(No Model.)

W. KENT.

BLAST FURNACE.

No. 273,742. Patented Mar. 13, 1883.

Fig. 1.

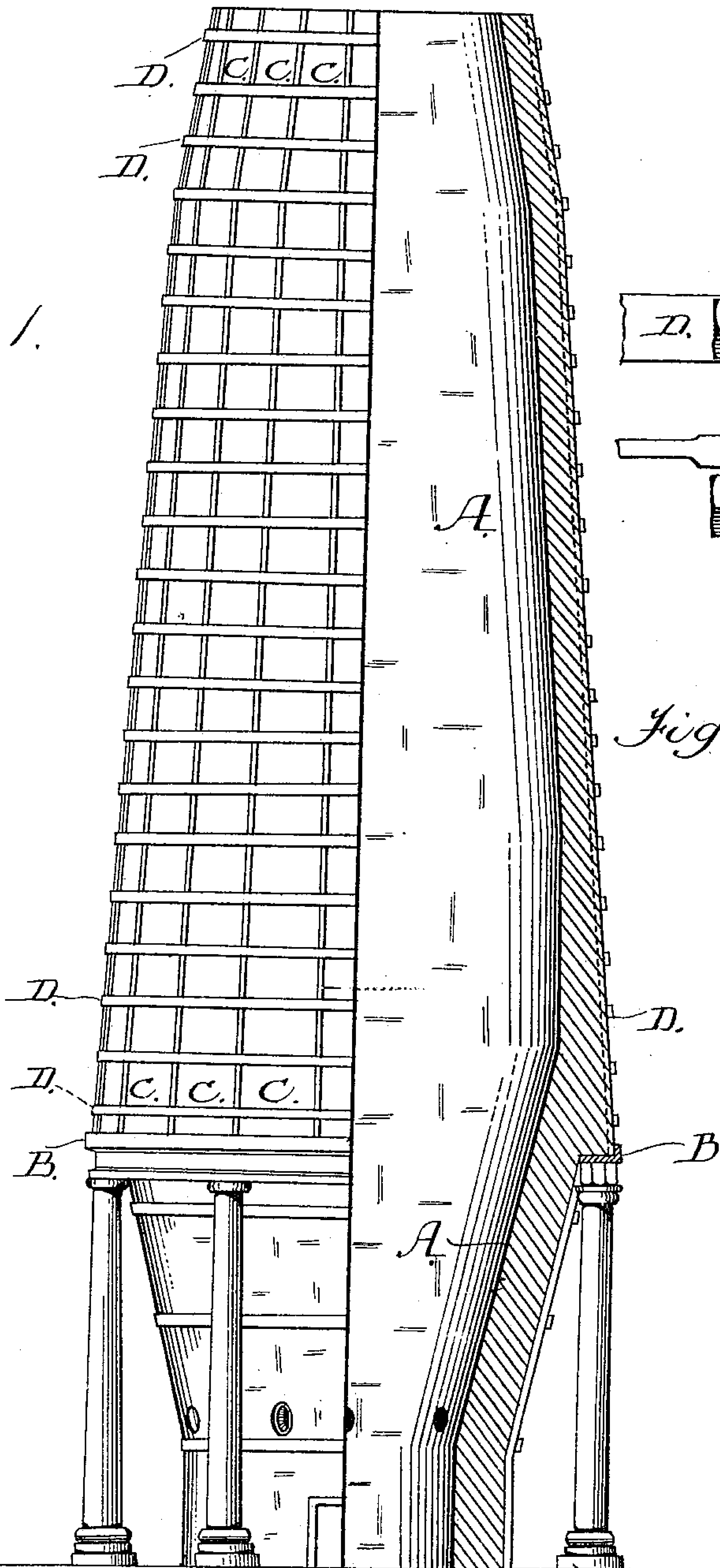


Fig. 2.

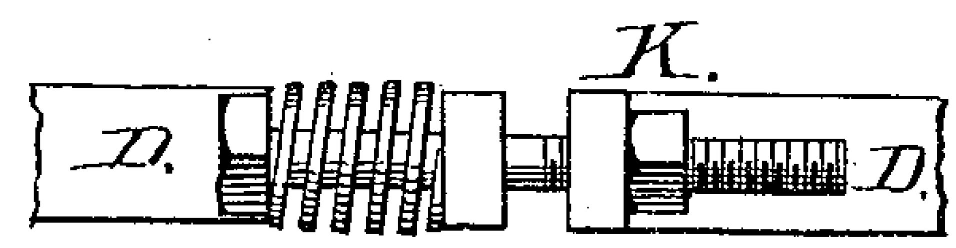


Fig. 3.

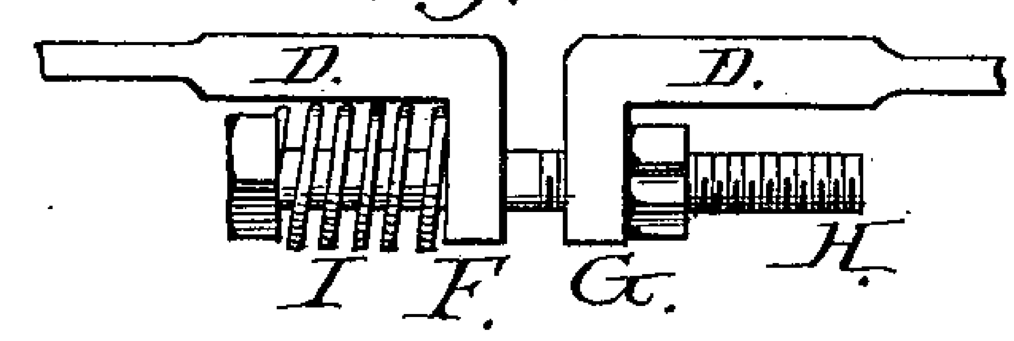
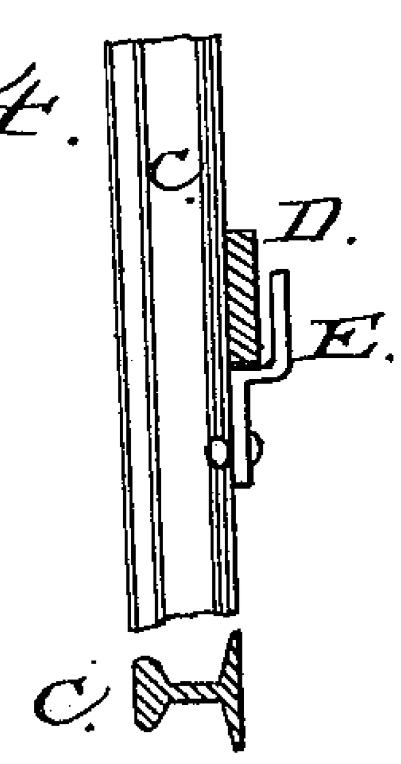


Fig. 4.



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UNITED STATES PATENT OFFICE.

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BLAST-FURNACE.

SPECIFICATION forming part of Letters Patent No. 273,742, dated March 13, 1883.

Application filed March 10, 1882. (No model.)

To all whom it may concern:

Be it known that I, WILLIAM KENT, of the city and county of Allegheny, and State of Pennsylvania, have made an invention of certain new and useful Improvements in the Construction of Blast-Furnaces Commonly Used for Smelting Iron and other Ores; and I do hereby declare that the following is a full, clear, and exact description and specification of the same in the best form in which I have embodied them at the present date.

In blast-furnaces as heretofore constructed a great difficulty has been to avoid the cracking or bursting of the wall through expansion caused by the intense and continuous heat. Efforts have been made to overcome this difficulty, first, by building two walls (usually of brick) with a space between, which space was filled with loam, ashes, or some other material supposed to be compressible; second, by building around the inner wall an outer structure of massive stone, also separated from the inner wall by a space to allow for expansion; and, third, by using, in connection with either a single or double wall, a surrounding "jacket" of plate-iron, still leaving an expansion-space either between the wall and jacket where the wall is single, or, where it is double, between the two walls, or between both walls and jacket. In practice, in all these constructions, wherever such an expansion-space has not been left (and sometimes in spite of the expansion-space) the surrounding structure has been burst or ruptured by the irresistible power of expansion.

The object of my invention is to provide a single sound and durable wall for a blast-furnace, which can be easily and cheaply built, and which will possess in itself by its construction a reliable support sufficiently elastic to meet all the necessary conditions of expansion without in the least impairing its strength or efficiency.

A single wall of the improved construction which I have invented, to the outside of which the surrounding atmosphere has free access, will not heat so rapidly or become so hot (and therefore liable to damage by melting or breaking) as the present inner wall inclosed by another wall or casing which retains the heat. My single wall is also constantly visible and easily accessible for repairs, which can be made from the outside while the furnace is in operation, while in other furnaces having inner walls invisible and inaccessible from the outside, repairs must be made from the inside, and after "blowing out" the furnace, which of course involves great expense and loss of time.

In the drawings, Figure 1 represents a blast-furnace, shown partly in front elevation and partly in section. Fig. 2 is a front view, and Fig. 3 a top view, of the connecting and elastic portion of one of the bands which encircles such furnace; and Fig. 4 shows a device for holding such bands in proper position.

The portion A of the blast-furnace stack which is above the mantel-plate B, as shown in Fig. 1, is constructed of one solid circular wall of fire-brick or other refractory material, inclosed within or bound around by a skeleton or frame-work composed of upright rails or bars C and horizontal bars or bands D. For the upright bars I prefer to use the ordinary pattern of steel railroad-bars cut to the proper length for the purpose, the flanges being placed outward, and in practice I have found it best to have the rail so built into the wall that the bottom of its flange shall be flush or even with the outside of such circular wall, although other shapes of upright bars or methods of placing them with relation to the outside of the wall will doubtless answer the purpose. For the horizontal bands, the shape of the section is not essential; but I prefer a wrought-iron or steel band about five inches in width by one inch in thickness. For the convenience of handling and erection, as well as from the fact that long lengths of such bands are not easily procured, the band may be made in two or three pieces. At least one joint of each band should be made in such a manner as to allow of free expansion and contraction within a limited range, the particular manner which I prefer being shown in Figs. 2 and 3, and which is more specifically hereinafter described. The other joints may be made rigid, and in any way which will connect the pieces of the band together and at the same time make a strong joint, although it would be better to dispense with all other than the expansion-joints.

The bands D are kept in their places—that is, kept from slipping downward on the furnace—by what I call "clip-pieces," E, Fig. 4, fastened by riveting or otherwise to the vertical bars C. As many of these clips may be used as are necessary to support the weight of each band and to keep it from sagging. Any other method of supporting the weight of the bands may be adopted at the option of the builder of the furnace; but the one described I have found both cheap and effective.

In order to secure the best results, it is necessary that the joint of the band above referred to should not only be made so as to permit a certain amount of expansion or contraction, but should also be made elastic; and the best method in which I have thus far embodied this portion of my invention is shown in Figs. 2 and 3, and is thus made. The two ends F and G of the band D are made thicker than the rest of the band—say twice as thick—preferably by having them so rolled in the rolling-mill, (which can be done on the mill patented by Andrew Kloman,) or else by welding the pieces on the ends of the band, and they are then bent at right angles, as shown in the drawings. Holes are drilled through the ends F and G, to permit the passage of a strong bolt—say two inches in diameter. The bolt has a square head at one end, and the other end is threaded for several inches in length for a nut, K. A steel spring, I, is first slipped on the bolt, and the bolt is then slipped through the holes in the ends of the bands. When the nut is screwed up it is evident that the spring will be compressed, its resistance steadily increasing until its coils touch each other, after which closure only can the whole force exerted through the wrench and the nut be applied to draw together the two ends of the band. I have found a steel spring known as a "car-buffer" spring, about six inches in length when open and four and a half inches in length when closed, and capable of sustaining a weight or pressure of ten thousand pounds before closure, entirely suitable for the purpose of my invention; but the shape of the spring, whether coil or otherwise, and the precise manner of affixing it, is of course a matter of convenience.

The furnace-stack being built and the bands D in their proper places, their inner sides touching evenly the flanges of the rails C and the outer side of the wall A, and the nuts on each bolt being screwed up to such an extent that a moderate strain shall be brought upon the spring—say a strain equal to one-fourth, or less, of its bearing capacity before closure, or sufficient to shorten the length of the spring, say, one-quarter of an inch—the bands should then be of such length that there should be some space—say two inches—between the ends F and G, as shown in Fig. 3. Upon further screwing up the nut, so as to bring greater strain upon the spring, the ends will approach each other, as the band itself is at the same time equally strained and slightly stretched within its elastic limit.

When fire is put into the furnace or the operation of smelting begun the wall of the furnace will become hotter and hotter for some days and will at the same time expand, tending to separate the ends of the bands F and G and bring a greater strain upon the spring I. If not guarded against, this expansion might continue until the spring was entirely closed, showing that the strain upon the band had become greater than the capacity of the spring, and until the band should break, either by the breaking of the bolt or a fracture at its own weakest part. Such breakage of the band, however, may always be prevented by unscrewing the nut to such an extent as will reduce the strain below the capacity of the spring and allow the coils to slightly open. The coil, unless it is entirely closed, is thus always an index of the amount of strain upon the band, and it will be necessary for the person in charge of the furnace to watch the springs occasionally for some days, or until the furnace attains its regular working-heat and its nearly permanent shape. At the end of this time the nut on each bolt should be so adjusted that the spring is strained to about one-half its capacity, or its coils half closed, when it will need no further attention during the time that the furnace is in blast. Should the heat of the furnace further increase and the wall expand, the portion of the coils remaining open will be sufficient to permit such extra expansion without danger; and should the furnace cool and the wall contract, the tension on the spring will prevent the bands from becoming slack. In this manner changes in the temperature in the inside of the furnace and the consequent expansion and contraction of the wall are amply compensated, and will therefore cause neither the bursting of the bands nor the opening of cracks in the wall itself.

That portion of the upper part of the furnace which extends above the roof of the casting-house may be protected from the weather, if desirable, either by a thin sheet-iron covering loosely inclosing it or it may be housed in by an extension upward of a portion of the casting-house, as may be most convenient.

It is evident that any portion of the furnace, as well as the whole, may be built in the manner described above, and I do not limit my claims to the particular form shown in the drawings. In my experiment with this form of construction I have used it successfully for a limited portion of a furnace—viz., for about twenty feet immediately above the mantel-plate.

While an elastic joint in the bands is essential to my invention, I do not desire to limit my claim to any specific form or method of constructing such joint.

I claim as my invention—

1. A blast-furnace having its stack constructed of a single wall inclosed by a framework of upright bars and encircling elastic bands, substantially as described.

2. In combination with a blast-furnace an elastic or automatically expanding and contracting band adapted to encircle the wall of the stack of such furnace and act in connection with upright bars, substantially as and for the purposes set forth.

3. In a band adapted to encircle the wall of the stack of a blast-furnace, an elastic or spring joint, in combination with mechanism for regulating the tension of the spring and the extent to which such joint may expand, substantially as described.

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Witnesses:
H. T. MORRIS,
A. W. DUFF.