

(No Model.)

2 Sheets—Sheet 1.

F. BROWN.
BLAST FURNACE.

No. 316,233.

Patented Apr. 21, 1885.

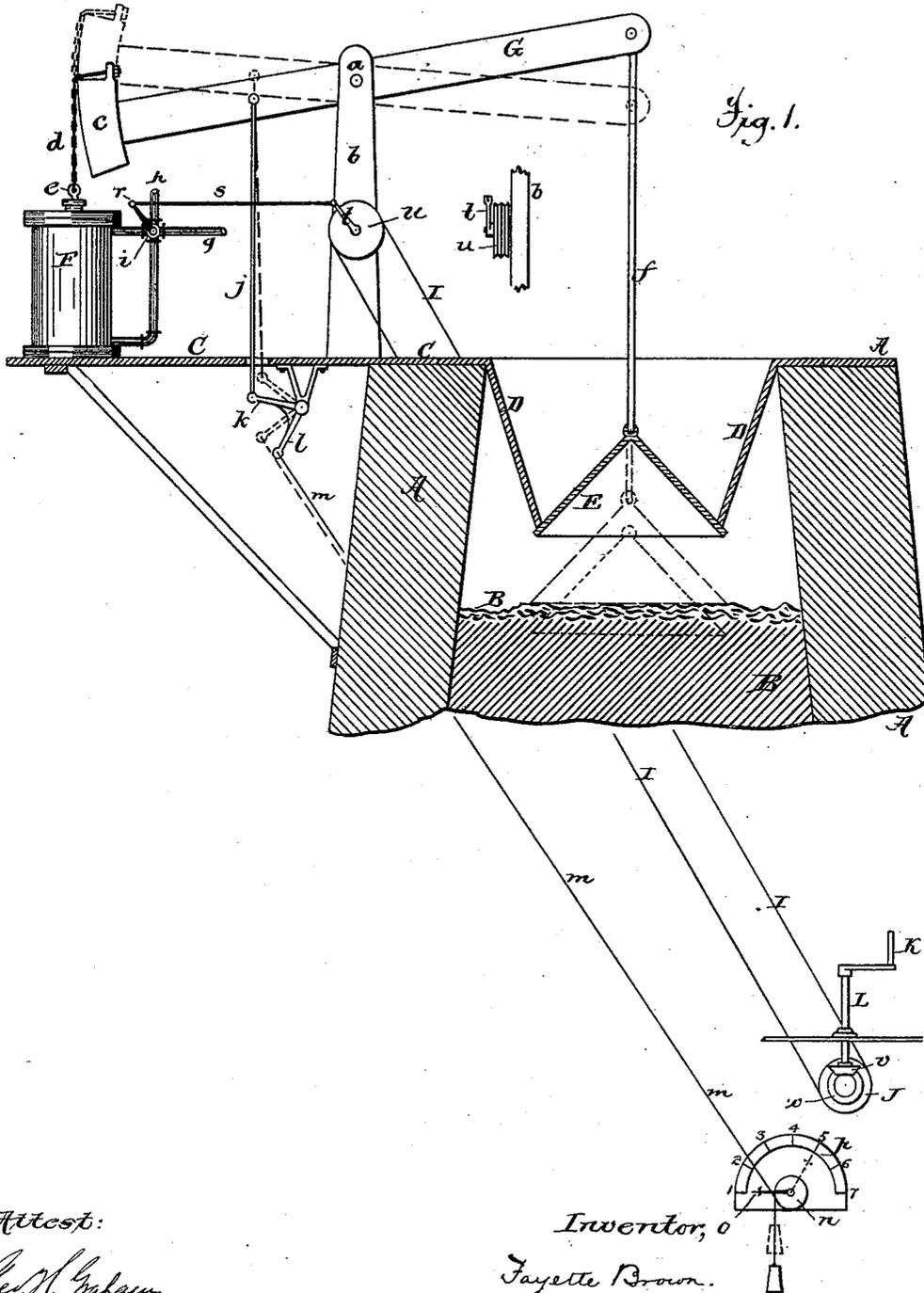


Fig. 1.

Attest:
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Atty.

UNITED STATES PATENT OFFICE.

FAYETTE BROWN, OF CLEVELAND, OHIO.

BLAST-FURNACE.

SPECIFICATION forming part of Letters Patent No. 316,233, dated April 21, 1885.

Application filed November 12, 1883. (No model.)

To all whom it may concern:

Be it known that I, FAYETTE BROWN, of Cleveland, in the county of Cuyahoga and State of Ohio, have invented certain new and useful Improvements in Blast-Furnaces; and I do hereby declare that the following is a full, clear, and exact description thereof, reference being had to the accompanying drawings, making part of this application.

My invention relates to certain new and useful improvements in blast-furnaces, and though more especially designed for use in connection with a hoisting and top-filling contrivance invented by me and made the subject of another application filed simultaneously with this, either one or all of the features of my said invention may be used in connection with blast-furnaces having any other sort of top-filling apparatus.

Previous to my present invention it has been customary to have the bell opened and closed by one or another of the operatives or hands usually employed in doing the work of filling in the ores, fuel, &c., ordinarily dumped by hand at the top opening of the furnace. This mode of manipulating the bell is more or less objectionable on account of the liability of neglect on the part of the hands working at the top of the furnace, and, furthermore, even if done properly at all times, necessitates the performance of considerable hand labor and the presence of some one close to the injurious gases and heat which escape more or less from the furnace-top during the filling operation.

I propose by my invention to avoid the necessity for hand labor at the top of the furnace for the purpose of manipulating the bell, and at the same time to place the operations completely under the control of the engineer or other trustworthy operator, who may be stationed below and in charge also of the hoisting and top-filling apparatus of the furnace.

To these ends and objects my invention consists, primarily, in the use, in combination with the lever or beam from one end of which the bell is suspended, and a compressed-air or other motor for operating said beam, of suitable mechanism within reach of and under the control of the engineer or other attendant stationed below, by means of which said attendant can at pleasure effect and control the

opening and closing of the bell, all as will be hereinafter more fully explained.

Previous to my present invention it has been customary to have the filling in of the furnace to the proper maximum extent regulated by the observation of some attendant working at the top of the furnace. It is always desirable and important that the charge in the furnace be kept up to a given standard to insure the best results; but under the heretofore-practiced method, by reason of the liability of neglect or carelessness on the part of the attendants engaged in arduous work at the top of the furnace, it has frequently occurred that the charge of the furnace has not been always kept in view and properly maintained. Ofttimes the charge, after having been brought up to the maximum point, has been allowed to become unduly reduced before replenishing with fresh supplies of ores, fuel, &c. I propose to overcome these defects in and disadvantages of the heretofore-employed modes and means in filling and keeping properly charged the furnace by placing the condition of the furnace-charge always within the knowledge of the engineer or some other competent attendant located below and far away from the labors and the unpleasant surroundings of operatives engaged at or near the top opening of the furnace; and to these ends and objects my invention consists, secondarily, in the employment, in combination with the furnace, of some sort of indicating mechanism or device located at some convenient place and operated through the medium of the bell (or some other device adapted to descend within the top opening of the furnace) which will indicate visually the height of the charge in the furnace, all as will be hereinafter more fully explained.

Heretofore the management of the gas-sealing doors has been under the control of some one of the men engaged in filling in and performing other labors at the top of the furnace. These doors should be opened and closed with a prescribed relationship to the dumping in of the charges of ore and fuel and with the opening and closing of the bell, in order that no unnecessary escape of the heat and gases shall occur; but as heretofore managed and with the means heretofore employed for opening and closing these doors it has not been

practicable to have them managed in the best manner. I propose to have the gas-sealing doors placed perfectly under the control of the engineer or some other trustworthy attendant located below; and to this end and object my invention consists, finally, in the use, in connection with the gas-sealing doors, of means by which some one at a distance and conversant at the same time with the periodical operations of the bell and the furnace-charging contrivance or devices can perfectly operate the said doors with proper relationship to the filling operations, all as will be hereinafter more fully explained.

To enable those skilled in the art to which my invention relates to understand and practice, either in whole or part, the several features of my invention, I will now proceed to more fully describe the latter, referring by letters to the accompanying drawings, forming part of this specification, and in which I have shown so much of an ordinary blast-furnace and such of the parts of the mechanism connected therewith as seem to be necessary for the purpose of illustrating the several features of my invention carried out in that form in which I have so far successfully practiced it.

In the drawings, Figure 1 is a partial vertical section of a blast-furnace with my improvements applied thereto. Fig. 2 is a side view or elevation showing only such portions of the whole contrivance as belong more particularly to the mechanism for operating the gas-sealing doors. Fig. 3 is a skeleton back view of the devices seen at Fig. 2, and Fig. 4 is a front view of the same.

In the several figures the same part will be found designated by the same letter of reference.

A is the upper part of the furnace, and B represents the top portion of the charge or filling therein. (See Fig. 1.)

At the top of the furnace is the usual top plate or platform, C, upon which is supported the machinery located at the furnace top, and from which extends down into the furnace top the usual hopper, D, the lower end of which is opened and closed by the lowering and raising of an ordinary bell, E, suspended by the rod *f*, from one end of a lever, G, fulcrumed at *a*, (in a suitable support, *b*,) and formed or provided with a segmentally-shaped weight, *c*, at its other end, from which a chain, *d*, extends downward to the piston-rod *e* of a cylinder, F, the piston of which is worked, preferably, by compressed air.

g is the supply and *h* the exhaust pipe of said cylinder, and *i* is a four-way cock, the turning of which in one way or another admits the compressed air to either side for the purpose of causing the piston to move either up or down in cylinder F, to either permit the descent of the forward end of lever G and the bell E or to raise them up, as occasion may require.

From a suitable connection at one side of the lever G, in rear of its pivotal point *a*, there extends downward a connecting-rod, *j*, which is coupled at its lower end to one of the arms, *k*, of a bell-crank, the other arm, *l*, of which is connected to the upper end of a descending cord or cable, *m*, that at its lower end is wound round upon a small pulley or wheel, *n*, which carries a pointer, *o*, that works in connection with a scale or dial, *p*, in a manner and for a purpose to be presently explained.

The cock *i* is provided with a lever, *r*, from which extends a horizontal connecting-rod, *s*, which is coupled (at its other end) to the arm *t* of a rock-shaft that carries a fast pulley, *u*, and by means of these devices an endless cable or cord, I, is made to work the said valve by the rotation in one direction or the other of a wheel or pulley, J, over which the lower end of the belt I passes, and which may be turned by the engineer or other person below, through the medium of a crank-handle, K, on the upper end of a shaft, L, which at its lower end is provided with a bevel-pinion, *v*, that engages with a bevel-wheel, *w*, fast on the shaft to which said pulley J is secured.

M M are the gas-sealing doors, which when down close and when turned upwardly open the top opening through which the ore, fuel, &c., has to be fed into the furnace. These doors are each connected (near their swinging edges) by a connecting-rod, P, (see Figs. 2 and 3,) with a stiff arm, Q, on the rock-shaft, one end of which is journaled in one of the standards S, and the other in the upper part of the bridge or truss T of an inclined railway on which runs the carrier (not shown) for carrying the ore, fuel, &c., to the furnace top opening.

The two rock-shafts R R are geared or belted together at their rearmost ends by sprocket-wheels U and an endless crossed chain, *v*, so that whenever one is turned the other must also rotate, but in an opposite direction. At the forward end of one of these shafts R is keyed fast a bevel-pinion, (seen in dotted lines at *y*, Fig. 2,) that engages with a similar pinion, Z, fast on a journal or spindle, *a*², (see Fig. 4,) mounted to turn freely in the bracket *b*², and on said spindle is made fast a pulley or chain wheel, *c*², over which passes an endless belt or chain, *d*². This belt or chain runs beneath guiding anti-friction wheels or idlers arranged, as shown, in two sets beneath the truss T, as seen at *e*² and *f*², and at its lower part said belt *d*² passes around the pulley *g*², fast on a shaft, *h*², on which shaft is also made fast a hand-wheel, *i*², by means of which the engineer or other attendant can turn the said shaft and thus rotate the pulley *g*², drive belt *d*², and operate the rock-shafts R R, for the purpose of either opening or closing the doors M M. At Figs. 2 and 3 I have shown these doors partially open in full lines and closed in dotted lines.

The hand-wheel *i*², it will be understood, is

located down below in the engineer's room, or where the attendant who manages the top filling apparatus can manipulate it.

In practicing my present invention I have arranged the whole contrivance so that the means for operating the bell, the means for operating the sealing-doors, and the means for indicating the condition of the charge in the furnace are all located close together, and where the engineer who runs the hoisting-engine can see the indicator, and can operate both the crank-handle K (for working the bell) and the hand-wheel *i*² (for opening and closing the sealing-doors.)

From the foregoing description, together with the drawings, it will be understood that the general operation of the whole contrivance shown is about as follows: The engineer who attends to the hoisting-machine turns the hand-wheel *i*², and, through the medium of the mechanism connecting said wheel with the sealing-doors M M, (as already explained,) opens said doors whenever a charge of elevated ore or fuel is to be dumped into the top opening of the furnace. After the dumping shall have been effected, he immediately closes the said doors, and then lowering the bell E by turning the crank-handle K (that is connected by the means described with the cock *i* of cylinder F) permits the dumped charge to descend into the furnace in about the usual manner. He then turns the crank-handle K in the reverse direction, thus closing up the bell.

In the operation of the bell, if it descends to the maximum or full extent of its downward movement, the pointer *o* of the indicator (see Fig. 1) will go clear round from 1 to 7, and the attendant, without knowing exactly the level or height of the charge B of the furnace, will know that it is not up to the proper level, and will see to it that supplies of ore, fuel, &c., are sent up and dumped in. When, however, the contents B reach a level such that the bell will strike and rest thereon before having descended to the full extent of its capacity, as indicated by the position of the bell E in dotted lines at Fig. 1, then the attendant will know from the fact that the pointer *o* has moved only to "5" that the furnace is nearly full, and will know about how much more material, if any, should be supplied; and thus, by attention to the indicator during periodical manipulations of the crank-handle K, the engineer or other attendant located far away from the top of the furnace can perfectly regulate the charge B in the furnace, and keep it always up to exactly the proper level or standard to produce the best results.

It will be seen that by means of the sets of devices shown and described for operating the sealing-doors and the bell, with the sources for the application of hand-power to both located in close proximity to each other and to the

indicator and to the appliances for controlling the operations of the hoisting-engine, the engineer or any one person can easily and perfectly run the whole apparatus; and it will of course be understood that in practicing my invention many changes in each of the mechanisms shown for the several purposes of working the bell, working the sealing-doors, and indicating to the eye of the attendant the exact condition of the furnace-charge may be made, and that though I have so far in the practical application of my invention used all of its novel features at the same time, and also together with an improved hoisting and top filling contrivance likewise controlled by the engineer, any one or more of the novel features or improvements which I have hereinbefore described may be used by itself with more or less advantage. I do not wish, therefore, to limit my claims of invention to either the use in one and the same furnace apparatus of all the features of improvement devised by me or to the particular details of construction shown as to any one of said features; but

Having now so fully described my invention that any one skilled in the art can make and use a furnace apparatus containing any one or all of the features thereof, in either the precise form illustrated or in some other form, what I claim as new, and desire to secure by Letters Patent, is—

1. In combination with the beam or lever from one end of which the bell is suspended, and a compressed-air or other motor for operating said beam, all located at the top of the furnace, means, substantially such as described, located at or near the base of the furnace by which, through intermediate devices, the bell raising and lowering mechanism may be controlled from below.

2. In combination with a blast-furnace, an indicator located below, preferably in the engineer's room, and intermediate mechanism for causing said indicator to register the height of the furnace-charge, substantially as set forth, whereby the engineer or other attendant stationed away from the furnace may be kept informed by visual inspection of said indicator as to the level of the charge in the furnace.

3. In combination with the gas-sealing doors and rock-shafts connected as described and located at the top of the furnace for opening and closing said doors, means, substantially such as described, located at or near the base of the furnace by which, through intermediate devices, the attendant below may control the door opening and closing mechanism.

In witness whereof I have hereunto set my hand this 3d day of November, 1883.

FAYETTE BROWN.

In presence of—

JACOB FELBEL,
M. H. SMITH.