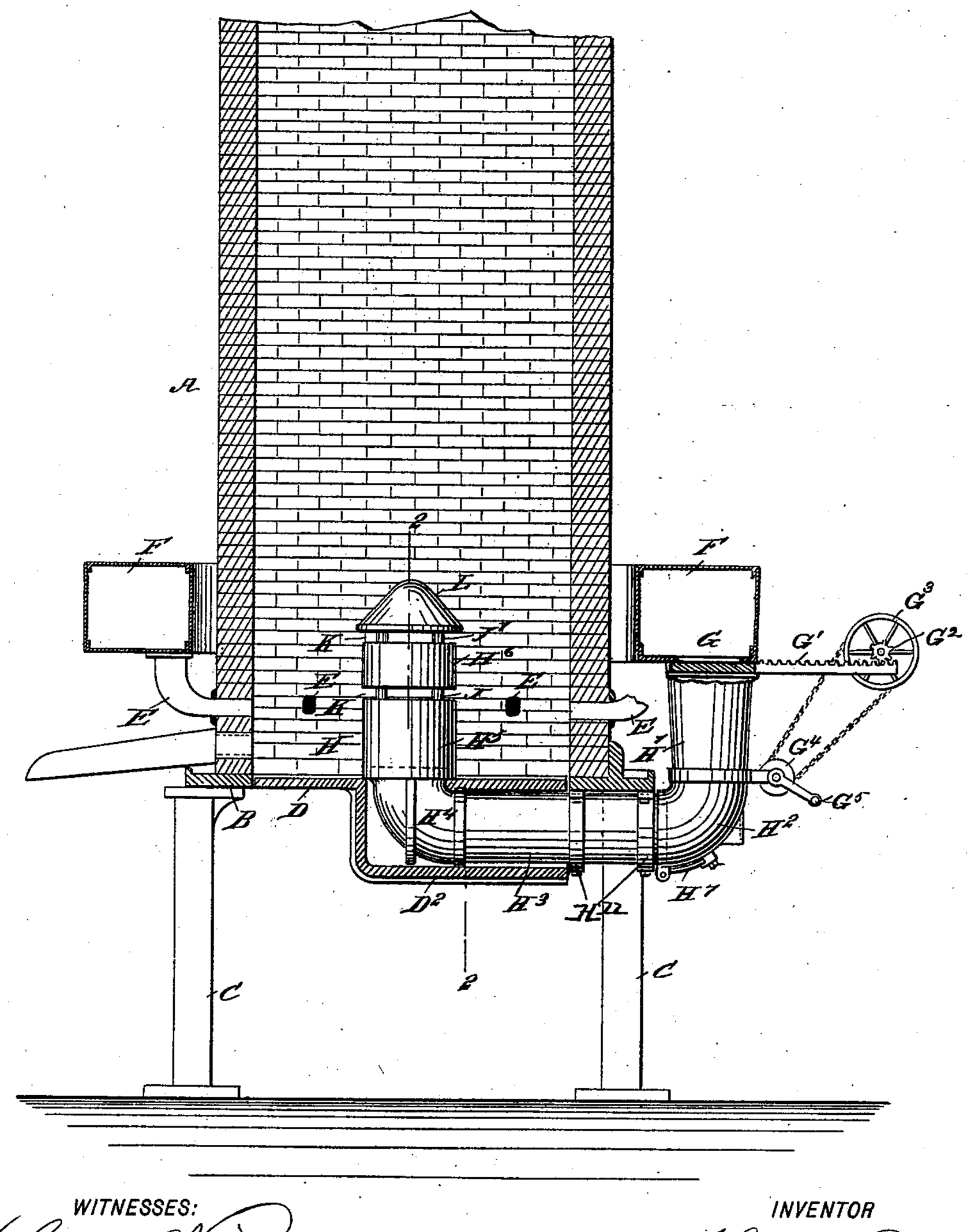
(No Model.) 2 Sheets—Sheet 1.

C. JOHNSON.

BLAST FURNACE.

No. 541,759. Patented June 25, 1895.

Fig: 1.



WITNESSES:

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(No Model.) 2 Sheets—Sheet 2.

C. JOHNSON.

BLAST FURNACE.

No. 541,759. Patented June 25, 1895.

Fig: 2.

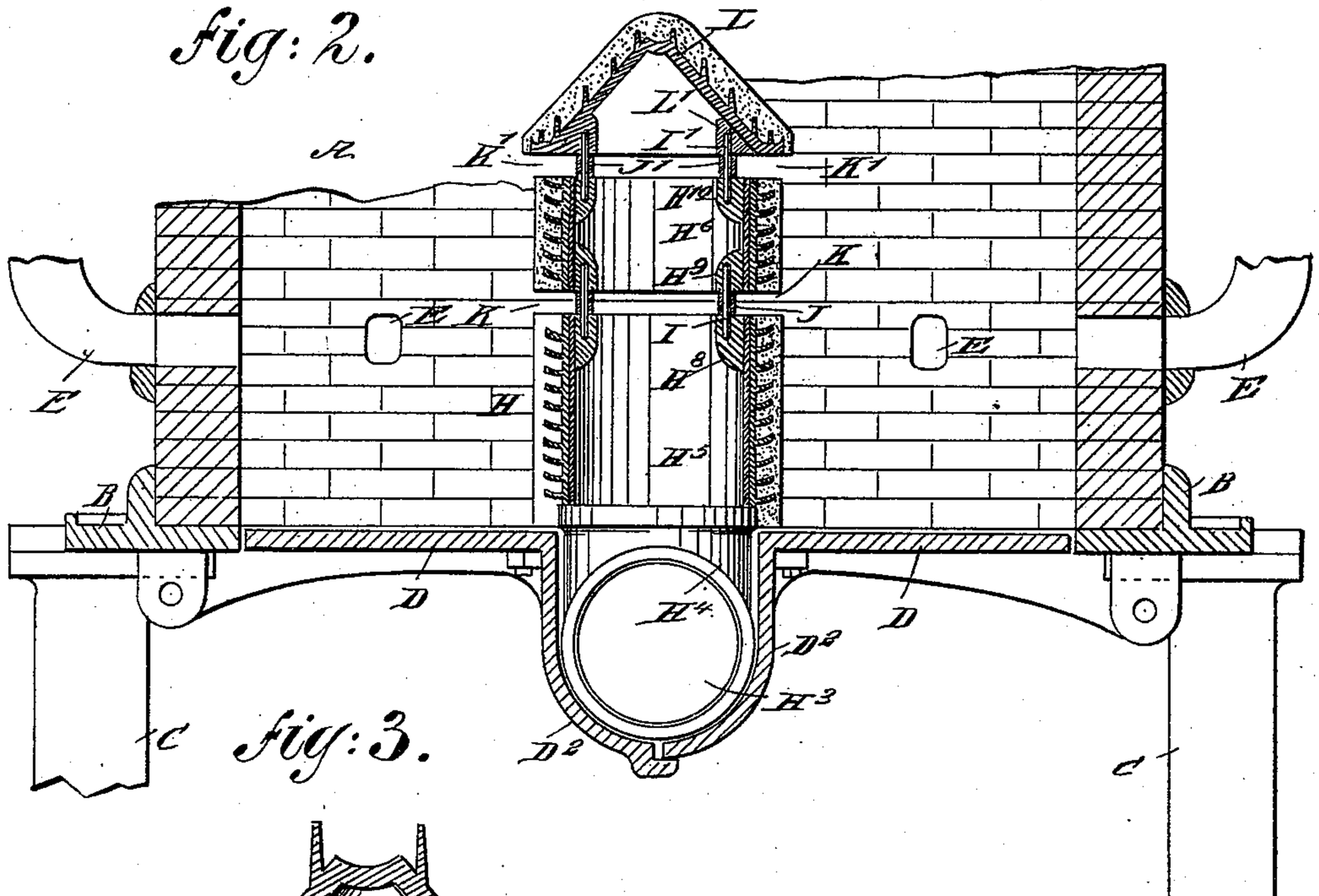


Fig: 3.

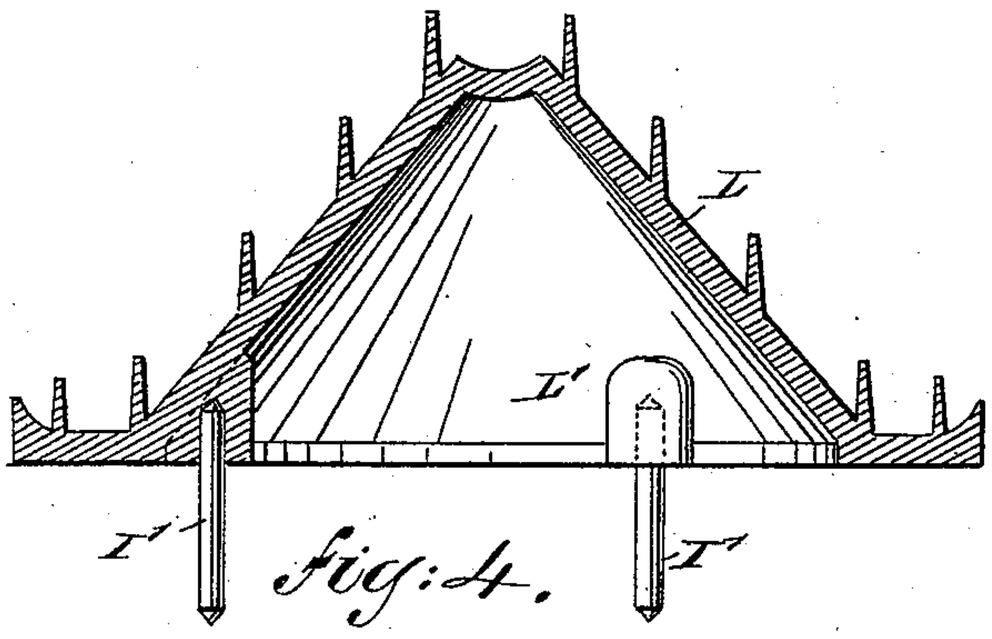
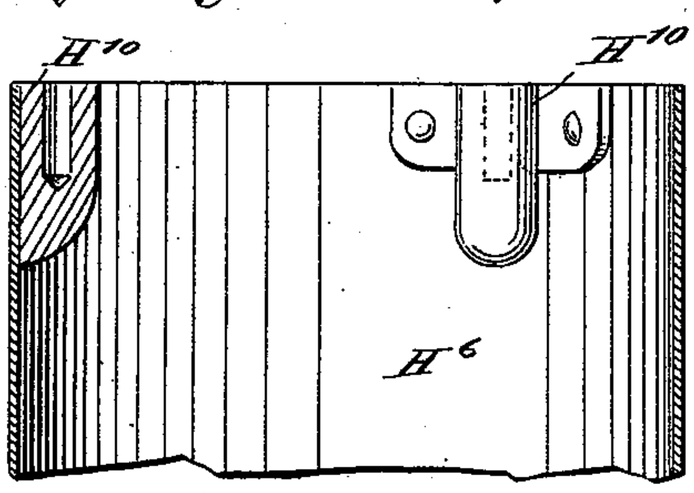


Fig: 4.

Fig: 5.



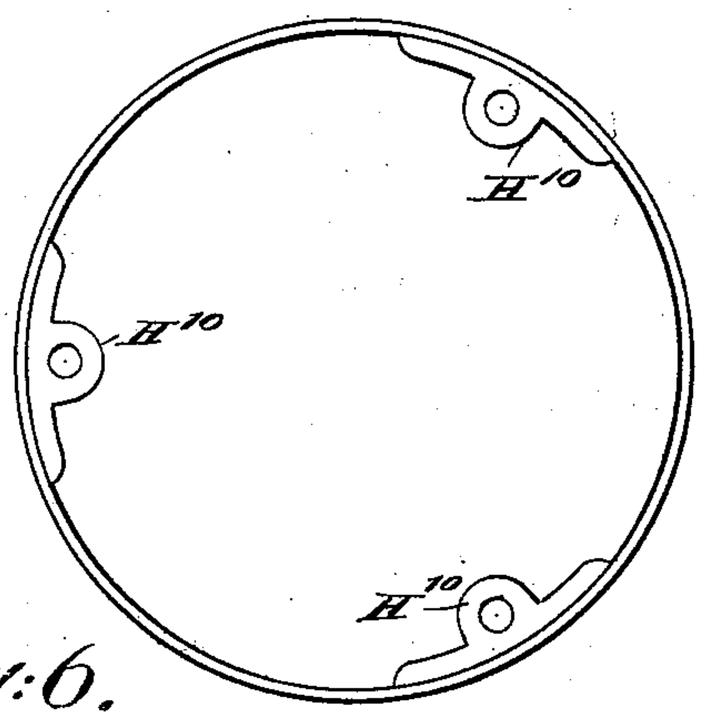


Fig: 6.

WITNESSES:

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UNITED STATES PATENT OFFICE.

CHARLES JOHNSON, OF RUTLAND, VERMONT.

BLAST-FURNACE.

SPECIFICATION forming part of Letters Patent No. 541,759, dated June 25, 1895.

Application filed December 1, 1894. Serial No. 530,566. (No model.)

To all whom it may concern:

Be it known that I, CHARLES JOHNSON, of Rutland, in the county of Rutland and State of Vermont, have invented a new and Improved Blast-Furnace, of which the following is a full, clear, and exact description.

The object of the invention is to provide a new and improved blast furnace, which is comparatively simple and durable in construction, and arranged to force air to the center of the charge, as well as to the sides thereof, so that the whole interior of the furnace is formed into a melting zone to insure complete combustion, thereby preventing gases from going to waste, increasing the capacity of the furnace, and lessening the wear and tear on the lining to a very appreciable extent.

The invention consists in certain parts and details, and combinations of the same, as will be fully described hereinafter and then pointed out in the claims.

Reference is to be had to the accompanying drawings, forming a part of this specification, in which similar letters of reference indicate corresponding parts in all the views.

Figure 1 is a sectional side elevation of the improvement. Fig. 2 is an enlarged transverse section of the same on the line 2 2 of Fig. 1. Fig. 3 is an enlarged sectional side elevation of the cap. Fig. 4 is a similar view of the upper blast-pipe section supporting the cap. Fig. 5 is a plan view of the same, and Fig. 6 is an enlarged sectional side elevation of one of the collars placed between the blast-pipe sections and the cap.

The improved blast furnace is provided with the usual stack A, set at its lower end on the base plate B, supported on columns C, and carrying trap doors D for closing the lower end of the stack A. Into the latter discharge the tuyeres E, connected at their outer ends with the usual wind-box F, connected with the blast supply in the usual manner. Centrally into the lower end of the stack A extends a center blast pipe H, so as to supply the interior of the charge with air from the wind-box F, in addition to the air supplied to the sides of the charge by the tuyeres E. The air admitted from the wind-box F to the outer end of the center blast pipe H, is controlled by a gate G, as illustrated in Fig. 1. Said gate is provided with a rack G′ meshing with a pinion G^2. On the shaft of this pinion is mounted a sprocket wheel or belt pulley G^3, adapted to be turned by means of a driving pulley G^4 whose shaft is provided with a crank arm G^5.

The center blast pipe H is made in sections comprising the sections H′, H^2, H^3, H^4, H^5 and H^6, of which the section H′ is on the outside of the stack A, and carries the gate G, and is connected at its upper end with the wind-box F. The lower end of the section H′ is connected by the elbow section H^2 with the horizontal section H^3, supported in hangers H^{11} attached to the under side of the base plate B, as plainly illustrated in Fig. 1. A trap door H^7 is formed in the bottom of the elbow section H^2, so that any slag, metal or iron that runs into the center blast pipe H, can be removed through the said trap door H^7. The inner end of the horizontal section H^3 is connected by an elbow section H^4 with the section H^5 located directly above the trap doors D within the stack A, as plainly shown in Figs. 1 and 2, and the said sections H^3 and H^4 are inclosed within a casing D^2, formed on the trap doors D, as plainly indicated in Figs. 1 and 2.

On the upper end of the section H^5 and at the inside thereof, are secured a series of sockets H^8, each adapted to receive the lower end of a pin I, extending upwardly to engage a similar socket H^9 secured or formed in the lower end of the section H^6, and between two corresponding sockets H^8 and H^9 are arranged collars J, forming spacing devices to hold the sections H^5 and H^6 a suitable distance apart to form a continuous tuyere opening K. The size of this tuyere opening K can be varied by employing longer or shorter collars J.

The upper end of the section H^6 is provided with a series of sockets H^{10}, similar to the sockets H^9 and H^8, and likewise carrying pins I′ adapted to enter at their upper ends sockets L′, secured or formed in a cap L, preferably made conical in shape, as indicated in the drawings. Collars J′ are placed on the pins I′, between the sockets H^{10} and L′, so as

to form a second tuyere opening K′, between the upper end of the section H^6 and the base of the cap L. This opening K′ is continuous, similar to the opening K, and it can be varied by employing collars J′ of different lengths.

By reference to Figs. 1 and 2, it will be seen that the tuyere opening K is a short distance above the inner ends of the tuyeres E, so that the blast passing through the pipe H into the interior of the charge is delivered a short distance above the air forced into the sides of the charge by the tuyeres E.

It has been demonstrated by experiment, and it is a well known fact, that air blown continuously through tuyeres into the heated fuel, taking up carbon and combining with it, produces an intense heat above and around within a space that is technically called the melting zone. Now this carbonic acid gas which is generated in this melting zone in passing upward through the fuel takes up more carbon and is converted into a carbonic oxide which has a temperature of only one-third the temperature required to melt cast iron, and in this case in passing up through it would be wasted; but by continuing the pipe by the addition of the section H^6, and blasting up through the fuel about a foot more, and making another continuous tuyere opening, as at K′, and by furnishing air to the heated fuel, the temperature is thereby raised about up to the melting point of cast iron, and the gas that is otherwise constantly wasted is burned and a steady melting zone is created in the stack. The gases are consumed, and the capacity of the stack is enormously increased by this arrangement and with the same consumption of fuel. To accomplish this by the center blast pipe H, it is necessary that the tuyere opening K should be opened just enough to admit the proper amount of air required to unite with the carbon to effect a perfect combustion of the fuel. For this purpose the section H^6 is raised or lowered relative to the central section H^5, to increase or decrease the size of the tuyere opening K, by making the collars J of a corresponding length. The tuyere opening K′ can in a similar manner be increased or decreased as required.

In order to prevent destruction of the pipe sections H^5 and H^6 and the cap L, I prefer to provide the same on the outside with covers made of an incombustible material such as plumbago, asbestos, &c. In order to securely hold such covers in proper position, I provide the cap sections and the cap with pins or projections, as indicated in Figs. 2 and 3.

It will be seen that by the arrangement described, the air from the blast supply pipe can pass simultaneously through the tuyeres E and axially through the center blast pipe H into the charge at the sides and at the centers thereof. By having the pipe sections H^6 and the cap L, two separate charges of air pass into the center of the stack, one above the other, by the air passing through two continuous tuyere openings K, K′. By this arrangement the whole interior of the stack A is formed into a melting zone, thus preventing the gases from going to waste, and at the same time increasing the capacity of the furnace and lessening the wear and tear of the lining to a great extent.

It will be observed that sockets H^8 and H^9, and H^{10} and L′ respectively are located in axial alignment so as to properly receive the spacing pins I and I′.

Having thus described my invention, I claim as new and desire to secure by Letters Patent—

1. In a blast furnace, a blast pipe comprising a relatively fixed section, an adjustable section located in the continuation of the fixed section and spacing devices engaging the opposing edges of the said pipe sections, substantially as described.

2. In a blast furnace, a blast pipe comprising a relatively fixed section and an adjustable section located in the continuation of the fixed section, the said sections being provided with axially aligning pin-receiving sockets in their opposing ends, substantially as described.

3. In a blast furnace, a blast pipe comprising a relatively fixed section, an adjustable section located in the continuation of the fixed section, the said sections being provided with sockets in their opposing ends, pins extending into the said sockets, and collars on the pins, substantially as described.

4. A blast furnace provided with a stack, a center blast pipe extending through the bottom thereof; and trap doors hinged on opposite sides of the stack to form a bottom therefor and embrace the blast pipe, substantially as described.

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Witnesses:
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AUSTIN C. JOY.