can be readily seen that the connecting hook having a slotted head can be readily disconnected from the pin M, while at the same time it can be accurately adjusted to regulate the movement or stroke of the valve and thus provide for every necessary adjustment thereof. The said rock shaft M is further provided near one side thereof with a downwardly projecting rock arm Q, having an inwardly projecting connecting pin *q*. The said connecting pin *q* receives the connecting hook R, at one end of the operating rod or pitman *r*, the other end of which is connected with the eccentric sleeve S, working over and operated by the eccentric *s*, secured upon and carried by the main drive shaft *i'*. As the drive shaft revolves, the eccentric communicates a short reciprocatory movement to the operating or connecting rod *r* and thereby rocks the rock shaft M. Motion is in turn communicated to the connecting hook *p* which reciprocates the slide valve D, which valve controls the admission and exhaust of the steam between the auxiliary and spaced pistons within the cylinder, the operation of which has been previously described and noted.

From the construction described it will be readily seen that an increased power is given to the main drive shaft from the driving pitmen. The said driving pitmen reciprocate in opposite directions under the same pressure of steam from the oppositely moving pistons in the cylinder, and thereby drive the double

crank simultaneously to impart a steady motion to the revolving drive shaft.

The construction, operation and many advantages of the herein described engine are now thought to be apparent without further description.

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

1. In an engine, the combination with the open cylinder the independent pistons working therein the steam chest, and the slide valve; of the main drive shaft carrying a crank wheel provided with a double crank arm at one side, parallel guide rods supported adjacent to one end of the cylinder, the oppositely moving piston rods having adjacent cross heads sliding upon said guide rods, and two adjacent pitmen each loosely connected to said sliding cross heads and provided with slotted wrist heads engaging the inner and outer pins of said double crank arm, one of said pitmen being provided with an inner slotted end or yoke embracing and working over the adjacent oppositely moving cross head, substantially as set forth.

2. The combination with the cylinder steam chest and the slide valve operating therein, said valve having the stem projecting out of the steam chest; a T-shaped supporting plate arranged adjacent to the cylinder and having integral bearing arms carrying bearing boxes, a rock shaft having its ends journaled in said bearing boxes, a vertically adjustable connecting and supporting pin arranged on top of said rock shaft, a connecting hook pivotally connected at one end to the projecting end of the valve stem and adapted to detachably embrace said adjustable pin, and suitable operating mechanism, substantially as set forth.

3. The combination with the cylinder steam chest and the slide valve working therein, of a T-shaped supporting plate located adjacent to said steam chest, and having integral vertically disposed bearing arms, bearing blocks mounted in said bearing arms, a rock shaft journaled in said bearing blocks and provided with a slotted valve arm, a vertically adjustable connecting and supporting pin adapted to be adjusted in said slotted arm, a connecting hook connected to said pin and the slide valve, and means for rocking said shaft, substantially as set forth.

4. In an engine, the combination with the cylinder the steam chest and the slide valve working therein; of an adjacent rock shaft provided with an upwardly extending valve arm having crossed slots and a threaded pin adjacent to said valve arm, a block vertically adjustable on said threaded pin and provided with a connecting and supporting pin working in one of the slots of said valve arm, a connecting hook working over said pin in the opposite slot of said valve arm and connected with the slide valve, the main drive shaft having an eccentric, and a connecting rod connected with said eccentric and said rock shaft, substantially as set forth.

In testimony that I claim the foregoing as my own I have hereto affixed my signature in the presence of two witnesses.

SERENO H. RATHBURN.

Witnesses:
C. A. FRISBIE,
W. A. MORRISON.