2 Sheets. Sheet. 1.

A. S. Cameron,

Direct Acting Engine.

No. 102,486. Patented May 3. 1870

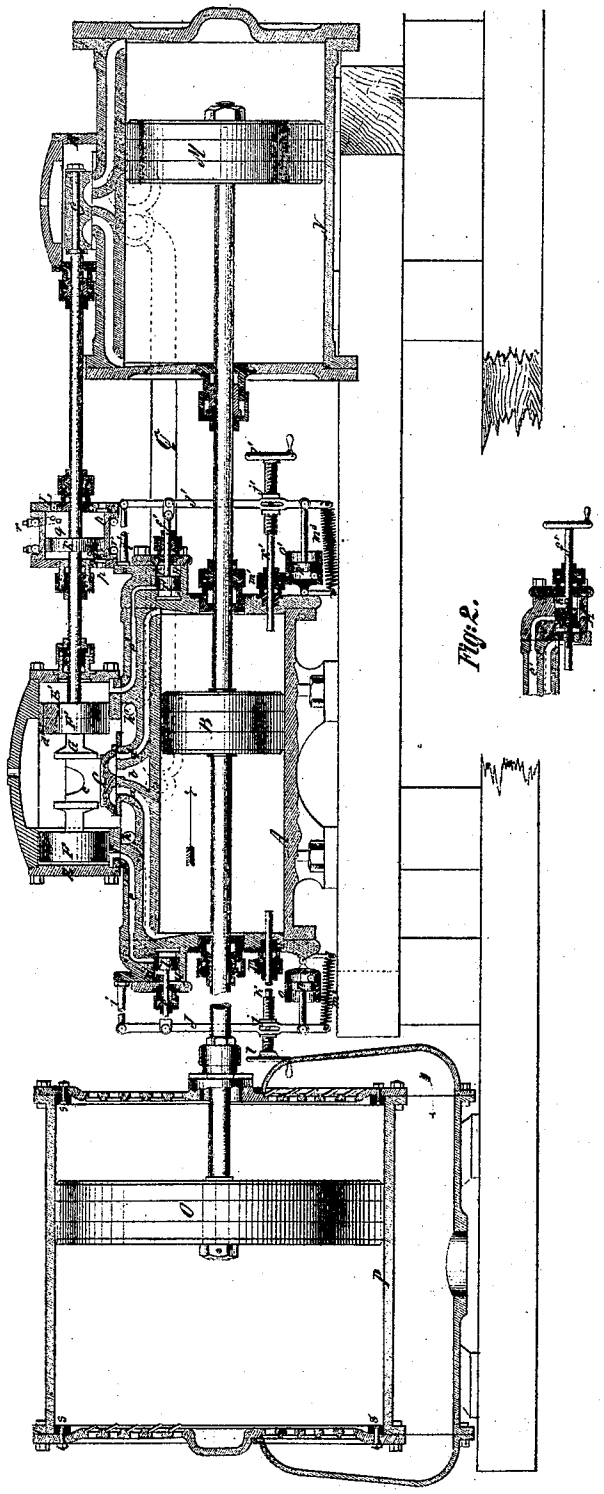

Fig. 1.

Fig. 2.

Witnesses.
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Van Santvoord & Hauff
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2. Sheets, Sheet. 2.

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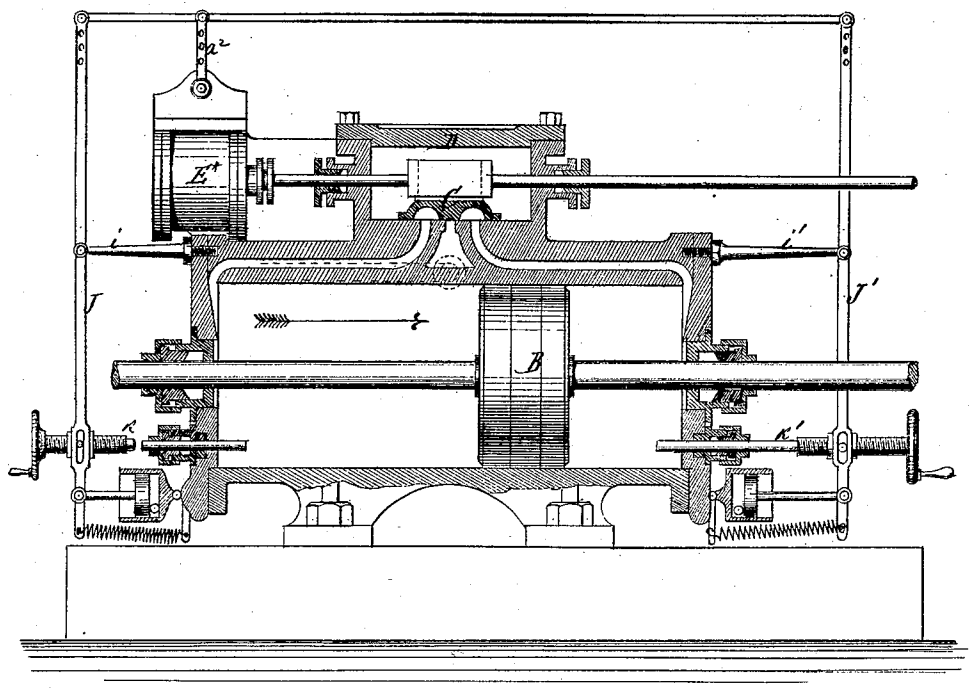
Fig: 3



Witnesses.
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United States Patent Office.

ADAM SCOTT CAMERON, OF NEW YORK, N. Y.

Letters Patent No. 102,486, *dated May* 3, 1870.

DIRECT-ACTING ENGINE.

The Schedule referred to in these Letters Patent and making part of the same.

To all whom it may concern:

Be it known that I, ADAM SCOTT CAMERON, of the city, county, and State of New York, have invented a new and useful Improvement in Direct-Acting Engines; and I do hereby declare the following to be a full, clear, and exact description thereof, which will enable those skilled in the art to make and use the same, reference being had to the accompanying drawing forming part of this specification, in which drawing—

Figure 1 represents a longitudinal central section of this invention, as applied to a direct-acting blowing-engine.

Figure 2 is a detached section of one of the piston-valves, with an adjustable stem.

Figure 3 shows a modification of my compensating mechanism, as applied to an auxiliary cylinder, which is detached from the the steam-chest of the main cylinder.

Similar letters indicate corresponding parts.

This invention consists in a compensating mechanism composed of a hinged lever and tappet-rod, either the lever or tappet-rod being made adjustable, in combination with an auxiliary cylinder or cylinders, in which the steam is changed by the action of the main piston on said tappet-rod or rods, the piston of the auxiliary cylinder serving to change the slide-valve of the main cylinder in such a manner that, by means of said compensating mechanism, the valve-motion can be adapted to the speed at which the main piston moves, and the slamming of the piston against the cylinder-head can be prevented when the engine moves rapidly, or waste of steam can be avoided when the engine moves slowly, said compensating mechanism being, by preference, so constructed that it can be set while the engine is in motion.

The invention consists, further, in the arrangement of springs, weights, or additional supplementary cylinders, in combination with the levers connected to the piston-valves or secondary slide-valve or slide-valves, for the purpose of closing said valves as soon as the same are relieved from the action of the main piston.

The invention consists, also, in the arrangement of air-cushions in combination with the levers connected to the piston-valves or secondary slide-valve or slide-valves, so as to ease said valves to their faces, or prevent them from slamming.

The invention consists, further, in the arrangement of an air-cushion cylinder, to be controlled by suitable stop-cocks or valves, in combination with the supplementary piston or pistons controlling the motion of the main slide-valve of the steam-cylinder, in such a manner that said slide-valve can be moved at any desired velocity without slamming.

The invention consists, further, in the arrangement of elastic cushions on the inner surfaces of the heads of the blowing-cylinder, in such a manner that, in case of an accidental derangement of the working parts of the steam-cylinder, the piston, or plunger of the blowing-cylinder, is prevented from slamming against its heads.

In the drawing—

The letter A designates an ordinary steam-cylinder, provided with a piston, B.

Steam is admitted to this cylinder through ports *a a'*, and it exhausts through the port *b*, and these ports are opened and closed by the action of the slide-valve C, which is of the ordinary construction, and which may be so arranged that it admits steam under the valve, as shown in the drawing, or which may be constructed in any other suitable manner.

The slide-valve is seated on the bottom of the steam-chest D, the ends of which form small cylinders, E E', bored out to receive small pistons, F F', which are connected to each other by a rod, G, and this rod is provided with two collars to straddle a standard, *c*, which rises from the back of the valve.

Small channels, *d d'*, passing through the pistons F F', form a communication between the interior of the steam-chest and the outer ends of the auxiliary cylinders E E', so that said small pistons are exposed to a uniform pressure from all sides.

The auxiliary cylinders E E' communicate through channels *e e'* with chambers H H', which are formed in the cylinder-heads or in projections cast to said cylinder-heads, or to the ends of the steam-chest, or to any other convenient part of the cylinder or chest. These chambers are bored out to receive the piston-valves I I', and they communicate, by means of channels *h h*, with the interior of the steam-chest D, said channels being so situated that the outer ends or heads of the piston-valves I I' are continually exposed to the pressure of the steam which fills the valve-chest, and by the action of the steam, which may be assisted by other forces, as will be presently explained. Said piston-valves are forced up against their seats, and held in such a position that they close the channels *e e'* leading from the chambers H H' to the auxiliary cylinders E E', as shown in the drawing.

The area of the transverse section of these channels is much larger than that of the channels *d d'* passing through the pistons F F', so that, when one of the channels *e* or *e'* is opened, the steam from the appropriate auxiliary cylinder E or E' rushes out more rapidly than it can be supplied through the channels *d d'*, and, consequently, the equilibrium of the pistons F F' is disturbed, and said pistons are caused to move toward that end in which the channel *e* or *e'* has been opened. In practice, however, the channels *d d'* may be omitted, the leakage round the pistons F F' being

ufficient to restore the equilibrium in the auxiliary ylinders.

The stems *f f'* of the piston-valves I I' extend through stuffing-boxes in the outer ends of the chambers H H', nd connect to levers J J', which are hinged to stand- rds *i i'* secured in the flanges of the cylinder-heads, r in any other part of said heads or of the valve- hest.

On the levers J J' are secured the screw-thimbles *j* ', which are tapped to receive the screw-rods *k k'*, and vhich are so arranged, by pins moving in slots, or by ny other suitable means, that they can accommodate hemselves to the oscillating motion of their levers.

The screw-rods *k k'* are operated by hand-wheels, *l* ', and they extend through stuffing-boxes, *m m'*, into he interior of the steam-cylinder A.

As the piston B, moving in said cylinder, approaches either end of its stroke, it comes in contact with the inner end of the screw-rods *k k'*, and as this rod is forced back the appropriate channel *e* or *e'* is opened, the equilibrium of the auxiliary pistons F F' is disturbed, and the slide-valve is changed. The motion of the main piston is thereby reversed, and as soon as it ceases to act on the screw-rod *k* or *k'* the appropriate piston-valve I or I' is carried back to its seat by the action of the live steam passing through the channels H H', or by the action of a spring, *m* or *m'*, which acts on the lever J or J', or the springs *m m'* might be replaced by a weight suspended from a cord running over a pulley attached to the lever, or by a supplementary cylinder or piston, or by any other suitable device or mechanism capable of performing the desired object.

With the levers J J' are also connected the air-pistons *n n'*, which work in chambers or cylinders *o o'*, secured to the heads of the main cylinder, and which serve to prevent the piston-valves I I' being slammed against their seats.

By means of screw-rods *k k'* the action of the main piston, in opening the piston-valves, can be regulated according to the speed with which said main piston moves, for it is obvious that, when the engine moves rapidly, the increased momentum of the piston makes it indispensable that the same shall commence to act on the screw-rods at a considerable distance from the end of the stroke, in order to be able to arrest said piston before it strikes the cylinder-head, and the screw-rods *k k'* are in this case screwed in; but if the engine runs slow, a considerable quantity of steam would be wasted if the screw-rods *k k'* could not be screwed back or adjusted to compensate for the difference in the speed of the piston. This object may, however, be also obtained by causing the stems of the piston-valves to extend into the cylinder A, as shown in fig. 2 of the drawing, said stems being screwed through their valves and provided with hand-wheels, so that they can be screwed in or out to compensate for the difference in the speed of the engine. In this case the valves must be provided with feather-keys to prevent them from turning round with their stems.

The levers J J', instead of being connected to the piston-valves I I', might be connected to secondary slide-valves controling the ports *e e'*, or to a slide-valve controlling the supply and exhaust-ports of an auxiliary cylinder, the piston of which serves to change the main slide-valve, so that, by adjusting the screw-rods *k k'*, the valve-motion could be adapted to the speed of the main piston. Instead of arranging the rods *k k'* so that they can be screwed in or out, the fulcra of the levers J J' may be made adjustable, so that the piston-valves or the secondary slide-valve or slide-valves will be changed with more or less rapidity, according to the position of said fulcra, and without moving the rods *k k'* in or out.

When an auxiliary cylinder, E*, is used, which is detached from the valve-chest of the main cylinder, as shown in fig. 3, the levers J J' may be made to extend beyond their bearings *i i'*, their upper ends being connected to a lever, a^2, which is mounted on the stem of the auxiliary slide-valve.

By providing the levers J J' and a^2 with different holes, the position of the rods connecting said levers can be changed, and thereby the motion of the auxiliary slide-valve can be adjusted according to the speed of the main piston. In this case the screw-threads on the tappet-rods *k k'* can be dispensed with.

The rod G of the auxiliary pistons F F' extends through a stuffing-box in the end of the steam-chest, and connects with a piston, K, working in an air-cylinder, L, which is provided with induction-valves, *p*, and with escape-channels, *q*. By this piston and cylinder an air-cushion is formed, which prevents the slide-valves from slamming when the same is worked rapidly, and the force of the air-cushions is regulated according to the speed of the engine by enlarging or diminishing the area of the escape-channels *q* by means of stop-valves, *r*.

The rod of the main piston B extends through stuffing-boxes in both heads of the cylinder A, and it connects at one end with a piston, M, working in an additional large cylinder, N, and at the opposite end with the piston or plunger O, working in the blowing-cylinder P.

The area of the piston M is about twice as large as that of the main piston B, and power is imparted to said piston by the exhaust steam from the cylinder A, said exhaust steam being conducted through a pipe, Q, to the steam-chest R of the additional large cylinder N. In this steam-chest works a slide-valve, S, which is secured to a prolongation of the rod G of the auxiliary pistons F F', so that its motion is controlled by said auxiliary pistons.

By these means a direct-acting engine is obtained, in which the steam is used to the best possible advantage.

The blowing-cylinder P is provided with a series of suction and escape-valves, and to the inner surface of its heads are secured the elastic cushions *s*, composed of India rubber or other suitable elastic material, and fastened to the cylinder-heads by screw-bolts in such a manner that, in case the valve-motion of the steam-cylinder should become accidentally deranged, the piston or plunger O will be prevented from slamming against the heads of the blowing-cylinder, and injury to the working parts will be prevented.

By these means a direct-acting blowing-engine is obtained which can be operated with great economy and with a very good effect.

I am aware that a compensating mechanism has been used heretofore, as, for instance, described in the patent of W. J. Steavens for steam-pump, dated September 13, 1864, and in the rejected application of Brown for patent on valve-mechanism, refused January 1, 1857; but in these cases the compensating and valve-mechanism are actuated from the main piston-rod, while in my engine the compensating mechanism is combined with a tappet-rod, acted on by either of the pistons, whereby I am enabled to place the cylinders close together, and adjust the valve-motion at any moment, as may be required.

What I claim as new, and desire to secure by Letters Patent, is—

1. A compensating mechanism composed of a hinged lever and tappet-rod, either the lever or the tappet-rod being made adjustable, in combination with an auxiliary cylinder or cylinders, in which the steam is changed by the action of the main piston on said tappet-rod, the piston of the auxiliary cylinder serving to change the slide-valve of the main cylinder, substantially as herein set forth.

2. The combination of screw-rods with the piston-valves I I', substantially in the manner described.

3. The arrangement of a spring, m^2 or m^3, or of an

equivalent device, acting on the levers J J', which controls the valve or valves of the auxiliary cylinder or cylinders, substantially as described.

4. The air-cushions *n o*, in combination with the lever J controling the valve or valves of the auxiliary cylinder or cylinders, substantially as set forth.

5. The air-cushion cylinder L, in combination with the auxiliary piston or pistons, and with the main slide-valve C, substantially as described.

6. The elastic cushions *s* on the inner surfaces of the heads of the blowing-cylinder, substantially as described.

A. S. CAMERON.

Witnesses:
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E. F. KASTENHUBER.