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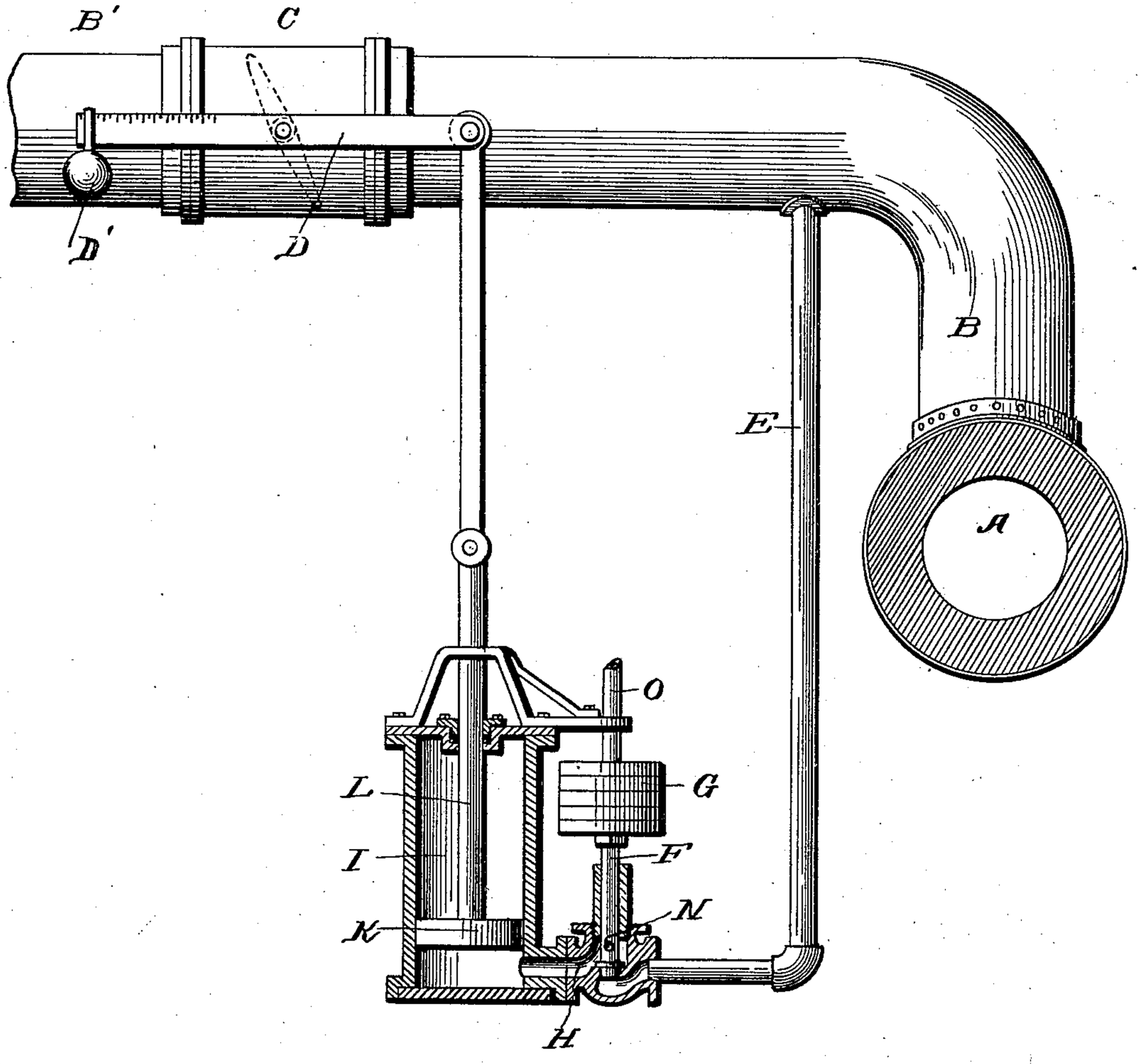
J. W. CABOT & S. W. VAUGHEN.

BLAST REGULATOR FOR FURNACES.

(Application filed Mar. 3, 1902.)

(No Model.)



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UNITED STATES PATENT OFFICE.

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BLAST-REGULATOR FOR FURNACES.

SPECIFICATION forming part of Letters Patent No. 710,247, dated September 30, 1902.

Application filed March 3, 1902. Serial No. 96,414. (No model.)

To all whom it may concern:

Be it known that we, JOHN W. CABOT, residing at Johnstown, in the county of Cambria and State of Pennsylvania, and SAMUEL W. VAUGHEN, residing at Lorain, in the county of Lorain and State of Ohio, citizens of the United States, have made a certain new and useful Invention in Blast-Regulators for Furnaces; and we declare the following to be a full, clear, and exact description of the same, such as will enable others skilled in the art to which it appertains to make and use the invention, reference being had to the accompanying drawing, and to letters of reference marked thereon, which form a part of this specification.

The drawing is a side elevation, partly in section, showing our invention as applied.

This invention relates to the automatic regulation of the blast used in the smelting of metals from their ores, and is particularly applicable in the manufacture of iron.

As is well known, pig-iron is manufactured in a blast-furnace, coke or charcoal being burned in such a furnace in admixture with iron ores and fluxes by means of a blast of hot air forced by blowing-engines through "twyers." In order that the furnace may do the best work and run most regularly, it is desired to use at all times a certain regulated quantity of blast per minute. It has been found that the furnace works best when this uniform quantity of blast goes into the furnace through the twyers and up through the mass of coke, ores, and fluxes contained therein at a uniform pressure per square inch. Each furnace has a certain back pressure at which it works best, such being caused by the resistance of this mass of materials to the passage through it of the blast. Whenever this back pressure increases abnormally, it shows that the furnace is not working right. It is desired to regulate this automatically. In practice it is done by hand, as follows: When the blowing-engines are kept going at a regular number of revolutions per minute, it is found that the resistance offered by the contents of the furnace to the passage of the blast varies according to certain conditions in the interior of the furnace, the principal one being temperature. An abnormal increase in the pressure is caused by too high temperature, and therefore when this condition exists it is customary to overcome it by reducing the temperature, which is done by reducing the temperature of the hot blast by mixing with it cold blast in the necessary proportions, and this mixing of cold blast with the hot blast has the effect of loosening up the contents of the furnace and allowing the blast to penetrate more freely, and hence reduces the resistance or back pressure. To do this, it is usual to have a valve attached to the hot-blast main and to connect the hot-blast main direct to the cold-blast pipe coming from the blowing-engines. When this valve is opened, cold air is forced into the hot-blast main and there mixes with the hot blast, and the temperature of the hot blast is thus reduced as may be desired. This valve has heretofore been worked by hand.

Our improved device is designed to operate this regulating-valve automatically by means of the back pressure of the furnace itself, so that whenever the back pressure becomes abnormally high the cold-blast-tempering valve opens automatically and cures the evil at once.

A description of our invention is as follows:

In the accompanying drawing, A is a section of the main blast-pipe, which carries the hot blast to the furnace after it has been heated by being forced through the hot-blast stoves by the blowing-engines. B is a branch of the hot-blast main, connecting the main through a cold-blast-admission valve C to the cold-blast-supply pipe B′, which comes direct from the blowing-engines and carrying cold blast at engine-pressure which has not passed through the hot-blast stoves. By means of this branch pipe the cold blast may be mixed with the hot blast in the main A by opening the valve C by means of the operating-lever D, having a suitable counterbalance at D′. A small pipe E is connected to the hot-blast branch B at some point between the valve C and the furnace, or it may also be connected at any point of the cold-blast-supply pipe between the blowing-engine and the furnace. The other end of this small pipe E

is connected to an operating mechanism for operating the blast-regulating valve C.

We do not confine ourselves to any particular form of operating mechanism, but may use any means of automatically operating the valve C. The form which we prefer, however, consists in a self-closing admission-valve F, having weights G, connected by means of the passage or port H, to an operating-cylinder I, provided with piston K and piston-rod L, passing through a stuffing-box and connecting with the operating-lever D of the cold-blast-admission valve C.

The mode of operation of the invention is as follows: Under normal conditions of blast-pressure in the furnace itself the pressure in the pipe E is not sufficient to raise the admission-valve F and no blast-pressure can get into the cylinder I. The valve C remains closed and all blast passing into the furnace through the hot-blast main A is heated to the temperature of the hot-blast stove through which it has just passed. If, however, the furnace-pressure increases above the normal, the pressure in the connecting-pipe E also increases in a like proportion. The admission-valve F is so weighted or held down that it is just balanced by the normal pressure, and when this pressure increases the valve F opens, allowing the blast to enter the operating-cylinder I to move the piston K, and thereby to open the cold-blast valve C. Cold blast will then enter the hot-blast main and mixing with the hot blast will reduce the temperature of the same as much as desired. The higher the pressure becomes in the furnace the greater the pressure in the operating-cylinder and the wider open will be the cold-blast-admission valve and the lower will be the temperature of the mixture of hot and cold blast in the blast-main. As soon as the cold blast has done its work in correcting the abnormal pressure in the furnace and this pressure falls again to the normal the pressure in pipe E and in the cylinder I also falls to the normal. The pilot-valve closes the cylinder-exhausts through the exhaust-ports N and the hollow valve-stem O, and the valve C then closes, cutting off the supply of cold blast to the blast-main, and the temperature of blast in the main returns to the normal point. It makes no difference whether the connecting-pipe E is joined to the blast system at the branch pipe B or at some other point, so long as it is attached somewhere between the blowing-engines and the furnace itself. Any increase in the blast-pressure above normal is transmitted to the operating mechanism of the tempering-valve, which is thus automatically opened and closed without attention on the part of the workman.

Having described this invention, what we claim as new, and desire to secure by Letters Patent, is—

1. In the smelting of ores with hot blast, an apparatus for automatically mixing hot blast and cold blast together, consisting of a hot-blast pipe, a cold-blast pipe, a branch pipe connecting the two, a valve situated in said branch pipe, and means for opening such valve upon increase of back pressure in the furnace, substantially as specified.

2. The combination with a blast-furnace, of a hot-blast main, a cold-blast-supply pipe, a branch pipe of said main connected to the cold-blast-supply pipe, a cold-blast-admission valve, a cylinder, the piston in said cylinder, and having an operating connection with said valve, a pipe for conveying furnace-blast pressure to said cylinder, and a balanced valve in said pipe, substantially as specified.

3. The combination with a blast-furnace, of a hot-blast main, a cold-blast-supply pipe, a branch pipe of said main connected to said cold-blast-supply pipe, a cold-blast-admission valve, a cylinder, and an operating-piston for said valve therein, and having means in connection therewith for closing the valve upon decrease of back pressure in the furnace, substantially as specified.

4. The combination with a blast-furnace, of a hot-blast main, its cold-blast-supply pipe, a branch pipe of said main connected to the cold-blast-supply pipe, a pivoted cold-blast valve, a lever connected to the pivot of such valve, a cylinder having a piston therein connected with said lever, a pipe for conveying the furnace-blast pressure to said cylinder, and a balanced valve in said pipe, substantially as specified.

5. The combination with a blast-furnace, of a hot-blast main, its cold-blast-supply pipe, a branch pipe of said main connected to the cold-blast-supply pipe, a cold-blast valve, a cylinder having a piston for operating said valve, a pipe for conveying furnace-blast pressure to said cylinder, and a balanced valve in said pipe having a hollow valve-stem for exhausting said cylinder, substantially as specified.

In testimony whereof we affix our signatures in presence of two witnesses.

JOHN W. CABOT.
SAMUEL W. VAUGHEN.

Witnesses:
FREDERICK W. FRAZIER,
W. MCLAIN.