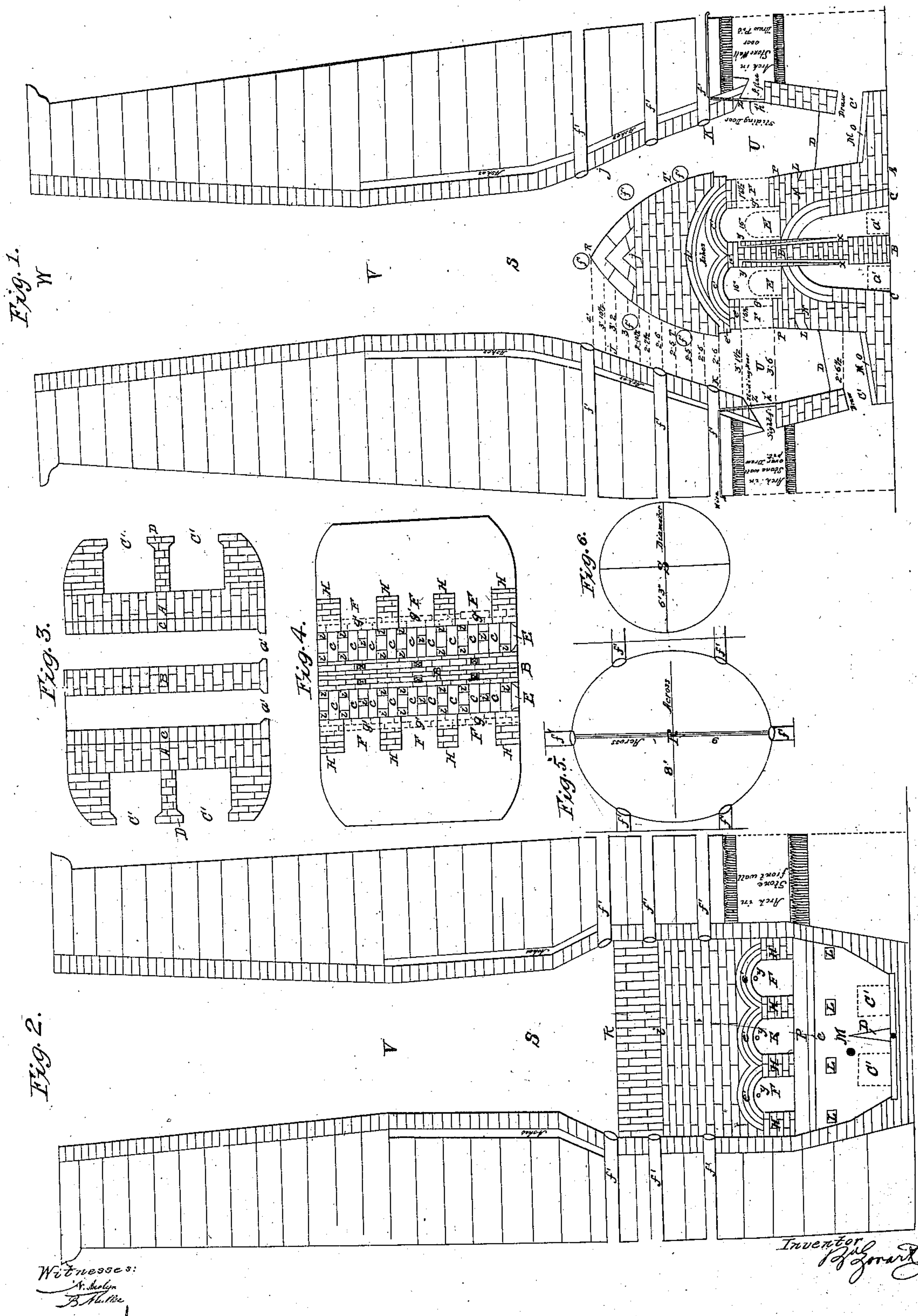


LIMEKILN.

No. 20,015.

PATENTED APR. 20, 1858.





# UNITED STATES PATENT OFFICE.

B. ZWART, OF KEOKUK, IOWA.

## LIMEKILN.

Specification of Letters Patent No. 20,015, dated April 20, 1858.

*To all whom it may concern:*

Be it known that I, BERNARD ZWART, of the city of Keokuk, county of Lee, and State of Iowa, have invented certain new and useful Improvement in Limekilns, of which the following is a full, clear, and exact description, reference being had to the accompanying drawings, making part of this specification, in which—

Figures 1 and 2, are vertical sections taken at right angles. Fig. 3, is a horizontal section taken at O in Figs. 1 and 2. Fig. 4 is a horizontal section taken at P in Figs. 1 and 2. Fig. 5 is a horizontal section taken at R in Figs. 1 and 2. Fig. 6 is a horizontal section taken at S in Figs. 1 and 2.

The letters of reference refer to the same parts in the different figures, wherever they occur.

In my improved limekiln the stone is placed in an oblique-vertical stack, to which the flame and gaseous products of the fuel (either wood or coal) are admitted from the fire chambers below, placed in the center of the kiln.

The first part of my improvement consists in the form of the stack, and more particularly from R down to O, which is so constructed as to be widest from the fire-flues to  $h'$ , and from thence up to T, where it is narrowest, from thence up to R it gradually enlarges, R being the largest diameter, from thence up to S it contracts again and at S is about 2 ft. 6, narrower than at R and J. By this arrangement the flames, escaping through the apertures F into the kiln, out to  $h'$ , from there slowly rise up to J along the lining of the kiln (and from thence fill up the space across to the spherical triangle I) so that none of the stones can come down without being perfectly burned to lime; the kiln being smallest at K and from thence up to J makes the lime hang up between those lines till the cold lime be drawn, (through the doors C',) out of the pits, after which operation the cold air-flues  $f'$ , are opened and in a little while the hot lime falls down to fill up the pits again, and as the said pits just hold the amount of lime burned from K to J (100 bushels each) none of the lime gets too much burned, nor can there be any stone drawn out unburned, because the upperpart of the lime, falling down from J, fills up the pit from U up to K and again has the benefit of part of the fire so as to convert

it into perfect lime before the next drawing. Every 12 hours a draw of 100 bushels on each side is effected in this way. Nor can there be any derangement in this kiln by changing from dry to green wood for fuel, because, unless the stone be burned just enough from K to T, the lime would run (as it is called by the limeburners) and this being ascertained through the light flues  $h'$  the operator should stop for an hour or so, when the drawing is resumed without any fear of the lime running then. The contraction of the kiln from J to S prevents the stones from clogging up at R because the lower they come the more room they find. From S up to V the cupola slightly contracts for the purpose to prevent too great a draft to the top; from V up to W, being 15 feet high, it gradually widens again so as to have a diameter of about 8 feet at the top in order to give room for a full supply of stones at all times.

The second part of my invention consists in the construction of a division wall B from the front to the back of the kiln whereby I create two fireplaces in the center of the kiln, which are (on the outside) bordered by a wall  $g'$  for the support of fire-arches  $c'$ , independent of fireflue arches  $e'$ . By this arrangement, no fire being wasted in or against the walls, my kiln not only has less inside pressure and consequently requires less repairs, but also about twenty-five per cent. in fuel and labor is saved over any of the present modes, and the great difficulty which makes all kilns with only one central fireplace almost useless and a failure, is obviated, namely that all the fire cannot over burn one side of the kiln and leave the other side raw, but both sides must burn in proportion to the fuel applied and burn every stone thoroughly, while by this arrangement also, one half of the kiln may be let out for any length of time, should the demand for lime not require the amount of lime burned on both sides whereby this kiln is really and practically a double lime kiln. In combination with the fireplaces E the fireflues F are an improvement over the old mode to leave several small fireflues to conduct the flames into the charge, whereby the flames are too much divided so as materially to lessen their joint action on the stones, in my kiln however the fireflues F, being 2 feet square, arched over, emit more fire in the charge than the suction air inside



the kiln will absorb and hence, being not driven to the top, slowly ascends, in one body, and most effectually burns the stones.

My kiln has the gas flues L, four in number in each drawpit; through these flues the gases evaporating from the burned lime escape into a cold-air, flue N running horizontally from the front to the back of the kiln, about  $2\frac{1}{2}$  feet above the highest level of the drawpits and provided with a valve in the front wall of the kiln, below the fire doors as marked, which valve must be opened after the lime has been drawn out and the hot lime fallen into the pits and be left open more or less time, (according to the atmosphere) till the lime is cooled off sufficiently to prevent its slaking whenever drawn out.

The third part of my invention consists in the construction of the hot-air conductors X in combination with the draftflues Y, which conductors run in a nearly vertical line through the division wall B, by which combination the hot air, originating in the coalpits, is made available in a great deal better and easier way than heretofore practiced, while I thereby also create a horizontal hot-air draft sufficient to feed the fires and drive the flames right across the kiln from F out to  $h'$ , so as to secure the thorough burning of all the stones at their farthest extremity from the fires, which cannot be otherwise effected, all other kilns being too wide at that place so that the fire ascends along the saddle or arch to the top thereof burning the lime at those places to dust without converting the outside stones to lime. My invention is a remedy for this objection by constructing one of these conductors and flues in the wall B opposite the center of each fire flue arch, thereby giving the desired horizontal hot-air draft.

The fire grating is 5 feet above the ground and sustained by a series of arches C at intervals of 4 inches apart, in these intervals are left open the flues  $i$  to allow the coals to fall down and keep the fire chamber clear thereof, six inches above the grating begin the fire flues F, the object thereof is, to prevent the ashes or coals from mixing with the lime and to allow iron grate bars to be put in, should coal be used as fuel, in such a case however the whole of all the intervening spaces between the arches C should be left open, with the exception of one row of top bricks so as to securely bind the arches C together.

All the bricks used in the construction

of the inside of the kiln, with the exception of those in the drawpits from L down to O and those inside the ungula, should be the very best kind of firebricks so as to prevent the necessity of stopping for repairs, from V up to the top may also be lined up with good common bricks, as experience has shown that they will stand for at least one season. From R up to V there should be about 4 inches of leached ashes or slaked lime behind the lining so as to prevent the heat from escaping through and cracking the wall. The flues  $f'$  should all be cast iron pipes because these are less liable to let the heat escape from the inside into the outerwalls and may be securely closed up with wooden stops to keep the air out.

E,  $a'$ , C', and  $h'$  should be cast iron doors hung in frames, as should also be N.

The line marked D in the drawpits is a division wall to make the lime run into the drawpits.

The outside walls of this kiln should be built of good durable stones and constructed with iron rods or anchors (securely fastened) over the arch of the drawpits and on a level with R, and there should be a wooden frame around the kiln on a level with V and one at W, and further such precautions taken as to secure it most effectively from the action of the heat and pressure.

Having thus fully described my improved doubled lime kiln what I claim therein as new and desire to secure by Letters Patent is:

1. I claim the construction of a division wall B in combination with the 2 adjoining fireplaces E and walls  $g'$  to secure the even burning of both sides when desired.

2. I claim the combination of the solid spherical triangle I in connection with the form of the canals from R down to K for uses and purposes as hereabove more fully described.

3. I claim the particular construction of the hot-air conductors X in combination with the division wall B and in combination with the draft flues Y, to procure the horizontal draft of hot air and make the same serviceable so as to act direct on the limestone in the manner and for the uses as hereinbefore fully described.

Dated February 22, 1858.

B. ZWART.

Attest:

N. ANSLYN,  
B. MULLER.