G. E. LUCE.

METHOD OF KILN SETTING AND BURNING.

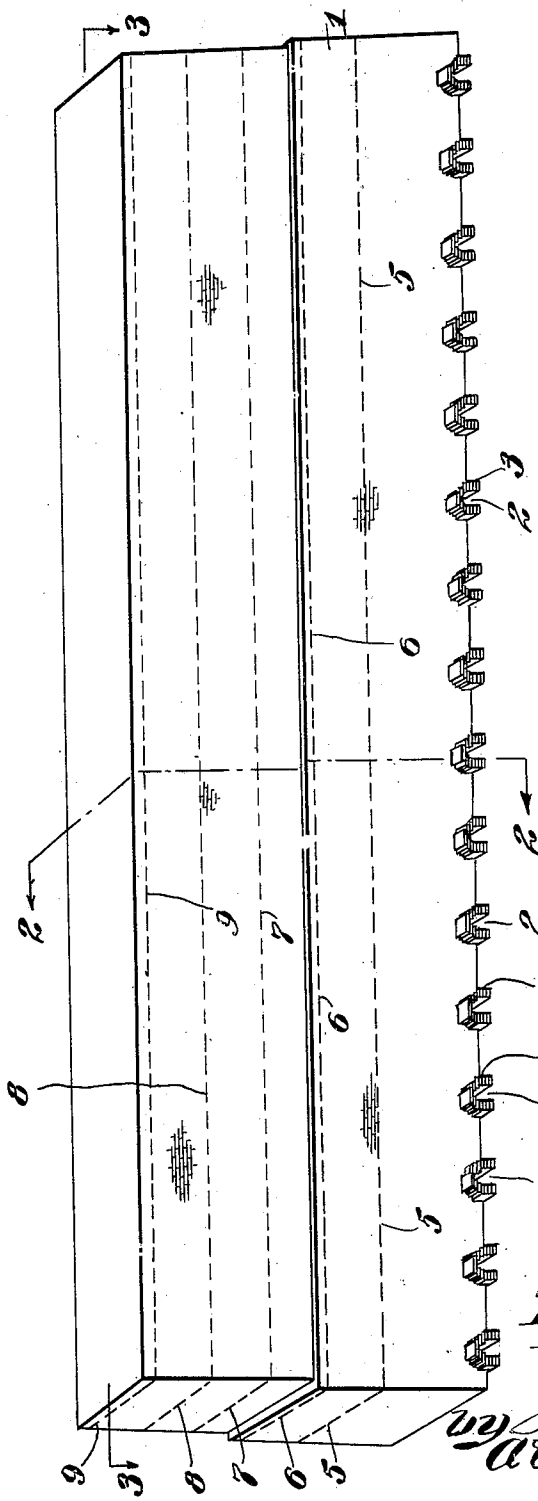
APPLICATION FILED MAR. 27, 1919.

1,369,752.

Patented Feb. 22, 1921.

3 SHEETS—SHEET 1.

Fig. 1.



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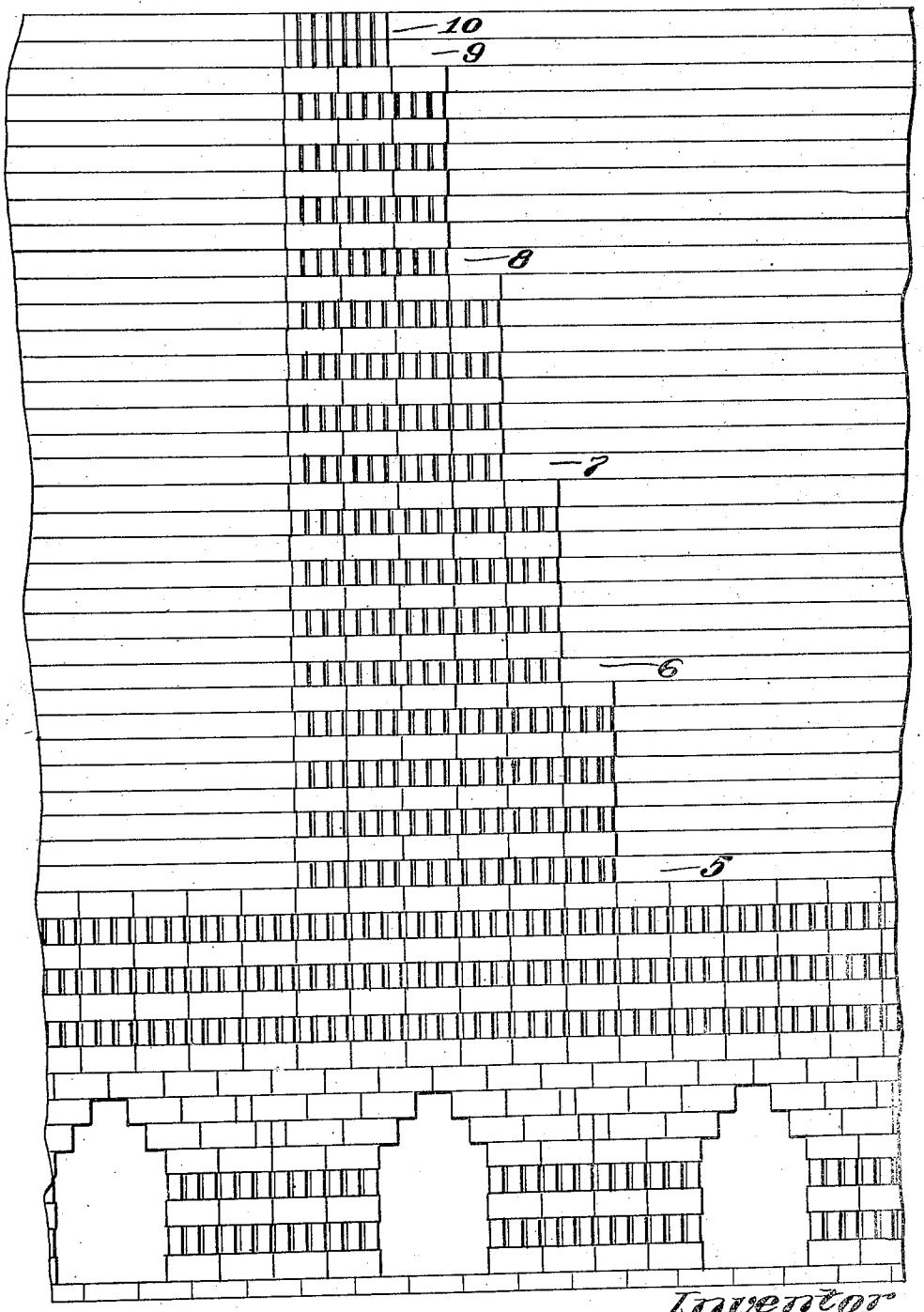


Fig. 2.

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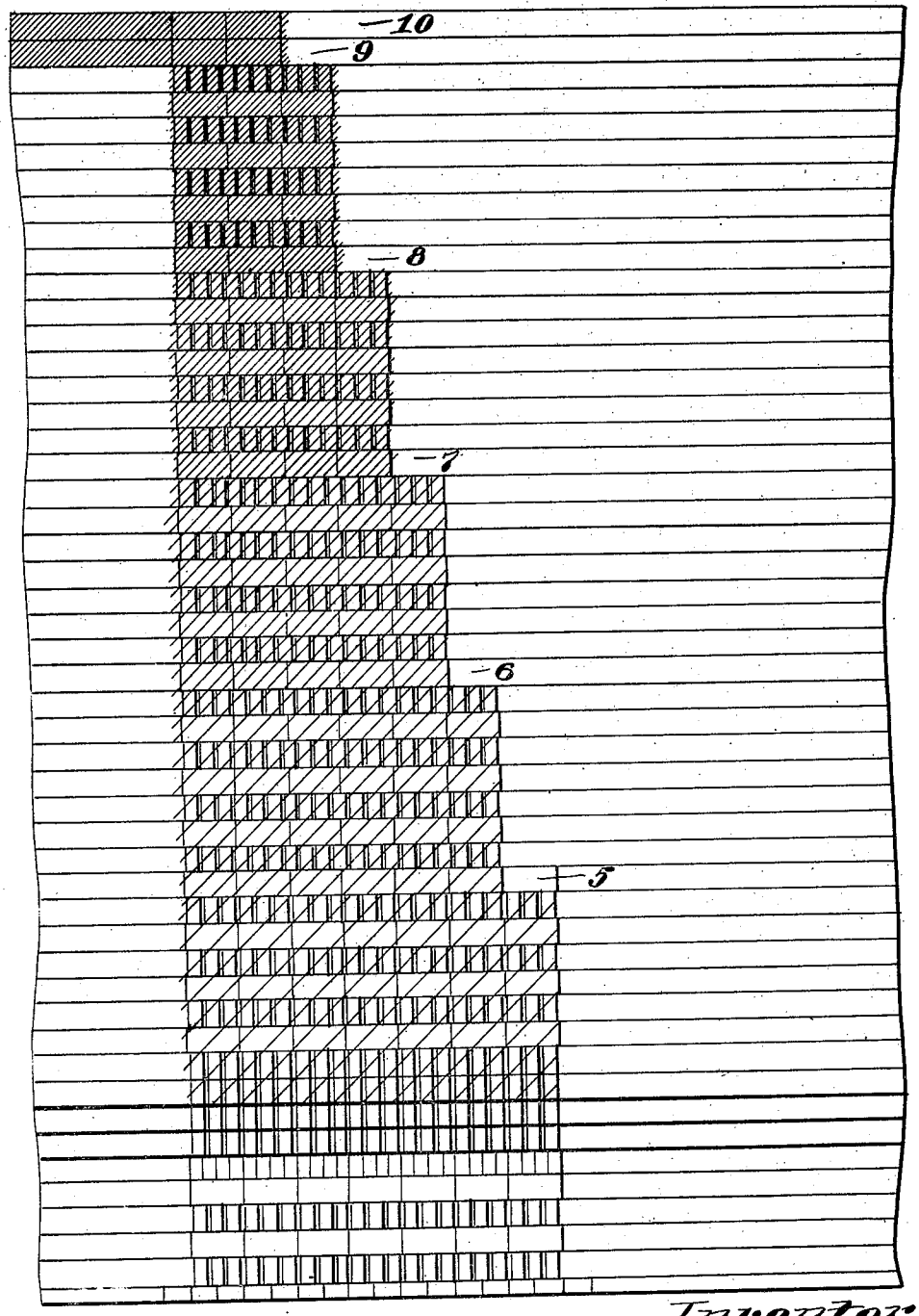


Fig. 3.

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UNITED STATES PATENT OFFICE.

GRAFTON E. LUCE, OF CHICAGO, ILLINOIS.

METHOD OF KILN SETTING AND BURNING.

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To all whom it may concern:

Be it known that I, GRAFTON E. LUCE, a citizen of the United States, and a resident of Chicago, Illinois, (whose post-office address is No. 140 North Pine avenue, Chicago, Illinois,) have invented an Improvement in Methods of Kiln Setting and Burning, of which the following description, in connection with the accompanying drawings, is a specification, like letters on the drawings representing like parts.

My present invention relates to the setting of kilns for burning brick, tile and other clay products and to the method of burning a kiln thus especially set. In carrying out my invention, I contemplate the building or setting of the kiln, with one or more relatively tightly set courses of brick and at predetermined heights or levels throughout the kiln. Preferably where a plurality of such tight courses are employed, I prefer to utilize a graduated spacing or setting of the successive tight courses, using such variations in the spacing as has been found advisable in practice. With the special object in view of burning the kiln by my improved and novel process, I contemplate the setting of a standard sized kiln, for example, a kiln fifty six brick wide or approximately thirty eight feet and forty eight brick, or about fifteen feet high and of thirty arches or one hundred twenty feet in length, more or less, with these tight courses, including the topmost platting, thus dividing the kiln into five horizontal zones or strata. This division is, of course, for illustrative purposes only and varying sized brick and different bodies of clay may require variations in the number and setting of the tight courses to carry out my invention. This method of building or setting a kiln can be readily carried out either by hand or by means of mechanical setters, and the desired tightened course or courses can be quickly arranged by simply filling in an additional number of brick on the desired course in addition to the brick already set therein. Where a mechanical setter is employed, the topmost course could be that selected for the closer setting in the units by which the kiln is built and thus my novel type of kiln and the method of building the same can be readily set by mechanical means.

The object of setting a kiln as above briefly outlined, with one or more tightened courses at predetermined levels and preferably in graduated degrees of tightness throughout the kiln is primarily to facilitate and to automatically control the burning. My improved burning process is a distinctly novel method and enables the burning process to be applied to the especially set type of kiln which I have devised.

Because of the several tightened courses of brick, I provide predetermined means to choke or hold the pressure and heat within the kiln between such tightened course and the fire, as will be more fully explained hereafter. I also prefer to entirely eliminate the danger of choking the kiln by steam and to rely mainly upon the tightened courses for the several steps in the burning process rather than upon any such uncertain tightening or choking as that given by escaping steam. To this end, I prefer to first water smoke the entire kiln and for this purpose also I have discovered that the tight end course of brick is important In order to effect the water smoke preliminary drying of the kiln, a relatively low fire is first supplied for the requisite number of hours to the arches. In fact, due to the first tightened course of brick above the firing arches, it is substantially impossible to maintain any large degree of heat or fire as there is not enough draft through the kiln for this purpose. The tight course therefore compels the operation of first water smoking and eliminates all danger of the kiln "running away with itself" or getting hot enough to damage the product at any point. I believe that this method of utilizing a course of brick set relatively on— or a plurality of such tightly set courses— as means coöperating with the burning of the kiln,—to be a distinct novelty in this art and I wish to claim the same broadly.

Heretofore it has been attempted to burn kilns of brick by first choking the kiln through the super-abundant supply of steam generated by a relatively high and intense heat applied to the kiln from the beginning of the burning. This prior method of choking a kiln relied upon the evaporation of water or moisture from the green brick faster than the draft of the kiln could possibly carry it away, thus forming a damper or blanket of steam. Such choking, however, was necessarily indefinite in position, location, time, and extent and the density

of this blanket of steam necessitated a relative intense fire greater than the green brick could properly stand thereby damaging the product. Nor was there any possibility of effecting such a choking by steam at successive or at predetermined points throughout the kiln. My present invention obviates the difficulties and uncertainties heretofore experienced with such prior method, and I rely upon a positive, predetermined and definite means to choke the kiln at such plurality of points, as desired. I find that three elements are capable of being utilized in thus choking the draft through the tightened course of brick, viz. the decreased spacing in the setting, the friction of the draft due to the difficulty of initiating the draft through moist brick and the natural choking at this tightened course as the air expands and the heat increases in the kiln below it. By thus predetermining the height and extent of the portion of the kiln to be burned, I am enabled to accomplish the very important results of quickly and easily raising and maintaining the desired pressure in this particular portion, section or zone of the kiln and also very greatly conserving fuel, only enough heat and pressure to burn that section of the kiln under the tightened course being required. Thus in burning the brick kiln under the first tightened course above the arches, for example, after the kiln has been water smoked, the heat and pressure are supplied and maintained in this lowermost zone or section—the proper heat to burn the brick weatherproof and shrink them to normal size, and the tightened course being the topmost of the brick in this section being burned are the last to be vitrified or fused and to shrink, necessarily aided in holding the pressure and heat, choking the kiln up to this course until it is shrunk. Thereupon with the shrinking of this tightened course, the pressure in the section below it is automatically released and the draft and heat passes through into the section above, to be again choked by the next succeeding tightened course. Whereupon the further supply of heat and pressure to the kiln raises the pressure and the heat in the section under the next tightened course until this portion or section of the kiln has been burned and the topmost course defining the section has been vitrified or fused and those brick shrunk to permit the extension of heat to the next section above and so on until the top of the kiln is reached. An important result of this process,—and an object both of the kiln setting and burning features of the invention,—is the provision of means permitting the burning of the kiln in predetermined sections substantially in an automatic manner; preventing the escape of heat beyond any section until that portion is substantially burned; maintaining the pressure; eliminating the danger of other burning and greatly conserving fuel because only heat and pressure substantially sufficient for the burning of one section at a time are supplied. By retaining all the heat in the arches from escaping excepting as the successive sections are burned, the heat supply is thus forced to its highest efficiency and the setting of the kiln is spaced just sufficiently for the escape of fuel gases. As each tightened course of dried brick is burned, shrinking and enlarging the openings, a pronounced draft is exerted from the arches so that the operators can keep track of these successive stages in the burning, a pressure and draft being released from one section up into the next one not only by the shrinking of the brick, but also through the easier flow of heat past the now dried and burned brick, a dried brick offering much less friction than a wet or moist brick to the passage of such heat and gases.

Referring to the drawings illustrating in diagrammatic form my present burning process and showing a kiln embodying the invention—

Figure 1 is a view in perspective illustrating a 16-arch kiln of standard type;

Fig. 2 is an enlarged view on the line 2—2 of Fig. 1 illustrating the method of setting the kiln with a plurality of tight courses therein;

And Fig. 3 is a fragmentary cross sectional view on the line 3—3 of Fig. 1.

As shown in Fig. 1, a kiln of typical field type, is shown adapted for burning with oil, gas, or powdered coal wherein the sides are scoved or walled as usual. This has the usual construction of arches (2) which as shown in Fig. 1 are built out slightly to "dog houses," 3 to facilitate the use of the burners for oil, gas, powdered coal, or the like. The kiln may be set as is customary throughout the first benches and to a height sufficient or appropriate for the first or lowermost section or use, whereupon a tightly set or closer spaced course of brick is set.

As shown in the drawings, this tighter course No. 5, is the sixteenth course from the bottom and this setting is preferably nineteen over six, the normal setting up to the sixteenth course being shown as six over two brick. Thereupon the succeeding courses or units may be set with the usual spacing but preferably as shown,—it being understood that I contemplate employing any desired mechanical setter for building the kiln and setting all courses, the relatively tight or closer set courses being formed simply by filling in the extra brick noted by hand or tightening the courses as desired. This next unit may also be of varying height and extent but as herein shown, I have placed the next tightened

course, the twenty-fourth course from the bottom, setting this course still closer than the first course 5, viz., sixteen over five. The next tightened course is shown as at the thirty second row, No. 7, in the drawings and set thirteen over four. A tightened course 8 set at the fortieth course is formed in the proportions of ten over three and the topmost courses 9 are preferably formed with the platting as closers, as seven over two, thus just allowing spaces or vents for the water smoking and the escape of foul gases.

While I prefer to employ a successively tightened series of courses at predetermined points throughout the height of the kiln, as just explained, it will be understood that I am not thus limited and also that the tightened courses may be otherwise set or formed. One of the objects and advantages of having the tightened courses substantially increasing as shown in the drawings and as above explained is to provide a series of tight courses proportional to the volume of heat, draft, and burning to be carried out in the kiln. Thus as the lower portions, for example, the first two sections of the kiln have become burned, there is a greater volume of heat and force and consequently a slightly tighter setting for the tightened course No. 7, at the thirty second row to produce substantially the same result of holding in the pressure and heat until the shrinkage and burning of this course and releasing of pressure and heat to the next above section. Consequently I consider it advisable to have the spacing in successively tightened courses gradually lessened, approximately proportional to the gradual increasing volume of heat and pressure. As the mass and volume of heat increases, the pressure also necessarily increases within the kiln and in order to obtain substantially the same restraint and within the varying tightened courses, the graduated method of setting the same is preferable.

I find that in actual practice, my novel method of burning of this new type of kiln is carried out substantially automatically. As already explained, it is practically impossible, at the first portion of the burning, to supply any more fuel than sufficient to water smoke the kiln. As soon as the kiln has been water smoked and is relatively dry, then the first strata of brick may be burned, the tightened course 5 holding and retaining the heat and pressure in this portion or strata and practically burning it with every bit of energy supplied by the fires, utilizing the same with the greatest possible degree of efficiency. As the course 5 is the last to burn and shrink, this lower portion is substantially all burned before the draft will flow up into the second portion or strata and again be restrained by the tightened courses 6 thereabove. Upon this release of pressure in the lower section, when burned, and the raising of the heat into the second portion, the fires in the arches will be stimulated by this increasing draft and the burners will at once know that the first portion has been burned through. Accordingly the fires are increased to supply the heat and pressure necessary for burning the second portion but only a relatively slight increase is necessary as all this additional heat is retained in the tightened course 6. These methods are continued until the topmost platting is reached. I find that in actual practice, the heat is all retained under the respective layers of tightened courses, until they are successively burned through and during such burning the top of the kiln is relatively cool until the last course is burned, showing that no heat escapes but that all has been used to burn the brick. I prefer to set the platting as best shown at 10, Fig. 2 showing a course of burned brick set edgewise instead of otherwise and fast with the last course 9 of green brick. This can be readily accomplished when setting the kiln and each course is trued up with the other by a spade, shovel, or the like. Furthermore this method of platting enables me to set the same on the car when utilizing a mechanical setter and applying this platting to the topmost units in the kiln. As a matter of fact, the method of platting just described and shown gives a much tighter topmost roof to the kiln than that of ordinary setting, since the greatly increased length of the small vents through the topmost course increases the friction of passing heat, retaining the same within the kiln.

While I have described the method of utilizing a tightened course of brick and preferably a series of tightened courses, it will be appreciated that I do not limit this process to the burning of brick, as other clay products may be made and burned in this manner with equal advantage, nor do I limit the process to the type of kiln shown in the drawings. Furthermore as long as the tightened courses intercept the line of travel of the heat and gases, I may form the same horizontally, vertically, or otherwise and carry out the object and purpose of my invention and attain the advantages and result incident thereto.

My present invention is further described and defined in the form of claims as follows:

1. The method of setting a kiln which consists in dividing it into a plurality of horizontal portions adapted to be burned successively, the dividing means having provision for automatically changing as the burning progresses.

2. The method of setting a kiln which consists in dividing it into a plurality of horizontal portions adapted to be burned

successively, the dividing means having provision for automatically changing from a dividing to a conducting means as the burning progresses.

3. The method of setting a kiln which consists in dividing it into a plurality of horizontal portions adapted to be burned successively, the dividing means having provision for automatically changing proportionately to the progress of the burning.

4. The method of setting a kiln which consists in dividing it into a plurality of horizontal portions adapted to be successively burned by setting courses of brick with a different spacing from that of the kiln.

5. The method of setting a kiln which consists in dividing it into a plurality of horizontal portions adapted to be successively burned by setting courses of brick with a different spacing from that of the kiln, at a plurality of predetermined positions in the kiln.

6. The process of setting a kiln which consists in forming a plurality of divisions across the line of travel of the gases during burning, the dividing means consisting in a course of brick setting closer than the normal brick setting in the kiln, said dividing course being spaced sufficiently to permit a flow of gas and heat therethrough.

7. The process of setting a kiln which consists in forming a plurality of divisions across the line of travel of the gases during burning, the dividing means consisting in a course of brick setting closer than the normal brick setting in the kiln, successively tight courses being differently spaced.

8. The process of setting a kiln to control the burning which consists in setting a plurality of courses of brick relatively closely spaced to constitute means to retain heat and pressure in portions of the kiln adapted to be burned successively, said courses being so spaced as to permit the flow of heat and pressure therethrough upon burning and shrinking of the brick in said tight courses.

9. A kiln adapted to be burned, consisting in a plurality of courses of brick set with relatively less space than the normal setting of the kiln.

10. A kiln adapted to be burned, consisting in a plurality of courses of brick set with relatively less space than the normal setting of the kiln, said relatively spaced courses having proportionately graduated openings to the volume of heat and pressure controlled thereby.

11. A kiln adapted to be burned, having a plurality of separate courses of brick dividing the kiln, said courses being set in equal gradually decreasing spacing from the bottom of the kiln to the top.

12. A kiln of brick to be burned having a plurality of courses of brick set relatively tighter and in different spacing than that of the normal setting of the brick, comprising one course in the proportion of nineteen brick over six, a course in the proportion of sixteen over five, and of thirteen over four, ten brick over three, and seven brick over two brick, said courses being spaced from each other to divide the kiln into burning portions.

13. A kiln of brick to be burned having a plurality of courses of brick set relatively tighter and in different spacing than that of the normal setting of the brick, comprising one course in the proportion of nineteen brick over six, a course in the proportion of sixteen over five, and of thirteen over four, ten brick over three, and seven brick over two brick, said spaced courses being proportionately placed throughout the kiln to insure a substantially even burning of successive portions.

14. The process of burning clay products in a kiln which consists in first setting the kiln with a plurality of courses of brick therein set relatively closer than the normal setting of the kiln, applying a water smoking fire at the beginning of the burning, then supplying heat sufficient partly to burn that portion of the kiln between the arches and the relatively tight course until the said portion and said course of brick are sufficiently burned to release the heat and pressure through the said tight course to the next portion of the kiln, then supplying heat sufficient to bring the second portion to a burning temperature and so on.

15. The process of burning clay products which consists in setting same in a kiln with a plurality of heat and pressure retaining courses in the kiln extending horizontally across the line of travel of the heated gases thus adapting the kiln to be burned in successive portions, then supplying heat for drying the kiln, then supplying heat sufficient to vitrify or fuse the brick in the first portion adjacent the arches and maintaining heat and pressure therein until the dividing course of brick is sufficiently burned to shrink to release the heat and pressure into the next adjacent portion, then raising the heat to supply a fusing temperature to the second portion until the course dividing the second portion from the unburned part is sufficiently burned and shrunk to again release the volume of heat and pressure to the succeeding portion of the kiln and so on progressively until all portions of the kiln are burned.

16. The process of burning clay articles which consists in setting the same in a kiln with provision for dividing the kiln into a plurality of portions horizontally across the line of travel of the heat and gases, supplying a drying heat to the kiln and then supplying heat under pressure to bring the clay products into the first divided portion up to

the required heat for vitrifying or fusing and maintaining the same under sufficient pressure to force the heat into the brick in that portion, then during the progress of the burning when the pressure is released from the first section and the heat advances into the next section, an increased supply of heat under pressure is used to raise the next unburned portion to a fusing temperature under pressure for the burning and so on progressively until the kiln is completely burned.

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

GRAFTON E. LUCE.

Witnesses:
JAMES R. HODDER,
RACHAEL L. CLARK.