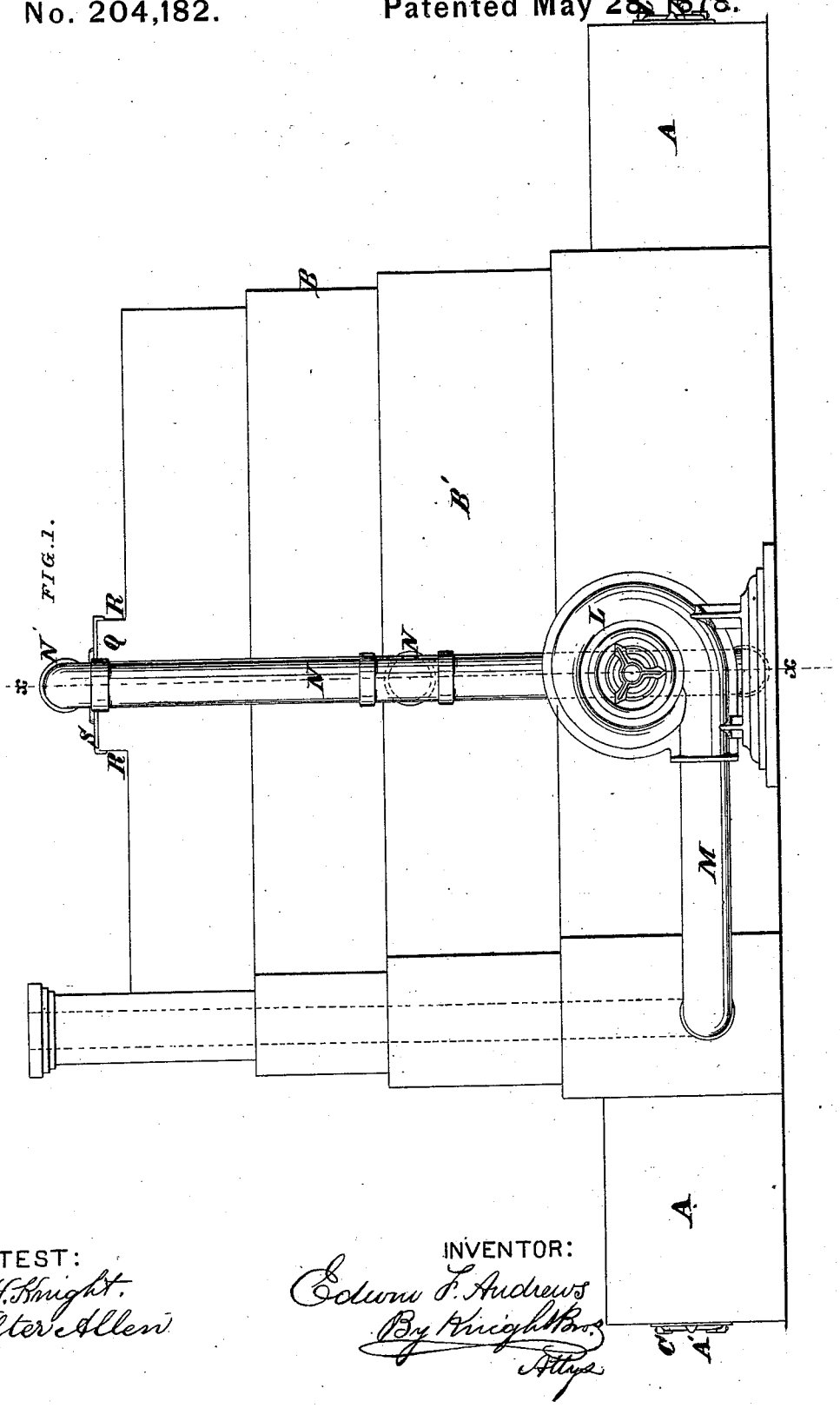
3 Sheets—Sheet 1.

E. F. ANDREWS.
Brick-Kiln.

No. 204,182. Patented May 28, 1878.



ATTEST:
Geo. H. Knight.
Walter Allen

INVENTOR:
Edwin F. Andrews
By Knight Bros.
Attys

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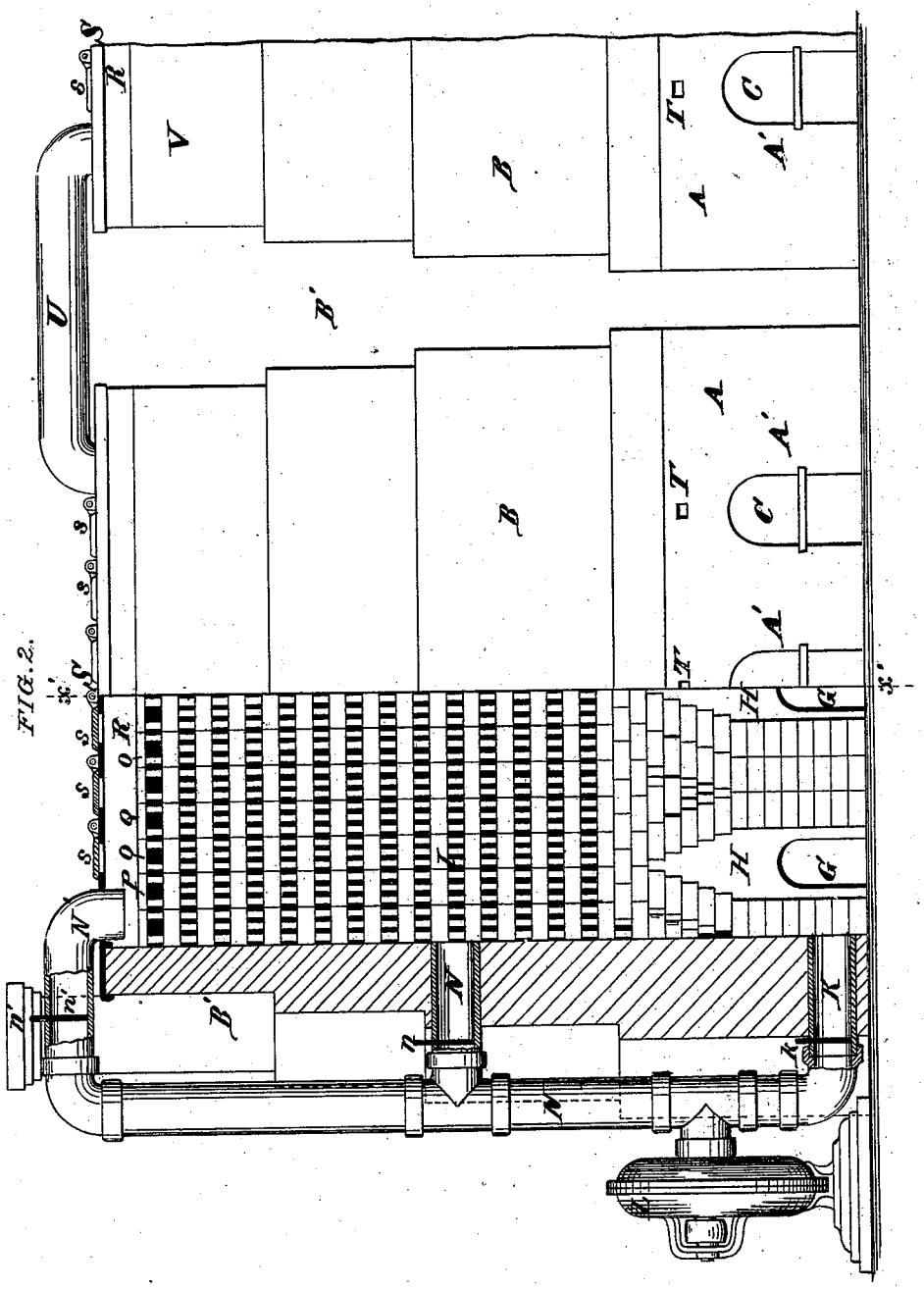

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E. F. ANDREWS.

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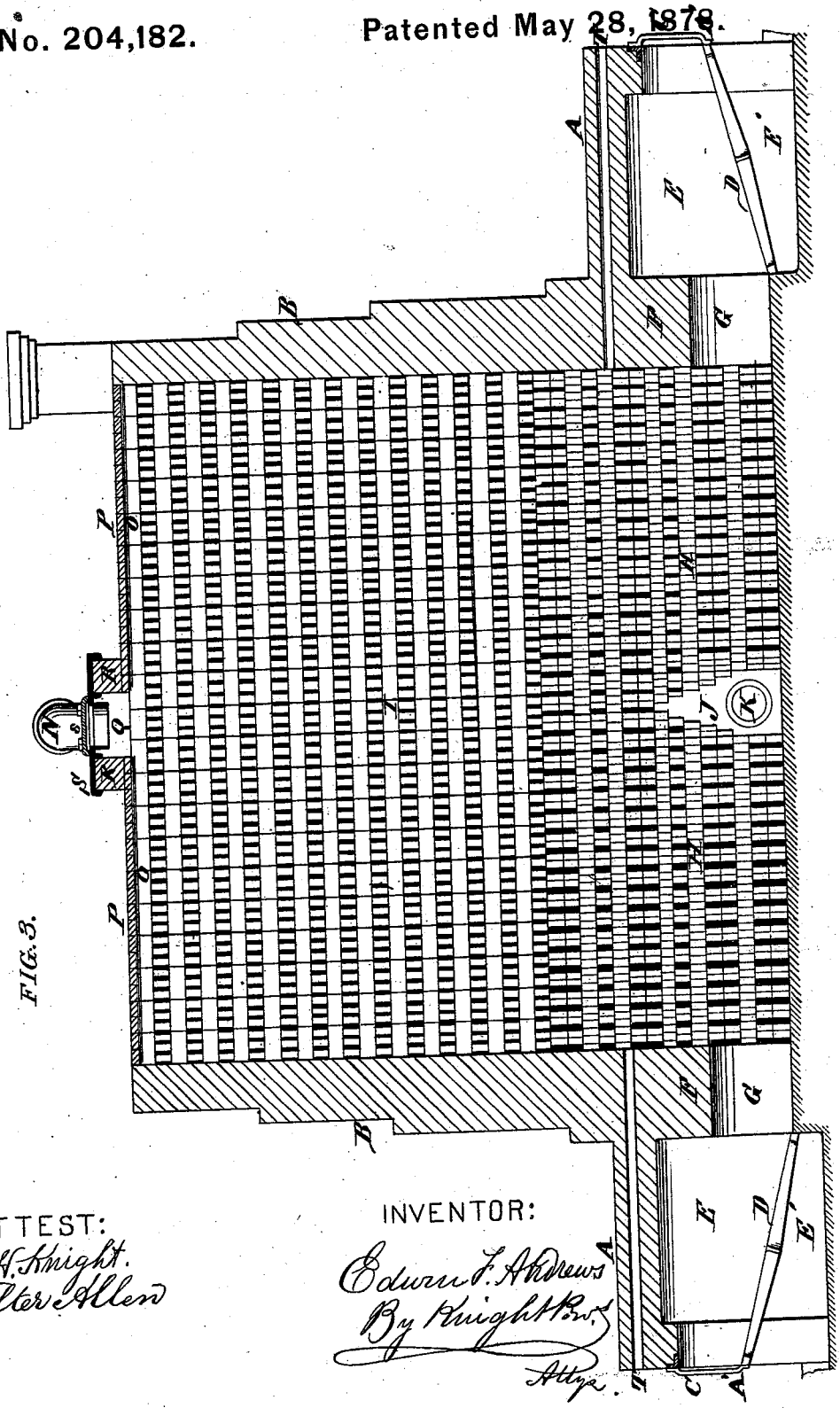

FIG. 3.

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UNITED STATES PATENT OFFICE.

EDWIN F. ANDREWS, OF ST. LOUIS, MISSOURI, ASSIGNOR OF ONE-THIRD HIS RIGHT TO THADDEUS S. SMITH, OF SAME PLACE.

IMPROVEMENT IN BRICK-KILNS.

Specification forming part of Letters Patent No. **204,182**, dated May 28, 1878; application filed March 28, 1878.

To all whom it may concern:

Be it known that I, EDWIN F. ANDREWS, of the city of St. Louis and State of Missouri, have invented a certain new and useful Improvement in Brick-Kilns, of which the following is a full, clear, and exact description, reference being had to the accompanying drawings, forming part of this specification.

The first part of my improvement consists in forming the top of the kiln with parallel flues beneath a closed top, formed of bricks laid flat, and which is smeared with mud to render the joints tight. A main flue extends from side to side of the kiln transversely to the above flues, and this has a cover of metal or other material, with doors or dampers in it. In communication with the last flue is a pipe leading to a suction-flue, by which an artificial draft is established.

The suction-flue has also pipes extending to an arch reaching across the lower part of the kiln at right angles to the fire-arches, so that the products of combustion all enter this cross-flue, and are evenly diffused throughout the kiln.

The blower may have pipes in communication with the kiln at any part between the top and the bottom, so as to enable the products of combustion from the furnaces to be drawn to any part of the kiln.

I do not confine myself to any particular place or places to attach the fan, nor to any particular number of flues, either in the arches or at the top of the kiln. Nor do I confine myself to the fan alone for sucking or drawing off the cold air or water-smoke. An air-pump, steam-jet, or other device may be used to do this work; but of the different devices I prefer the suction-fan.

To appreciate the value of this invention, comparison should be made, first, with the arched and chambered kilns used successfully in Europe, which save in fuel, but are rejected in this country on account of the high price of labor, which more than makes up for the saving in fuel; and, second, with the ordinary open kilns of this country, which economize the labor of handling bricks to the utmost, but are wasteful in fuel.

It needs no argument to prove that if a method can be devised to force and regulate the draft and confine the heat, and which can be applied to our ordinary kilns at small expense, the advantages of both classes of kilns would be combined, and the minimum secured both as to labor and fuel.

An examination of the following description of this invention will show that by a simple device applied to ordinary kilns the advantages of arched kilns are secured.

To compare it with the open kilns intelligibly, we must first examine into the method of burning in them, and into such scientific principles as are developed in the operation.

First in order is the drying off of the kiln. Here is met the first great difficulty, which is to get the heated gases to ascend through the mass of the bricks, which present a large aggregate of cooling and condensing surfaces to the rising gases. When it is remembered that the greatest bulk of the gases resulting from the combustion of wood and soft coal goes to form watery vapor, it will be understood that in the early stages of drying off the vapor is rapidly condensed on the surface of the bricks, causing the so-called "sweating" of the bricks. Wood is used as a fuel in preference to coal for this operation, because it gives little soot, while, on the contrary, coal under slow combustion give large quantities, which, being deposited on the wet surfaces of the bricks, clogs up the interstices so rapidly as to prevent the successful burning.

It will be seen that this invention creates at the very outset a positive draft throughout the mass of the bricks, which not only carries the heated gases up into the kiln with rapidity and certainty, but enables the use of coke and anthracite coal in drying off, because these coals will burn freely when a draft is applied, and, being free from hydrogen, their combustion produces carbonic acid and carbonic oxides without any watery vapor whatever, and consequently they prove efficient in absorbing the moisture from the partially-dried bricks. Instead of the bricks undergoing the sweating process, which often injures their form and strength by their being crushed while in a soft state, they will become evener and harder all the time.

The superiority and desirability of the invention in the early stage of burning is so self-

evident that I will proceed at once to the last stage.

After the water-smoke is driven off, the main efforts of burning are directed to getting the heat up into the kiln. Here again the advantages of this invention are apparent. After the bricks attain a red heat there is ordinarily too much draft, and the difficulty is to repress the draft and distribute the heat evenly throughout the kiln without melting any of the arches. It is here that the greatest waste of fuel occurs, and that this appliance shows its value, for by its means the draft may be carried off, so that just enough fuel is used to increase the heat without any waste.

Figure 1 is an end elevation of the walls of a kiln with fan attachment. Fig. 2 is a side elevation, with part in section at *x x*, Fig. 1, showing flue-connection with another kiln. Fig. 3 is a section at *x' x'*, Fig. 2.

A A are side extensions from the lower part of the kiln, which contain the series of furnaces A' upon each side. B B are the side walls, and B' B' the end walls, of the kiln. In each furnace, C is the furnace-door. D is the furnace-grate; E, the fire-chamber; E', the ash-pit, and F the fire-arch. G is the flue leading into the arch H of the kiln. The arch H is set in the usual manner when filling the kiln for burning. The walls of the kiln between the furnace and the kiln should be built of fire-bricks as high as the top of the arch, and the balance of the wall of any ordinary bricks. Above the arch H the bricks are set in the usual manner at I. J is a flue or arch running through the kiln at right angles with the arches H, and communicating at the end with the suction-pipe K, which extends to the fan L, so that in the commencement of burning the cold air may be drawn from the bottom of the kiln, which will immediately be followed by the heated gases from the furnace, the condition of each arch being regulated by opening or closing the doors of the furnace. The fan discharges into the smoke-stack through a pipe, M. N N and N' are suction-pipes, leading from the kiln to the fan respectively from the top of the kiln and from a central portion and from the bottom.

Above the main body I of the kiln there are horizontal flues O, formed by leaving out every third brick in setting one of the upper tiers. The last tier in the kiln is preferred; but two or three tiers below the top would do nearly as well. The flues O are shown in the top tier in the drawing, and are covered by the first tier of flatting P. These flues extend from one side wall, B, to the other, B. Two tiers of flatting should be used. The last or uppermost one should be of burned bricks, and carefully plastered with thin mud to prevent the escape of heat. These flues receive the smoke and heated gases and conduct them to the main flue Q, extending from end to end of the kiln, and communicating at one end with the suction-pipe N. The main flue Q is formed of walls R, supporting a cover, S, containing a number of dampers, *s*, by which the draft of the kiln is regulated, and through which the exhausted gases and smoke are allowed to escape. All of these dampers may be partially opened at the same time, or some opened and others closed; or, should there be a backward place in the kiln, all the dampers may be closed and the flatting P over the backward place loosened, by which means the heated currents from the kiln are conveyed to the backward place. T are peep-holes, through which the operator inspects the condition of his arches in the body of the kiln. *k*, *n*, and *n'* are dampers in suction-pipes, said dampers enabling the operator to use the entire force of the fan on any one point by opening one of the dampers and closing the other.

In order that my improvement may be more fully understood, I will now give a description of the mode of operation.

This kiln being ready for firing, the first thing to be done is to see that the dampers *s* over the main flue Q at the top of the kiln are closed and all openings plastered with thin mud. Fires are now built in the furnaces E, the damper *k* in suction-pipe K is fully opened, and the fan is set in motion. As soon as all of the cold air has been drawn out of the lower part of the kiln, which will be known by the heat being thrown off by the fan, the damper *k* is partially closed, and the dampers *n* and *n'* opened a little more as soon as the bricks are thoroughly dried in the lower part of the kiln, which will be known by the heat of the pipe leading from that point. The damper *k* is closed tight when the heat of the pipe communicating with the center of the kiln shows the bricks to be dry there, and damper *n* should be closed and damper *n'* fully opened. When the water-smoke ceases to come off at this point the kiln is known to be thoroughly dried off. Now stop the fan, close the damper *n'*, and partially open dampers *s s* in the cover S of the main flue at top of kiln. These may be opened or closed at the will of the operator until the kiln is thoroughly burned, which will be known by the color of the burning bricks (which in most clays is almost white) and by the settling of the kiln. As soon as the burning is finished the dampers should be closed down, all places where heat can escape plastered with thin mud, and the furnace-doors closed and plastered at their edges. A new kiln being ready to burn, the pipe-connection U should be made, the fan moved to the opposite end of the kiln V, and connected with the bottom of the kiln by suction-pipe K. The new kiln is made as air-tight as possible, except where connected with the fan. Small openings are now made in the ash-pits of the burned kiln. The fan is now set in motion, and as the cold air is drawn out of the unburned kiln V an equal quantity of cold air will rush into the burned kiln, forcing the heat in the burned kiln over into the unburned kiln. When the new kiln is thoroughly dried off, the dampers

s over the main flue at the top of the kiln are opened, and the operation continued as in first kiln.

I claim as my invention—

1. The combination, with a closed-top kiln, of a suction-fan or similar mechanical device having connection with the interior of the kiln at different heights, substantially as and for the purpose set forth.

2. The combination in a covered kiln, of main flue Q with one or more adjustable dampers, *s*, to regulate the draft through the kiln.

3. In combination, with a covered kiln, a series of small flues extending from the heads to a large central discharging-flue, Q, provided with a series of dampers, *s s*, substantially as set forth.

4. The large central discharging-flue Q, series of small longitudinal flues O, giving the central discharging-flue connection with every course of bricks at the top of kiln, in combination with a cover composed of flatting P, as and for the purpose set forth.

5. The furnaces A, placed outside the kiln, in combination with the arches H in line with the furnaces, and an unobstructive central cross-arch, J, extending from side to side of the kiln, substantially as set forth.

6. The combination, in a closed kiln, of arches H and J, extending, respectively, from side to side and end to end of the kiln, and suction pipe or pipes and suction-fan L, or other equivalent device, for the purpose set forth.

7. The combination, in a kiln with sealed top, of the furnaces A, arches H and J, the main flue Q at top, provided with a series of dampers, *s*, for the purpose set forth.

8. The combination, in a sealed-top kiln, of the outside furnace A at base of kiln and transverse discharging flue or flues, covered by a series of dampers, for the purpose of localizing caloric currents, as described.

9. The combination of outside furnace A′, small series of flues O, and main flue Q, with series of dampers *s s*, substantially as and for the purpose set forth.

10. In a covered kiln, with a series of small flues, O, main flue Q, adjustable dampers *s s*, and fan or other suction device to draw off the water-smoke before the draft is established by the action of the fire in the furnace or furnaces.

11. The combination, with the suction device, vertical pipe, series of draw-pipes, and dampers, of the flues extending to the interior of the kiln at two or more points, for the purpose set forth.

12. The combination, with a burning or burned kiln and an unburned kiln, of a flue or flues connnecting the kilns at their upper part, and a suction device in communication with the interior of the unburned kiln, for the purpose set forth.

EDWIN F. ANDREWS.

In presence of—
SAML. KNIGHT,
GEO. H. KNIGHT.