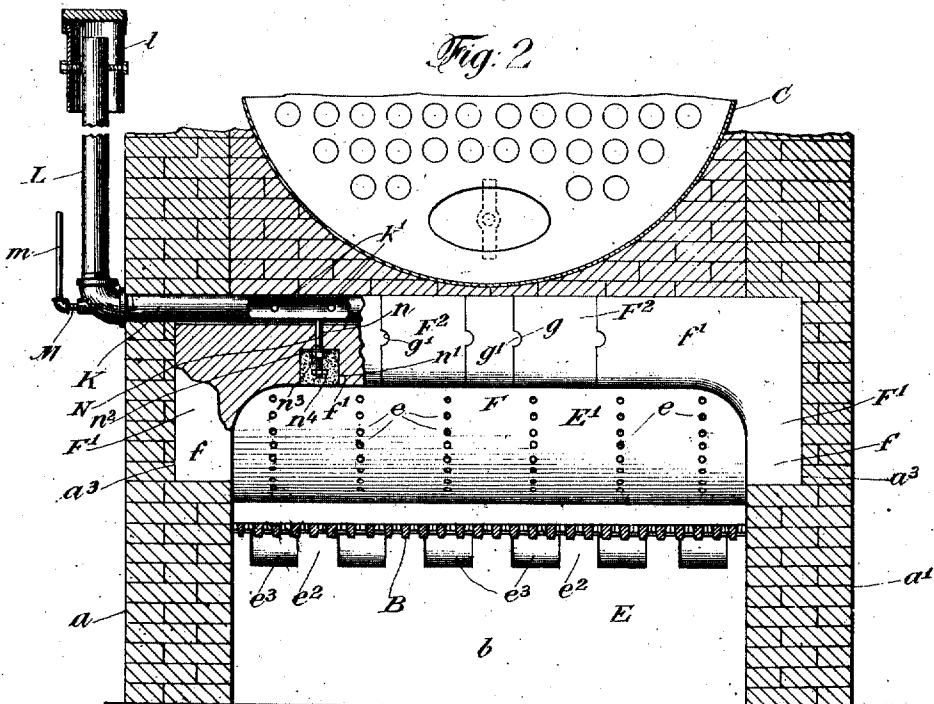
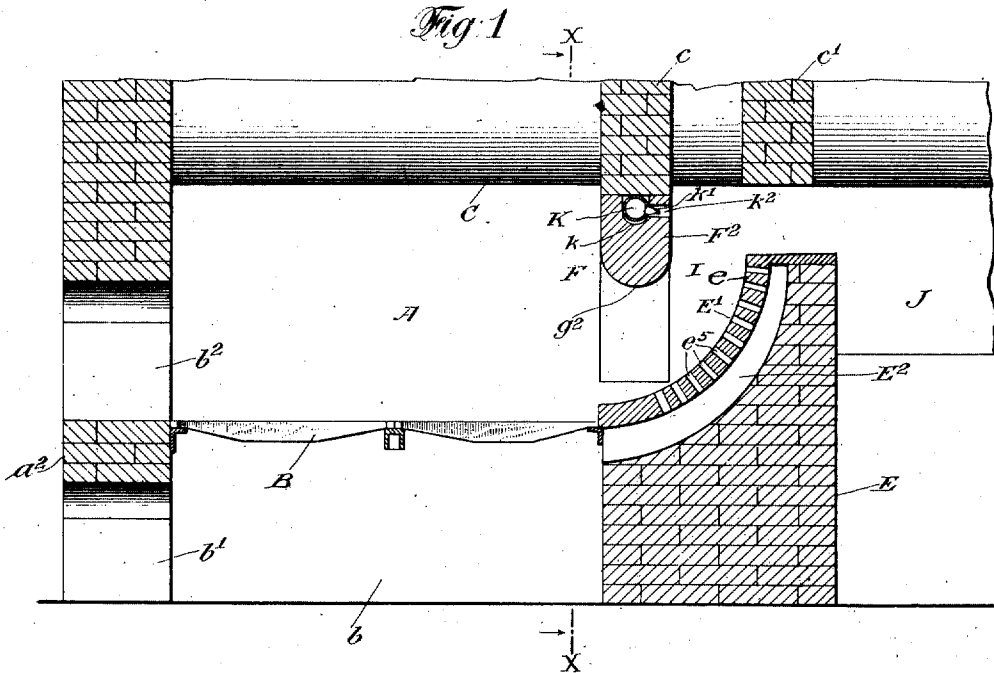


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 SMOKE CONSUMING FURNACE.
 APPLICATION FILED MAY 1, 1909.

1,000,191.

Patented Aug. 8, 1911.



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ORLAND D. ORVIS, OF NEW YORK, N. Y.

SMOKE-CONSUMING FURNACE.

1,000,191.

Specification of Letters Patent.

Patented Aug. 8, 1911.

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To all whom it may concern:

Be it known that I, ORLAND D. ORVIS, a citizen of the United States, residing in the city of New York, borough of Manhattan, county of New York, and State of New York, have invented a certain new and useful Smoke-Consuming Furnace, of which the following is a specification.

This invention is a steam boiler furnace wherein a blast of air and steam is directed into the products of combustion for the purpose of consuming the carbon in the smoke, increasing the draft, and generating increased heat, thereby securing economy by thorough consumption of the coal and overcoming the serious objection of municipalities to the so-called "smoke nuisance," besides affording facilities for clearing out the clinkers and other objectionable matter in the bed of fuel and upon the breast of the bridge wall.

The objects of the invention are, first, to incase a pipe with a view to precluding it from rapid deterioration under the intense heat generated in the furnace; and second, to so arrange the arch with reference to the bridge wall that the dust will be carried off by the escaping gases and the fire can be raked without obstruction by said pipe incasing means.

To the accomplishment of this end, one part of the invention consists of an arch composed of sections which may be easily installed, cheaply manufactured, and adapted to be used in furnace chambers, the width of which may vary from side wall to side wall thereof.

In a preferred form of the arch, it comprises two end members, the terminal portions of which are at an angle to each other, preferably a right angle, and other sections intermediate the end sections, said sections having interlocking engagement.

An arch such as described is adapted to be installed easily and quickly in an ordinary furnace chamber, and by the employment of intermediate sections which are different in length, the arch may be built longer or shorter to accommodate chambers of different widths.

It is preferred to provide matching or registering grooves in the sections composing the arch, for the purpose of producing a chamber adapted to receive a pipe, such as a blast pipe adapted to supply steam and

air to the products of combustion. Obviously, however, the arch may be equipped with one or more water circulating pipes.

Another part of my invention comprises a bridge wall having a concave breast forming, approximately, a continuation of the upper surface of the grate, and in arranging the arch directly over the breast, the front surface of the arch being in the vertical plane, substantially, of the front edge of the curved breast. The lower edge of the arch is, or may be, curved correspondingly to the contour of the breast, and a throat or passage is thus formed between the breast and arch for the escape of the products of combustion. By placing the arch directly over the breast, and by curving or inclining the breast of the bridge wall, the fireman is able to clean the furnace without hindrance from the arch, and to rake off the coals from the breast, the draft through the throat tending to carry off any ashes or dust which might otherwise tend to lodge thereon.

In the accompanying drawings I have illustrated a practical embodiment of the invention, but the construction shown therein is to be understood as illustrative only, and not as defining the limits of the invention.

Figure 1 is a vertical section taken longitudinally through a part of a return tubular boiler, the furnace of which is constructed in accordance with my invention. Fig. 2 is a vertical cross section on the line X-X of Fig. 1, parts of the arch and the blast pipe being broken away.

A, designates a furnace chamber, the side walls thereof being indicated at a , a' and the front wall at a^2 .

B, designates the grate of any usual or preferred construction which is supported within the furnace chamber, b , indicating the ash pit, access to which is obtained through ash pit door opening b' . As is usual, the furnace is charged through the fuel door openings, b^2 .

The boiler, C, is set in the furnace in the usual or any preferred way, one seat, c , of a plurality of boiler seats, c , c' , resting upon an arch, F, which is constructed in accordance with this invention.

The bridge wall, E, is somewhat wider than the bridge walls of ordinary furnaces, and said bridge wall is constructed with the breast, E' . While the breast may be in-

clined from a point above the grate to the top edge of the bridge wall, it is preferred to employ a concave breast as shown in Fig. 1.

1 The breast may be composed of five
5 brick, fire clay, or fire clay tiles, a tile of this character being shown in Fig. 1. The concave breast is so arranged that its lower front edge is above the horizontal plane of grate B, and the tiles, *e*, composing the said
10 breast are laid in a continuous row until they reach the top edge of the bridge wall.

An important feature of my invention consists of arch, F, which extends across the furnace chamber and is positioned directly over the breast of the bridge wall,
15 the front surface of said arch being in the vertical plane of the front edge of breast, E', see Fig. 1. Said arch is composed of terminal sections, F', F', and one or a plurality
20 of intermediate sections, F². Each terminal section, F', is, preferably angular in form, consisting of a depending portion, *f*, and a horizontal portion, *f'*, it being preferred to make each terminal section of a right angular form along the top and outer edges
25 thereof, see Fig. 2. In installing the arch in the furnace, side walls, *a*, *a'*, are built so as to form recesses, *a*², which form seats for the terminal sections F', F', of the arch,
30 whereby said terminal sections are supported in a secure manner in the side walls of the furnace chamber, the horizontal portions, *f'*, of each terminal section extending inwardly with respect to the side walls, *a*, *a'*.

35 Should the furnace be of narrow cross section, I may employ a single intermediate section, F², positioned between the end sections, F', but as shown in Fig. 2 the arch is composed of three intermediate sections, F²,
40 said intermediate sections being of different sizes. In order to retain the sections in position and enable them to be installed easily and quickly the intermediate sections are interlocked with each other and with the
45 end sections, and for this purpose it is preferred to provide each section with the groove, *g*, and a tongue, *g'*. When the end sections shall have been placed into position in the seats of the side walls, the proper
50 number and sizes of intermediate sections are placed in position, the tongue of one section entering the groove in the other section. The several sections are thus firmly interlocked, and the arch can be installed
55 easily and quickly. The employment of intermediate sections differing in length permits the operator to install the arch with ease and facility in furnace chambers which differ in width.

60 The transverse part of the arch which extends over the concave breast is, preferably, curved or rounded in cross section at the lower edge thereof as indicated at, *g*², in Fig. 1. The said cross sectionally curved
65 edge conforms, substantially, to the contour

of breast, E', and thus the throat or passage, I, is produced between the arch and the breast. The transverse part of the arch extends below the top edge of bridge wall, E, and the corresponding edge of breast, E',
70 so that the escaping products of combustion will pass in an upward and rearward direction from the grate chamber into and through throat, I, and thence over the bridge wall back into the flue, J.
75

The arch is provided in its upper edge with a channel, *k*, adapted to form a chamber for the reception of blast pipe, K. In its rear side, said pipe is provided with a plurality of openings or nipples, *k'*, and in
80 the rear face of arch, F, is a series of openings, *k*², which register with the openings or nipples of the blast pipe. One end of said blast pipe extends preferably through a side wall of the furnace in order that it may be
85 connected with an air inlet pipe, L, extending in a suitable direction from the blast pipe and provided, preferably, at its inlet end with a muffler, *l*, see Fig. 2. A steam nozzle, M, enters the blast pipe, K, at its
90 outer exposed end, and steam from the boiler is supplied to said nozzle by a steam pipe, *m*.

The operation of the invention is as follows: The fire having been started, the operator admits steam to nozzle, M, and the velocity of the steam admitted to pipe, K, induces air to flow through muffler, *l*, and pipe, L, into pipe, K. The steam and blast commingle in the pipe and are delivered
100 under pressure from the openings in the rear side of the pipe and the arch, the blasts flowing under pressure across the upper part of throat, I, over the top edge of bridge wall. The blasts of steam and air are directed into the escaping products of combustion so as to secure two primary ends,
105 namely; to break up the smoke and supply oxygen thereto for the purpose of consuming the carbon therein, and to increase the draft through the furnace chamber and the escape flue. By supplying the blasts over the bridge wall and above the throat, I, the air and other gases in the throat are rarefied, or as it might be termed a partial vacuum is produced therein, the air and
110 products of combustion being forcibly drawn round the lower edge of the arch, thus securing the increased draft referred to. The blasts operate, furthermore, to draw the products of combustion forcibly into throat, I, so that they will impinge upon the curved breast, E', which in a measure reflects the gases against the arch, F, from which the gases rebound. The
115 arch and the breast being composed of fire clay tiles, they will become heated to a white or red heat, and the gaseous products of combustion impinging against these heated surfaces, it follows that thorough com-
120
125
130

bustion of the gases is secured, thus resulting in an increased number of heat units. On the whole, the apparatus secures great economy in the consumption of fuel, increases the heat as compared with ordinary furnaces, and consumes the carbon in the smoke so that the escaping gases are practically free from the heavy black color of the smoke from ordinary furnaces.

From the foregoing description taken in connection with the drawings, it is apparent that my invention can be embodied in existing furnaces as well as new furnaces. The breast of the bridge wall can be built rapidly, and the arch may be installed with very little labor, it being necessary only to place the tile sections, F', F², in the required positions. The blast pipe can be quickly placed into position and the necessary connections made with said blast pipe.

My new arch is placed in such relation to the bridge wall that it overcomes the practical objections which have been raised by firemen or stokers to other forms of arches which are placed in the furnace chamber in front of the bridge wall so that the old form of arches lay over the fuel on the grate, said old position of the arches interfering with the operation of cleaning the grate. It will be noted that the arch in my structure lies over the breast of the bridge wall, thus leaving the entire surface of the grate free from obstruction. Should the coal lodge upon the breast, the operator is able to rake it off and upon the grate. The increased draft through throat, I, secured by the operation of the blast pipe devices, precludes the lodgment of ashes and dust upon the bridge wall, for the reason that said draft has sufficient strength to carry off the lighter particles of dust and ashes.

After the arch is placed into position, and the blast pipe positioned within the chamber of said arch, it is preferred to employ means for upholding the tiles composing the arch. To this end I provide the end sections, F', with vertical openings, n, each opening being enlarged at its lower end as at n'. Bolts, N, are secured in the under side of blast pipe, K, and pass through opening n, so that the lower ends thereof will enter in the enlarged ends, n', of the openings, the lower extremities of the bolts being above the under face of the arch. A washer n² is fitted on each bolt for engagement with the arch and two nuts, n³, n⁴, are screwed on the bolt. The nut, n³, engages with the washer, but the other nut, n⁴, is spaced with reference to the washer.

The chamber formed by the enlarged part, n', is filled with plastic fire clay or other appropriate material which will harden under the action of the heat, whereby the bolts uphold the arch sections from sagging and the pipe is protected from the heat, and

said bolts in turn serve to prevent displacement of the blast pipe, the latter being protected from the heat by the arch.

It may be desired to supply air to the products of combustion as they flow upwardly through throat, I, and in this event I prefer to employ a concave breast, E', which is provided with rows of perforations, e¹. Said concave breast may be composed of one or more sections in order that it may be properly installed on the bridge wall. Said bridge wall is constructed with the air chamber, E², back of the concave breast, and with this chamber communicates the openings, e², of said breast, thereby providing for the outflow of atmospheric air through the breast and into the throat, I. Air may be supplied in any suitable way to the chamber, E², but as shown in the drawings, the bridge wall may have its bricks, e², adjacent to the breast so arranged as to provide air ducts or channels, e³, which open into the ash pit at a point below grate, B. Air is thus free to pass through ducts or channels, e³, into chamber, E², and through openings e², of breast, E, the desired flow of air through said breast being induced by the draft and suction through said throat, I, when the blast pipe, K, is in operation. It is evident that the air flowing through the bridge wall and the breast will become heated more or less, and by this construction an additional supply of heated air is drawn into the products of combustion, thus more thoroughly consuming the gaseous products.

Having thus fully described my invention, what I claim as new and desire to secure by Letters Patent is:

1. In a furnace, a furnace chamber, an arch comprising angular end sections seated in the side walls of the furnace chamber, each end section having an integral part thereof extending inwardly from the side wall, intermediate sections interlocked with the inwardly extending parts of the end sections, a blast pipe the ends of which are supported in the side walls, the intermediate part of said blast pipe being substantially incased by said sections, and means for fastening the end sections to the blast pipe, whereby the intermediate sections are held against sagging by the interlocking engagement thereof with the supported end sections.

2. In a boiler furnace, a grate chamber, a bridgewall, a blast pipe supported in side walls of said grate chamber, said blast pipe being provided with rearwardly discharging blast exits positioned in a plane above the top of said bridgewall, and an arch incasing that part of the blast pipe which extends between the side walls, said arch comprising end members and a plurality of other members positioned intermediate said end members, said end members being sup-

ported in the side walls of the grate chamber and being attached to the blast pipe, the intermediate members of the arch being interlocked to the end members.

5 3. In a boiler furnace, a grate chamber, a
 bridgewall the top surface of which slopes
 downwardly and forwardly, a blast pipe
 supported in side walls of the grate cham-
 ber, said blast pipe being positioned above
 10 the sloping surface of said bridgewall and
 in a plane intermediate the front and the
 rear surfaces thereof, said blast pipe being
 provided with blast outlets which lie in a
 plane above the top surface of the bridge-
 15 wall, an arch incasing that part of the blast
 pipe which extends between the side walls,
 the end portions of said arch being sup-
 ported in the side walls of the grate cham-
 ber, and means for rigidly fastening the
 20 arch and blast pipe together, said arch be-
 ing positioned over the sloping surface of
 the bridgewall, so that the front surface
 of said arch is substantially in the vertical
 plane of the front surface of the bridgewall,
 25 whereby the arch produces a throat for the
 escape of products of combustion, into the
 upper part of which throat a blast is dis-
 charged for producing a partial vacuum
 within said throat and for accelerating the
 30 flow of the escaping gases around the bot-
 tom face of the arch.

4. In a boiler furnace, a grate chamber, a
 bridgewall, a blast pipe supported in side
 walls of the grate chamber, said blast pipe
 35 being provided with rearwardly discharging
 exits positioned in a horizontal plane above
 the top surface of the bridgewall, and an
 arch positioned in the vertical plane of the
 bridgewall and incasing that part of said
 40 blast pipe which extends between the side
 walls, the bottom surface of the arch being
 below the top surface of the bridgewall, said
 arch comprising end members and a plural-
 ity of intermediate members, said end mem-
 45 bers being supported in the side walls of
 the grate chamber and being attached to the
 blast pipe, the intermediate arch members
 being interlocked to each other and to the
 end members.

50 5. In a boiler furnace, a grate chamber, a
 bridgewall, a blast pipe supported in side
 walls of said grate chamber, said blast pipe
 having rearwardly discharging exits, and an
 arch incasing that part of said blast pipe
 55 which extends between the side walls, said
 arch comprising end members each sup-
 ported in one side wall of said grate cham-
 ber, a plurality of intermediate members,
 means for interlocking the intermediate
 60 members to each other and for interlocking
 two of said intermediate members to the
 end members, and means for securing said
 arch members to the blast pipe.

65 6. In a boiler furnace, an arch compris-
 ing right-angular end blocks each having

the wider end thereof seated in the side
 walls of the furnace, other blocks inter-
 mediate the narrow ends of said end blocks,
 all of said blocks having abutting engage-
 70 ment on their meeting end faces, and inter-
 locking tongues and grooves in said abut-
 ting end faces of the blocks, intermediate
 the upper and lower faces thereof, said
 tongues and grooves extending at a right
 angle to the longitudinal axis of the arch, 75
 combined with a blast pipe supported in the
 side walls and having its intermediate part
 substantially incased by the members com-
 posing said arch, said pipe being provided
 with blast outlets which discharge rear- 80
 wardly through the arch.

7. A furnace having seats in its side
 walls, an arch composed of interlocked sec-
 tions, the end sections occupying said seats
 of the side walls, a blast pipe supported at 85
 its ends by the side walls and having its in-
 termediate part substantially incased by
 said arch, and means for fastening the end
 sections of the arch to the blast pipe, where-
 by the end sections are supported by the 90
 side walls and the blast pipe, and the sec-
 tions intermediate said end sections are
 precluded from sagging by interlocking
 them with the end sections.

8. In a furnace, a bridge wall having a 95
 curved breast, an arch in the vertical plane
 of said curved breast, a blast pipe incased
 in said arch, and means for supplying air
 through said curved breast, said curved
 breast having rows of blast outlets which 100
 direct the blasts on converging lines, to-
 ward the arch, and across the throat be-
 tween the arch and the bridge wall.

9. In a furnace, a bridge wall having a 105
 curved breast provided with air supply
 openings, an arch directly over said bridge
 wall, the front surface of said arch being
 substantially in the vertical plane of the
 front edge of the breast, and a blast pipe 110
 adapted to deliver a blast across the space
 between the arch and the bridge wall, the
 air supply openings from said breast direct-
 ing the inflowing air on converging lines,
 toward the arch, and across the throat be-
 115 tween said arch and the bridge wall.

10. In a furnace, a bridge wall, a concave
 breast on the front side of said bridge wall,
 an arch springing from the side walls of the
 furnace and spaced relatively to the breast
 to produce an upwardly extending throat, 120
 the front face of the arch being substan-
 tially in the vertical plane of the front edge
 of said breast, and means for supplying a
 blast to said throat, said breast being pro-
 vided with blast openings which direct the
 125 inflowing air on converging lines, toward
 the arch, and across the throat between said
 arch and the bridge wall.

11. In a boiler furnace, a grate chamber,
 a bridgewall, a blast pipe supported in the 130

sidewalls of the grate chamber, an arch incasing that part of the blast pipe which extends between the side walls and comprising angular end sections and a plurality of intermediate sections, said angular sections being supported in the side walls and each intermediate section being interlocked with two adjacent arch sections, the width of the intermediate sections being ununiform, and bolts securing the end sections to the blast pipe, said arch and the blast pipe having rearwardly facing exits adapted to discharge a blast over the bridgewall.

12. In a boiler furnace, a grate chamber, a blast pipe supported in side walls of said grate chamber, said blast pipe being provided with rearwardly discharging exits, a bridge wall having a blast chamber, said bridge wall being provided, also, with a breast which is curved downwardly and for-

wardly, an arch positioned over the breast and incasing that part of the blast pipe which extends between said side walls, the top surface of the bridge wall being in a plane intermediate the plane of the bottom surface of the arch and the exits from the blast pipe, and rows of blast exits in the breast of said bridge wall, said blast exits being positioned to discharge jets or streams on converging lines and into a throat or flue which intervenes between the arch and the bridge wall.

In testimony whereof I have signed my name to this specification in the presence of two subscribing witnesses.

ORLAND D. ORVIS.

Witnesses:

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M. C. POWELL.