2 Sheets—Sheet 1.

H. A. & C. H. ENGELS & J. WIELAND.

HOT AIR FURNACE.

No. 63,490. Patented Apr. 2, 1867.

Fig: 2.

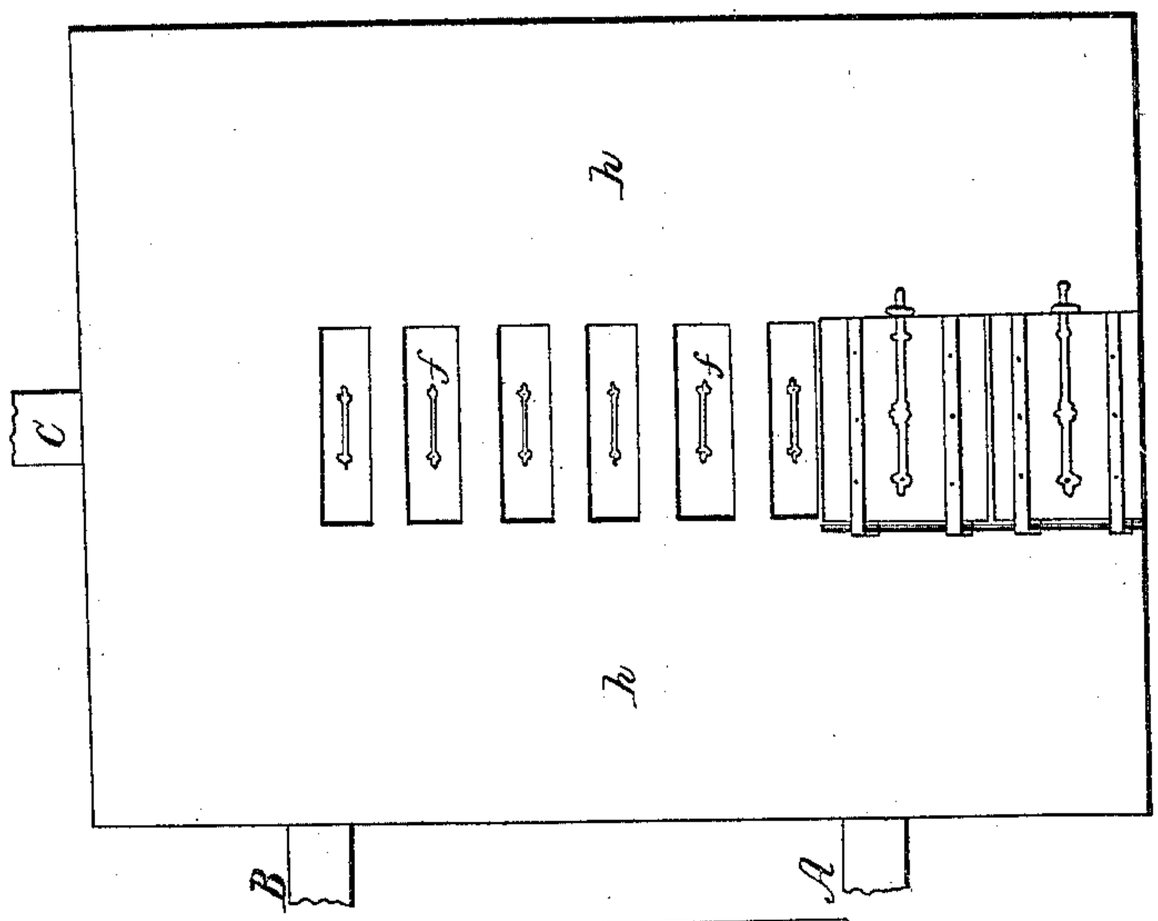

Fig: 1.

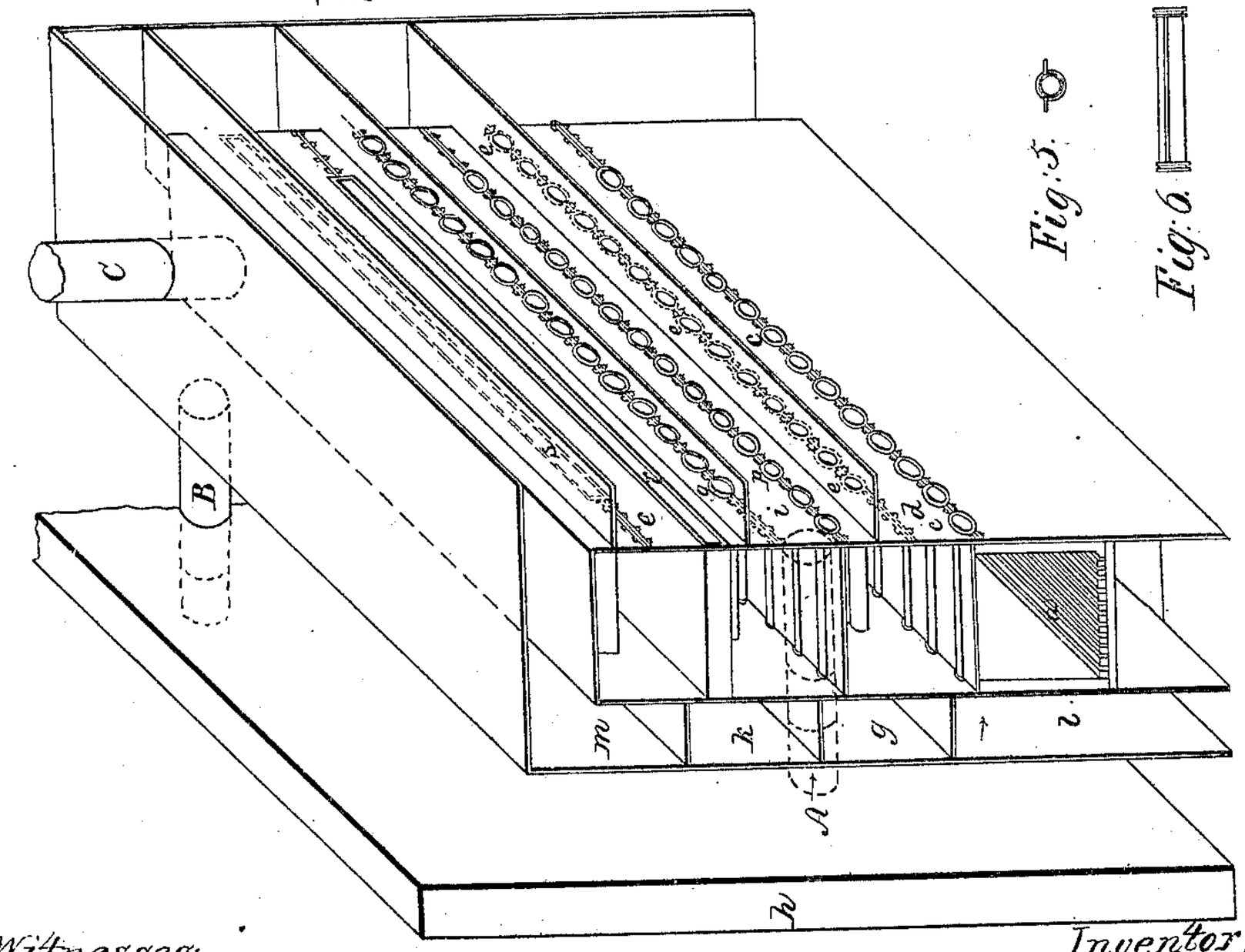

Fig: 5.

Fig: 6.

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Adolph C. Weber

Inventor;
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2 Sheets—Sheet 2.

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HOT AIR FURNACE.

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Fig: 3.

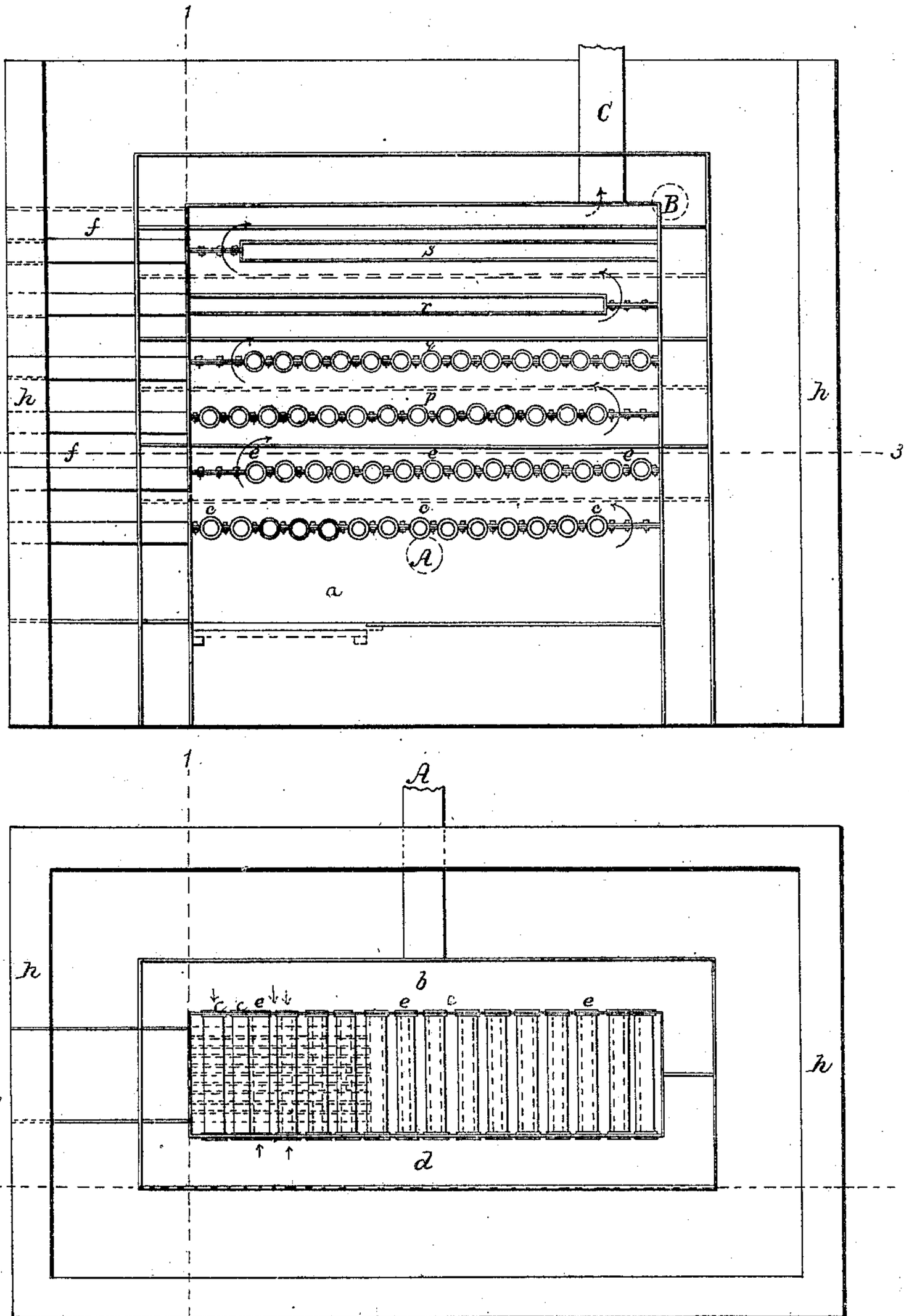

Fig: 4.

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United States Patent Office

H. A. ENGELS, CHARLES H. ENGELS, AND JOHN WIELAND, OF SAN FRANCISCO, CALIFORNIA.

Letters Patent No. 63,490, *dated April* 2, 1867.

HOT-AIR FURNACE.

The Schedule referred to in these Letters Patent and making part of the same.

Be it known, to whom it may concern, that we, H. A. ENGELS, CHARLES H. ENGELS, and JOHN WIELAND, of San Francisco, county of San Francisco, State of California, have invented a new and improved "Hot-Air Furnace;" and we do hereby declare that the following is a full and exact description thereof, reference being had to the accompanying drawings, and to the letters of reference marked thereon, and of which—

Figure I represents a view of the interior arrangement of the furnace as opened by a "vertical section" in the line of 1 1, parallel with the front of the furnace, and also opened by a "vertical section" in the line of 2 2, parallel with the sides of the furnace.

Figure II is the front elevation of the furnace, with doors to fire-place and ash-box below, and square caps *f f* to the flue openings for taking out the soot. Through the pipe C the smoke escapes, and through the pipe A enters, or is forced to enter by a blower, all pure cold air to be heated and passed out of pipe B for drying purposes.

Figure III represents a "vertical section" of the furnace parallel with its long sides, showing the returning course of the fire backward and forward alternately around the sets of pipes and square tubes, as indicated by dotted lines and curved arrows; shows the fire-place and ash-box, the encasing plates of the furnace, with the division plates to form those chambers *b d g i k l m*, which turn the air-current from left to right and from right to left, etc., through those sets of pipes and square tubes, till the hot air is brought to the place desired by means of pipe B. Figure III also shows the working space between the oven and brick wall *h* in the rear, and also the openings *f f* for cleaning the flues.

Figure IV shows a "horizontal section" of the furnace along the line 3 3, with the surrounding still-air space and brick wall *h*.

In Figures III, IV, also V, VI, is shown the system of pipes and single pipes with their flanges, and also their grooved shoulders to stay the side plates at the joints of the sections of the furnace, by means of which flanges and shoulders, cast on the pipes, each set of pipes is bolted and cemented together, and at the same time staying the side plates, the sections, and the whole structure of the interior furnace.

The nature of our invention consists in the construction of an apparatus which will answer manifold purposes of application in a thorough, rational, economical, and simple manner. The arrangement we have introduced in our invention of heating a confined current (a natural current or accelerated by a blower) of pure air in a system of pipes connected with air-chambers and exposed on two sides to the fire in a returning flue to any degree of heat, and conductable to any place or apparatus where needed for drying purposes or otherwise, will speak for itself, and will show its striking usefulness, not alone in connection with our other invention of a malt-drying apparatus, but for a multitude of like purposes—drying vermicelli, raisins, fruit of all kinds, starch, sugar, etc., and also for warming rooms and buildings generally.

The inventors beg to point out the peculiar alternating passage of the current of air to be heated in durable iron pipes, or sets of them, one set above the other, horizontally arranged, and at the same time building up a returning, hermetically separated flue for the fire so as to expose the lower and upper sides of them in succession to the under and above them circulating, gradually rising, and absorbed heat of the fire, and also a combination of horizontally-laid sets of pipes in the lower part of the furnace, and of so laid square box-like tubes for the air in the upper part of the furnace, or reversed, or, as the case may be, either one of them, for generating a heated current of air in preference to the use of plates alone, or vertical tube arrangements in building up the known air-heating furnaces. As one of the manifold merits the inventors believe their apparatus to possess may be mentioned the perfect freedom of the hot-air current from all noxious gases produced by the fire, and also the general clearness and healthiness of the air-current. In continuing to direct proper attention to the matter, the inventors may further add that in their sets of pipes, etc., which, as to size and number, will be particularly adapted to any required case, the greatest surface of the current of air to be heated is exposed to the fire, which therefore expends almost the last degree of heat before leaving the last set of air pipes and chambers and before passing out of the furnace. Finally, the inventors beg to recommend, as seeming to them worth the judge's consideration, the free access to the furnace for repairing or exchanging single pipes or sets of them, etc., by dividing horizontally the sides or casings of the furnace in sections, which are joined along the centres of the pipes and square tubes so that each set A *b b*, with half

its thickness in the lower section of the furnace, and with the other half staying the next section above, and that by this arrangement each section in succession can be partly or wholly lifted up, overhauled, and reset in cement; also the ease of access to the flues or fire-channels, for cleaning purposes; also that there is left on four sides of this cast-iron furnace, and between it and the surrounding brick walls, a sufficient space to lift up those sections for repairing, etc., and at the same time a space constantly filled with a non-conducting substance, viz, quiet air. It is yet to be remembered that for warming rooms or buildings, etc., when needed, a quantity of steam can be infused into the hot-air current in the manner of the invention patented February 12, 1850, No. 7,082, to H. A. ENGELS, then of Cincinnati, Ohio, said H. A. ENGELS being a copartner in the invention as described within.

To enable those skilled in the art to understand and use our invention, as described above, we will proceed in showing its construction and operation.

The cold air enters or is forced to enter through pipe A into chamber *b*, crosses for the first time through set of pipes *c c* to the chamber on the right *d*, thence upward and to the left, recrossing the fire through set of pipes *e e*, into chamber *g*, thence upward and through set of pipes *p p* to the right into chamber *i*, thence upward and through pipes *q q*, to the left into chamber *k*, thence through square tube *r r* into chamber *l* on the right, thence upward and through square tube *s s* to the left into chamber *m*, and through pipe B to the drying place, etc.

The "hot-air furnace" represented in the annexed plans will show the size of what the inventors would call their "hot-air furnace, No. 10," about four (4) feet wide, ten (10) feet long, and eleven (11) feet high, external measurements, which would afford a radiating surface of about fifty thousand square inches, three-fourths of which is, by the peculiar construction of the furnace, horizontally laid out.

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

The arrangement of the set of pipes *c i p l q*, bolted and cemented together, and, at the same time, staying the side plates, the sections, and the whole structure of the furnace by the means of the grooved shoulders and flanges of said pipes, as shown in Figs. V, VI, in combination with the square tubes or drying chambers *r s*, substantially in the manner, for the purpose, and upon the principle as herein set forth.

San Francisco, November 16, A. D. 1866.

H. A. ENGELS.
CHARLES H. ENGELS.
JOHN WIELAND.

Witnesses:
H. BERNHAMER,
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