(No Model.) 2 Sheets—Sheet 1.

F. McCARTHY.

SPEED AND PRESSURE REGULATOR FOR BLOWING ENGINES.

No. 385,941. Patented July 10, 1888.

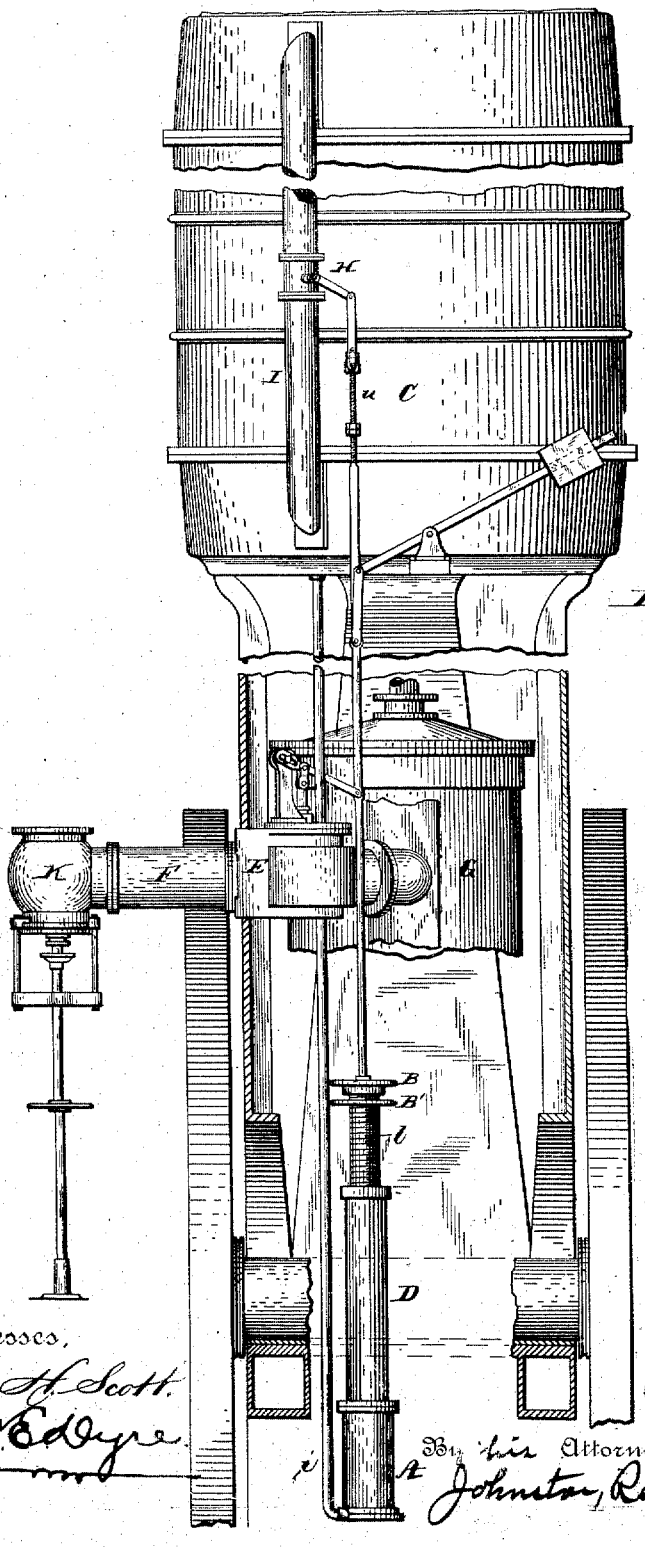

Fig. 1.

Witnesses,
Wm. H. Scott.
Wm. E. Dyer.

Inventor,
Felix Mc Carthy
By his Attorneys
Johnston, Reinohl & Dyer.

(No Model.) 2 Sheets—Sheet 2.

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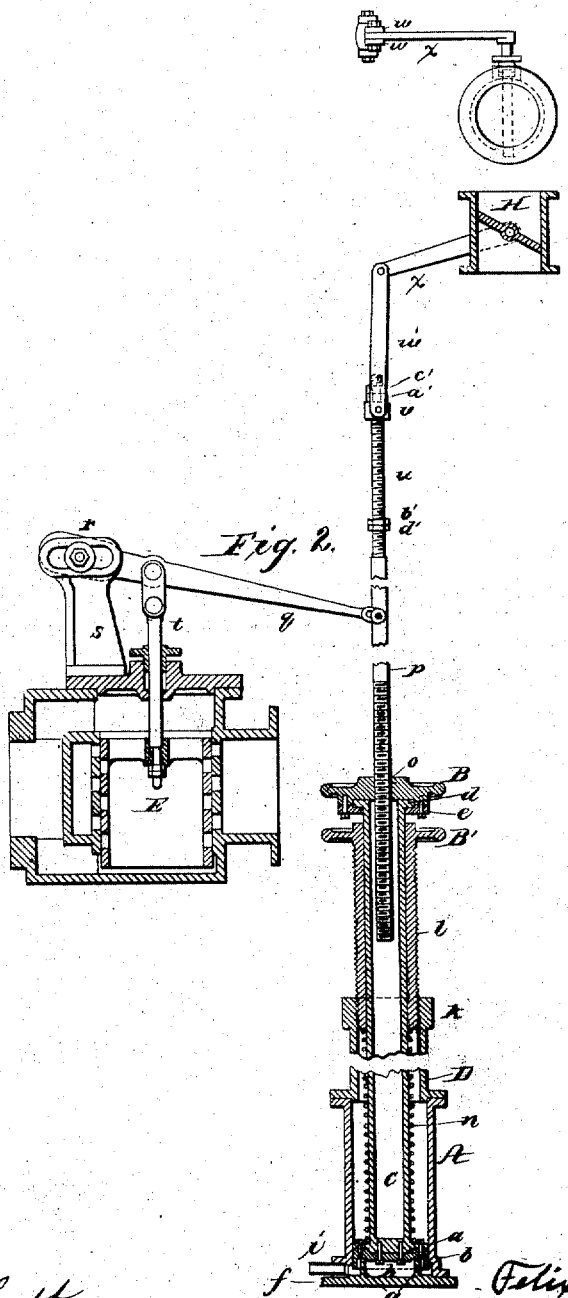

Fig. 2.

Witnesses.

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Inventor.

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UNITED STATES PATENT OFFICE.

FELIX McCARTHY, OF POTTSTOWN, ASSIGNOR OF PART TO THE WEIMER MACHINE WORKS COMPANY, OF LEBANON, AND EDGAR S. COOK AND ISAAC FEGLEY, OF POTTSTOWN, PENNSYLVANIA.

SPEED AND PRESSURE REGULATOR FOR BLOWING-ENGINES.

SPECIFICATION forming part of Letters Patent No. 385,941, dated July 10, 1888.

Application filed January 12, 1888. Serial No. 260,556. (No model.)

To all whom it may concern:

Be it known that I, FELIX MCCARTHY, a citizen of the United States, residing at Pottstown, in the county of Montgomery and State of Pennsylvania, have invented certain new and useful Improvements in Speed and Pressure Regulators for Blowing-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 means for regulating the speed and pressure of blowing-engines used for supplying air to blast-furnaces.

In the practice of operating blast-furnaces it is a matter of frequent occurrence that the blast in the furnace is subject to changes of more or less violence, caused by the slipping of the stock, which obstructs the mouth of the tuyeres or blow-pipes through which the blast is delivered from the blowing-engine into the interior of the furnace. Sliding of the stock, occasioned by "scaffolds" in the furnace giving away or yielding to the weight of the stock resting upon them, increases the density of the stock, so as to greatly augment the pressure of the blast at the tuyeres, and at times the pressure is so augmented as to stop the blowing-engine if the engineer is not at the throttle-valve to turn on more steam at the moment the back-pressure accumulates at the tuyeres. At other times the accumulated pressure is so great as to stop the engine and allow the blow-pipes to fill with liquid slag, which causes great trouble and labor as well as the waste of time to again restore the affected parts to their normal condition.

Such being the difficulties attending the operation of blast-furnaces under the present practice, my invention has for its object the construction of means to overcome said difficulties and cause the engine to deliver blast to the furnace at a uniform predetermined pressure.

The invention will be hereinafter described, and particularly pointed out in the claims.

In the accompanying drawings, which form a part of this specification, Figure 1 represents a side elevation of a Weimer blowing-engine with my invention for regulating the speed and pressure applied thereto, and Fig. 2 a detail sectional view.

Reference being had to the drawings and the letters marked thereon, A represents a fluid-pressure regulating cylinder, the interior of which is accurately bored and provided with a piston, *a*, having a cup leather packing, *b*.

The head of the piston *a* is provided with a long hollow rod, *c*, and terminates with a flange, *d*, which is secured to a hand-wheel, B, by an annular disk, *e*, bolted to the under side of the hub of said wheel. The lower end of the cylinder A is provided with a head, *f*, from the inner surface of which projects an annular rim, *g*, which forms a seat for the piston *a* when the engine is at rest, and provides a fluid-chamber, *h*, below the piston when raised from its seat for the reception of air from the blowing-cylinder *e*, which is supplied through a pipe, *i*.

To the upper end of the bored cylinder A is attached an unbored extension, D, which terminates in a thick head, *k*, screw-threaded on its interior to receive an externally-screw-threaded gland, *l*, which is provided with a hand-wheel, B', at its upper end. Around the hollow piston-rod *c* is coiled a spring, *n*, which extends from the top of the piston *a* to the head *k* of the extension D of the cylinder A, bears against the lower end of the gland *l*, and is compressed thereby, as will hereinafter more fully appear. The hand-wheel B is provided with a central aperture, *o*, which is screw-threaded to receive the screw-threaded lower end of a rod, *p*, to which is attached a lever, *q*, fulcrumed at *r* on a bracket, *s*, and connected to the rod *t* of a piston-throttle valve, E, attached to the steam-supply pipe F, leading to the steam-chest of the engine-cylinder G.

The upper end of the rod *p* is screw-threaded at *u*, and passes loosely through a yoke, *v*, to

which are attached links *w*, which are connected to the arm *x* of a butterfly-valve, H, in the pipe I, which connects the two ends of the blowing-cylinder and forms a by-pass for transferring the air compressed by the piston of said cylinder from one end to the other when the blow-pipes or tuyeres become obstructed by the slipping of the stock in the furnace and prevents the discharge of the blast into the furnace. On the screw-threaded portion of the rod *p* are nuts *a' b'*, provided with suitable jam-nuts, *c' d'*, and which nuts *a' b'* operate upon the yoke *v* to open and close the valve H as the pressure of the blast becomes excessive in the blow-pipes or tuyeres of the furnace.

K is the main steam-supply valve.

The several parts being constructed substantially as described, the operation is as follows: The engine having been started, by opening the valve K and raising the rod *p* sufficiently high, by means of the hand-wheel B, to allow steam to pass through the piston throttle-valve E, air from the blowing-cylinder C immediately enters the cylinder A of the regulator below the piston *a* through pipe *i*. It is now desired to bring the speed of the engine to a predetermined number of revolutions per minute, which is accomplished in the following manner: The air from the blowing-cylinder C, pressing upon the under side of the piston *a* in the cylinder A, moves the piston and its hollow rod *c* upward, compresses the spiral springs *n*, and, through the medium of rod *p* and the lever *q*, opens the throttle-valve E still farther. Now, by turning the hand-wheel B, which controls the length of the rod *p*, and turning the hand-wheel B', which controls the tension of the spring *n*, a medium will be obtained between the pressure of the air under the piston *a* and the tension of the spring *n* above the piston that will control the steam passing through the throttle-valve E, and give to the engine the number of revolutions desired. The main steam-supply valve K has in the meantime been opened wide. Should any slip of stock now occur in the furnace, augmenting the pressure of the blast, such increased pressure will act on the piston *a* in the cylinder A, compress the spring *n*, move the rod *p* upward, and open the throttle-valve E, until an equilibrium is restored and the speed of the engine maintained. Should the slip of the stock in the furnace have been of such violence as to augment the pressure of the blast beyond the power of the steam-cylinder of the engine, the piston *a* in the cylinder A will still farther compress the spring *n*, move the rod *p* farther upward, and open the throttle E to its full capacity; but before the valve E has been thus fully opened the nut *b'* on the rod *p* will have come in contact with the lower side of the yoke *v*, and opened the butterfly-valve H in the pipe I, and established communication between the two ends of the blowing-cylinder, thus relieving the piston of back-pressure and preventing the engine from stopping, while the full maximum pressure of the blast is maintained in the furnace, so as to prevent the cinder from backing into the blow-pipes in the tuyeres. When the excess of pressure in the furnace is relieved, the resiliency of the spring *n* will force the piston *a* down and restore the valves E and H to their normal positions. Should any air pass the piston *a* in the cylinder A, it will escape between the walls of the rod *c* and the gland *l*; but to secure a ready means of escape for it a small hole may be drilled through the upper head of the cylinder.

Having thus fully described my invention, what I claim is—

1. A pressure-regulating cylinder having a piston operated in both directions by a yielding pressure within the cylinder, in combination with an adjustable rod connected to said piston and to a relief-valve and a throttle-valve for operating them positively in both directions, substantially as described.

2. The combination, with a pressure-regulating cylinder having a piston or fluid chamber on one side and a yielding medium on the opposite side of said piston and within the cylinder, of a throttle-valve and a relief-valve connected to said piston by a rod having an adjusting mechanism at both ends, substantially as described.

3. A pressure-regulating cylinder having a fluid-chamber, a piston, and a tubular piston-rod, in combination with a spring and an adjustable gland engaging with one end of said cylinder for compressing said spring, substantially as shown and described.

4. A pressure-regulating cylinder having a fluid-chamber, a piston, and a tubular piston-rod, in combination with a spring, an adjustable gland engaging with one end of said cylinder, and an adjustable rod connected to the piston, a throttle and a relief valve, substantially as described.

5. A pressure-regulating cylinder, in combination with a throttle-valve, a relief-valve, and a rod adjusted within the hollow rod of the piston of said cylinder, extending from and connecting said piston with said valves, substantially as described.

6. A pressure-regulating cylinder, in combination with a piston, a spring resting upon the piston, an adjusting-gland, a relief-valve, a throttle-valve, and a rod provided with an adjusting mechanism at both ends connecting the piston and the valves, substantially as described.

7. A pressure-regulating cylinder having a piston provided with a tubular rod extending through one end of said cylinder, and an operating-wheel secured thereto provided with a threaded aperture, in combination with a screw-threaded rod extending into said tubular piston-rod and connected to a throttle-valve, substantially as described.

8. A pressure-regulating cylinder having

a piston provided with a tubular rod having an operating-wheel attached thereto, and a rod connected to said piston and to a valve or valves, in combination with an externally-threaded gland provided with an operating-wheel, and a spring between said piston and gland, substantially as described.

In testimony whereof I affix my signature in presence of two witnesses.

FELIX McCARTHY.

Witnesses:
ELMER E. ALTENDERFER,
J. D. BOYER.

Corrections in Letters Patent No. 385,941.

It is hereby certified that in Letters Patent No. 385,941, granted July 10, 1888, upon the application of Felix McCarthy, of Pottstown, Pennsylvania, for an improvement in "Speed and Pressure Regulators for Blowing-Engines," errors appear in the printed specification requiring the following corrections, viz: On page 2, in line 87, the comma after the word "relief-valve" should be stricken out, and in line 88, same page, a comma should be inserted after the word "throttle-valve;" and that the said Letters Patent should be read with these corrections therein that the same may conform to the record of the case in the Patent Office.

Signed, countersigned, and sealed this 17th day of July, A. D. 1888.

[SEAL.]

D. L. HAWKINS,
Assistant Secretary of the Interior.

Countersigned:

BENTON J. HALL,
Commissioner of Patents.