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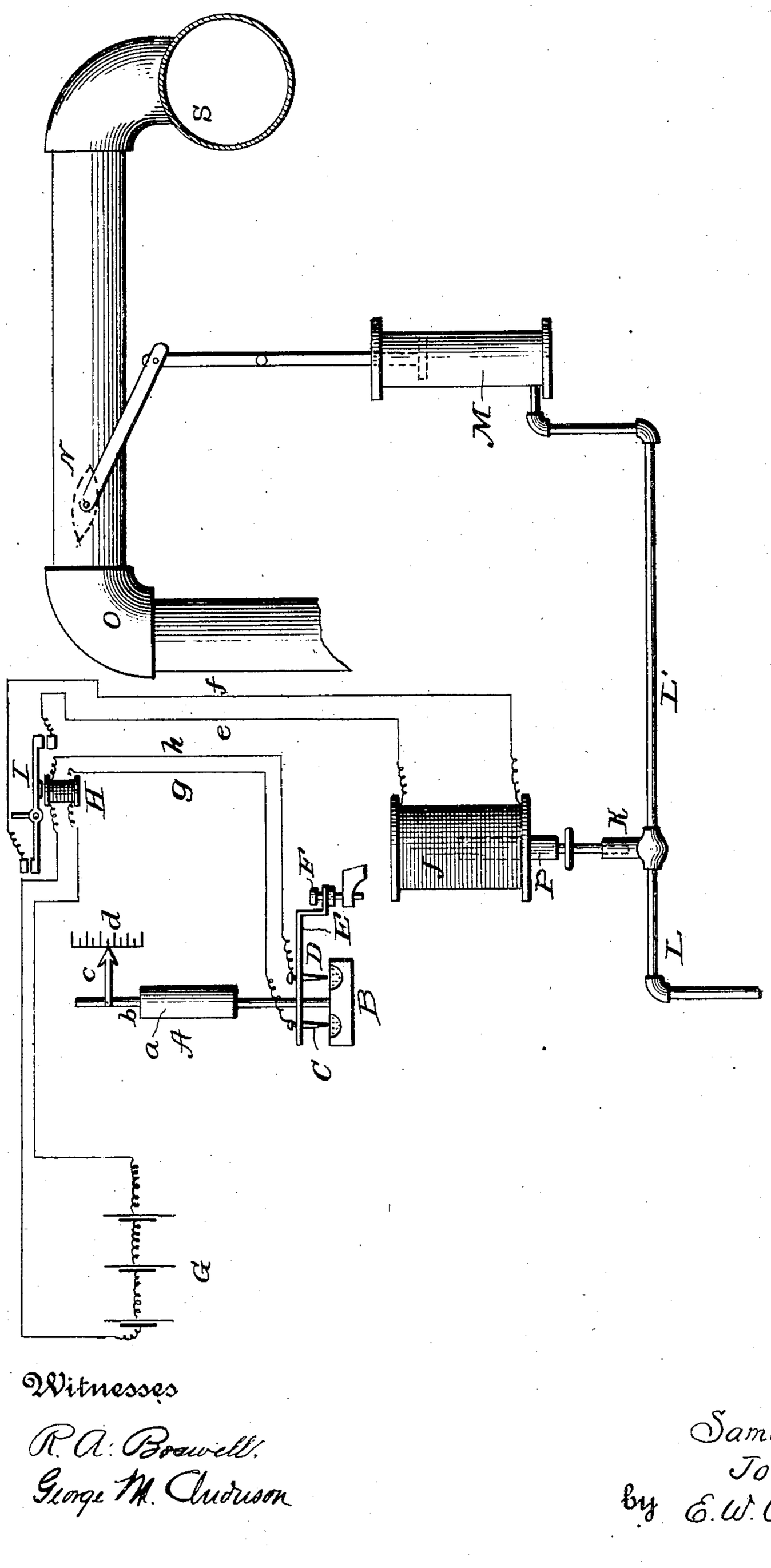
S. W. VAUGHEN & J. W. CABOT.

AUTOMATIC BLAST TEMPERATURE REGULATING VALVE.

APPLICATION FILED JAN. 10, 1903.



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UNITED STATES PATENT OFFICE.

SAMUEL W. VAUGHEN, OF LORAIN, OHIO, AND JOHN W. CABOT, OF JOHNSTOWN, PENNSYLVANIA.

AUTOMATIC BLAST-TEMPERATURE-REGULATING VALVE.

SPECIFICATION forming part of Letters Patent No. 791,958, dated June 6, 1905.

Application filed January 10, 1903. Serial No. 138,550.

To all whom it may concern:

Be it known that we, SAMUEL W. VAUGHEN, a resident of Lorain, in the county of Lorain and State of Ohio, and JOHN W. CABOT, a resident of Johnstown, in the county of Cambria and State of Pennsylvania, citizens of the United States, have made a certain new and useful Invention in Automatic Blast-Temperature-Regulating Valves; 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 forms a part of this specification.

The drawing is a diagrammatic view illustrating the operation of our valve.

In the smelting of ores in a blast-furnace it is customary to use a hot blast.

The object of our invention is to automatically regulate the temperature of such hot blast and to automatically maintain it uniformly at any desired degree of heat; and the invention consists in the novel construction and combinations of devices, as hereinafter set forth.

The production of hot blast is accomplished by blowing cold air by means of blowing-engines into and through "hot-blast stoves" previously heated by waste gases, whence it issues as hot blast. It has heretofore been found impossible to keep this hot blast at a uniform temperature, which is desirable for good working. The blast issuing from a hot-blast stove is hotter at first than after it has been passing through the stove for some time. It has been sought to overcome this by mixing cold blast direct from the blowing-engines with the hot blast during the first portion of the time and taking off the cold air during the latter part. This has been accomplished by having a cold-blast valve situated on a branch pipe leading from the engines to the hot-blast main, this valve being opened and shut by hand, as needed, according to the judgment of an attendant. Such opening and shutting is necessarily irregular and the judgment of the attendant often at fault, so that it has been found impossible to maintain the temperature of the blast as uniform as is desirable. Our improved device is designed to do this automatically and without depending on the care or judgment of the workman in charge.

In the accompanying drawing, A represents a portion of a recording-pyrometer known as a "Uehling pyrometer," in which *a* is a weight suspended by the rod *b*, carrying the indicator *c*, which travels over the scale *d*. In operation the weight *a* rises and falls, causing the index-finger to travel up and down the scale. These motions are produced by variations in the temperature of the hot blast in the hot-blast main S, to which the pyrometer is attached by means not material to our invention. When the temperature of the blast in the pipe S rises, the weight and the indicator rise, and when it falls the indicator also falls. The scale is so graduated that the readings of the indicator are in degrees of heat. We do not, however, confine ourselves to the use of this form of pyrometer, but may use any pyrometer having a movable indicator.

To the weight *a* we attach an insulated cup B, filled with mercury or any other suitable conducting material. The two needle-points C and D are suspended over the cup by a carrier E, independently supported and adjustable up and down by the adjusting-screw F. The rod connecting the cup B with the weight *a* passes freely through a hole in the carrier E. Each needle-point is connected to a pole of an electric battery G through an ordinary circuit-breaker H I, adapted to making and breaking the current in the circuit *e f*, which includes the solenoid-coil J and any source of electric current. This solenoid is provided with a soft-iron core or armature P, which is drawn up into the coil when the circuit in the wires *e f* is closed by the circuit-closer H. Attached to the armature P is the stem of the valve K. When the current is on the solenoid, the soft-iron core is drawn up into the coil, which opens the valve K. When the circuit is broken, the iron core drops down, closing the valve.

The admission-valve K connects the supply-pipe L with the pipe L′, which is connected to the operating-cylinder M. A constant supply of air-pressure is maintained in the pipe L, so that when the valve K is opened the pressure passes into the cylinder M, causing it to open the cold-blast by-pass valve N, situated in the cold-blast pipe O. This admits cold air to the hot-blast main S. If it is desired, for example, that the blast temperature in the main S shall be maintained at 1,000° uniformly, the carrier E is set by means of the adjusting-screw F so that the two needle-points C and D are nearly in contact with the mercury in the cup B when the weight *a*, from which the cup is suspended, is hanging at such a level that the indicator C points to the mark "1,000°" on the scale *d*. If now the temperature of the blast rises above 1,000°, the weight *a* rises, carrying with it the mercury-cup, and thus bringing the mercury in the cup in contact with the needle-points C and D. This closes the circuit in the wires *g h* and causes the primary current to flow through the circuit-closer H, drawing down the armature I and closing the circuit in the wires *e f* and causing the secondary current to flow through the solenoid J. This draws up the soft core P and opens the admission-valve K, allowing pressure to flow from the pipe L′ into the operating-cylinder M, which then actuates the piston, and this in turn opens the cold-blast valve N and cold blast flows into the hot-blast pipe S and mixing with it reduces the average temperature of the whole to 1,000°. As soon as this happens the pyrometer-weight *a*, which is governed by the temperature in the pipe S, falls and the mercury-cup drops down until the needle-points are just out of contact with the mercury, which breaks the secondary current in the solenoid and allows the soft core to drop down, thus shutting the admission-valve and allowing the piston in the operating-cylinder to also drop, which thus closes the cold-blast valve and shuts off the admixture of cold air with the hot blast. If the temperature of the pipe S again rises above 1,000°, the same round of operation occurs automatically. The apparatus can evidently be set to maintain the blast at any other degree of temperature up to the highest limit to which the hot stoves are capable of raising the blast.

It is not desired to confine this invention to a primary current generated by a battery, as any electric current of suitable voltage may be used.

What we claim as our invention, and desire to secure by Letters Patent, is—

1. A hot-blast apparatus for furnaces, having in combination a hot-blast stove connected to the furnace, a pipe for conducting hot air into the furnace, a valve controlling the flow of temperature-regulating air into the furnace, a motor for shifting said valve, and a pyrometer controlling the motor, substantially as specified.

2. A hot-blast apparatus for furnaces, having in combination a hot-blast stove connected to the furnace, a pipe for conducting hot air into the furnace, a valve controlling the flow of temperature-regulating air into said pipe, a motor for shifting said valve, electrically-actuated mechanism for controlling the motor, and a pyrometer controlling the electrically-actuated mechanism, substantially as specified.

3. A blast-regulating apparatus for furnaces, having in combination a hot-blast stove connected to the furnace, a pipe for admitting air into the connection between the stove and the furnace, a valve controlling the flow of air through said pipe, an electrically-controlled mechanism for shifting the valve, and means for controlling the movement of the valve-shifting mechanism, substantially as specified.

4. The combination with a blast-furnace, a cold-air pipe and its mixing-valve of a hot-blast-recording pyrometer having a movable indicator, an insulated cup containing mercury or any suitable conducting substance, in connection with such indicator, adjustable needle-points suspended over the same, wires connecting such needle-points to the poles of an electric battery through a current-breaker and means in connection with such needle-points for operating said mixing-valve, substantially as specified.

5. The combination with a blast-furnace, a cold-air pipe and its mixing-valve and an operating-cylinder therefor, of a hot-blast-recording pyrometer, its movable index-finger, and attached mercury-cup, adjustable needle-points adapted to complete an electric circuit through the mercury by coming in contact with it, wires connecting the needle-points to a circuit-breaker, a solenoid-coil attached by wire to the circuit-breaker, a soft-iron armature, and an attached valve-stem and an air-admission valve operating in connection with said valve-stem and adapted to admit air to said operating-cylinder, substantially as specified.

6. The combination with a blast-furnace, a cold-air pipe and its mixing-valve and an operating-cylinder in connection therewith of a hot-blast-recording pyrometer, its movable index-finger, and attached mercury-cup, adjustable needle-points adapted to complete an electric circuit through the mercury by coming in contact with it, wires connecting the needle-points to a circuit-breaker, a solenoid-coil attached by wire to the circuit-breaker, a soft-iron armature, and an attached valve-stem of the air-admission valve adapted to admit air to the operating-cylinder operating the cold-air-mixing valve, substantially as specified.

7. In a hot-blast apparatus, the combina-

tion with a recording-pyrometer and means for making and breaking a primary electric current connected to the circuit-breaker of a secondary current, of a solenoid, an air-admission valve provided with a stem, having a soft-iron armature, operating in such solenoid, an operating-cylinder, an air-passage from the air-admission valve to such operating-cylinder, a main cold-blast-mixing valve, and its connection to the operating-cylinder substantially as specified.

8. In a hot-blast apparatus, the combination of the recording-pyrometer A, its mercury-cup B, needle-points C, and D, and adjustable carrier E, of the battery G, the current-breaker H, the solenoid J, its armature P, and admission-valve K, the pressure-pipe L, the operating-cylinder M, the cold-blast valve N, situated in the cold-blast pipe O, and the hot-blast pipe S, in connection with such cold-blast pipe substantially as specified.

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

SAMUEL W. VAUGHEN.
JOHN W. CABOT.

Witnesses:
B. A. FORKETT,
BENJAMIN F. CAMPBELL.