

No. 812,509.

PATENTED FEB. 13, 1906.

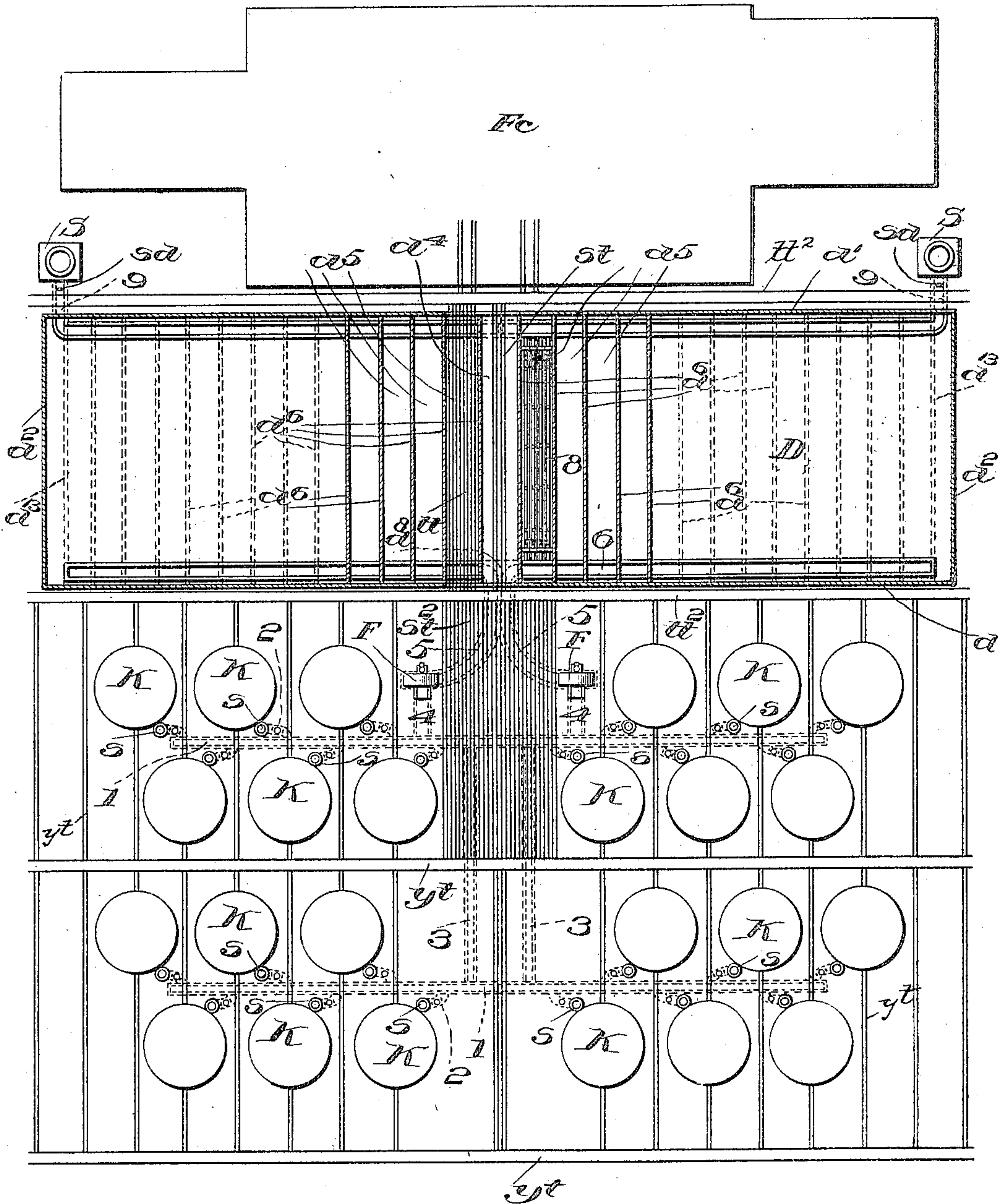
R. W. LYLE.

SYSTEM AND MEANS FOR DRYING AND BURNING CLAY PRODUCTS.

APPLICATION FILED NOV. 10, 1904.

4 SHEETS—SHEET 1.

Fig. 1.



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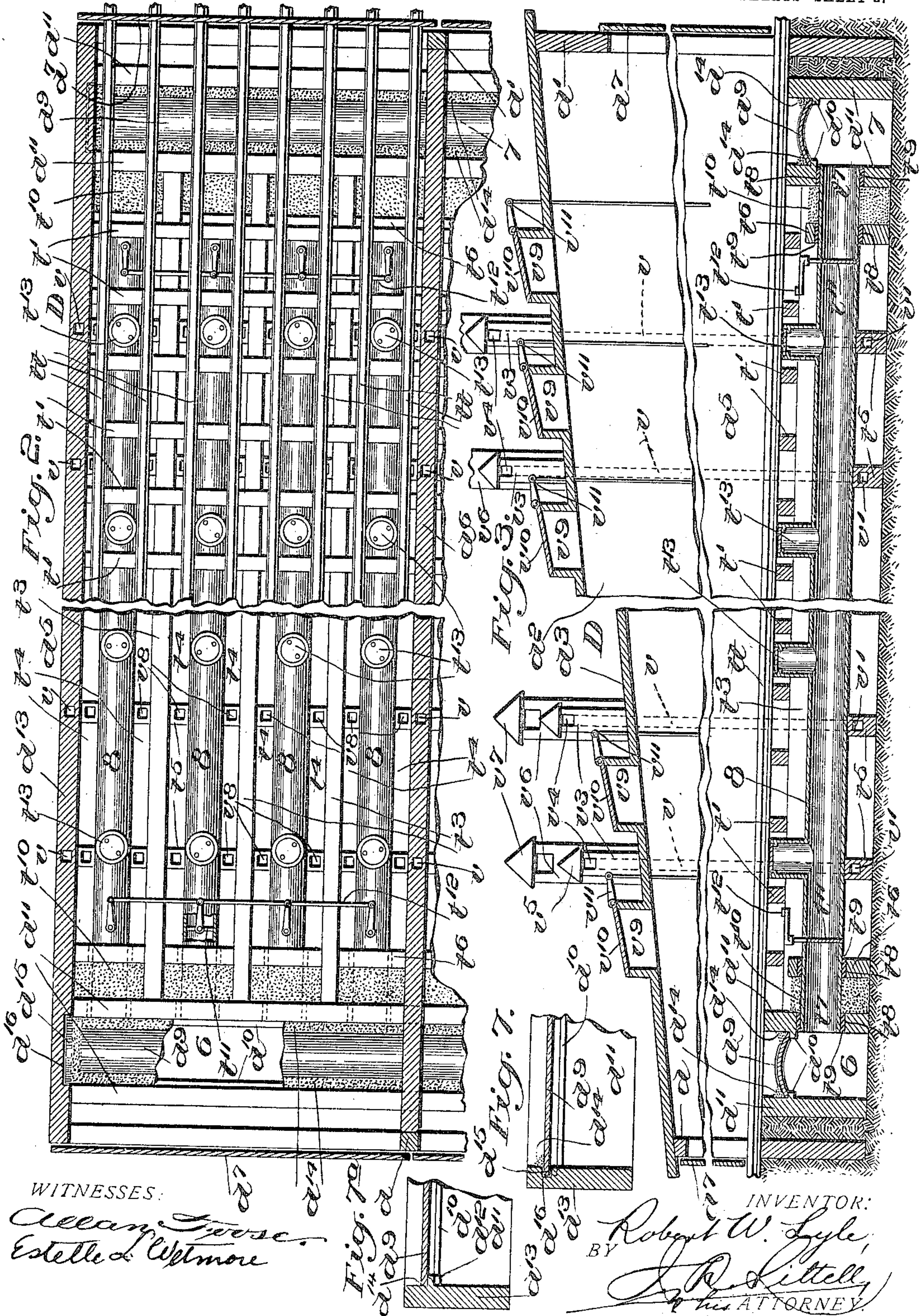
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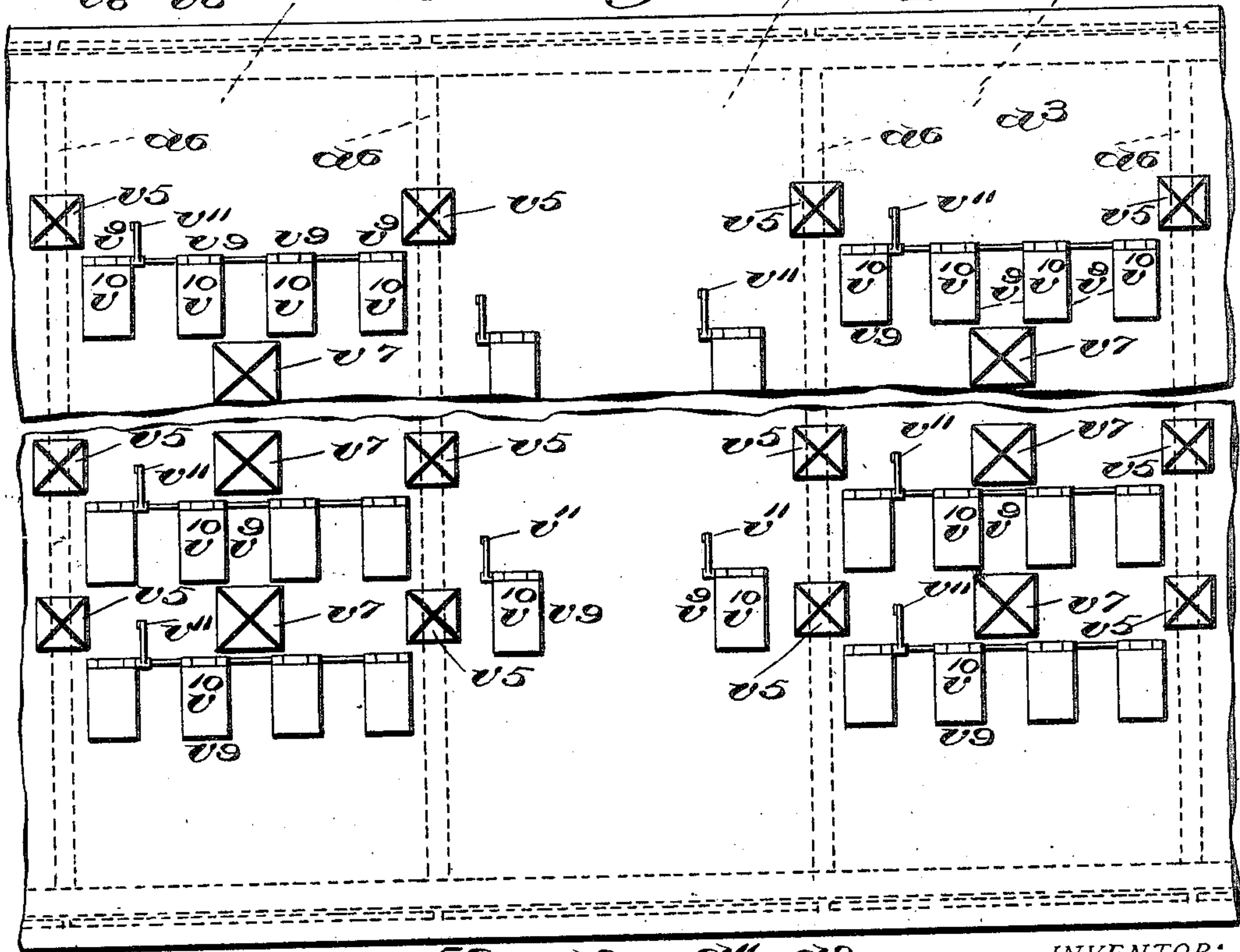
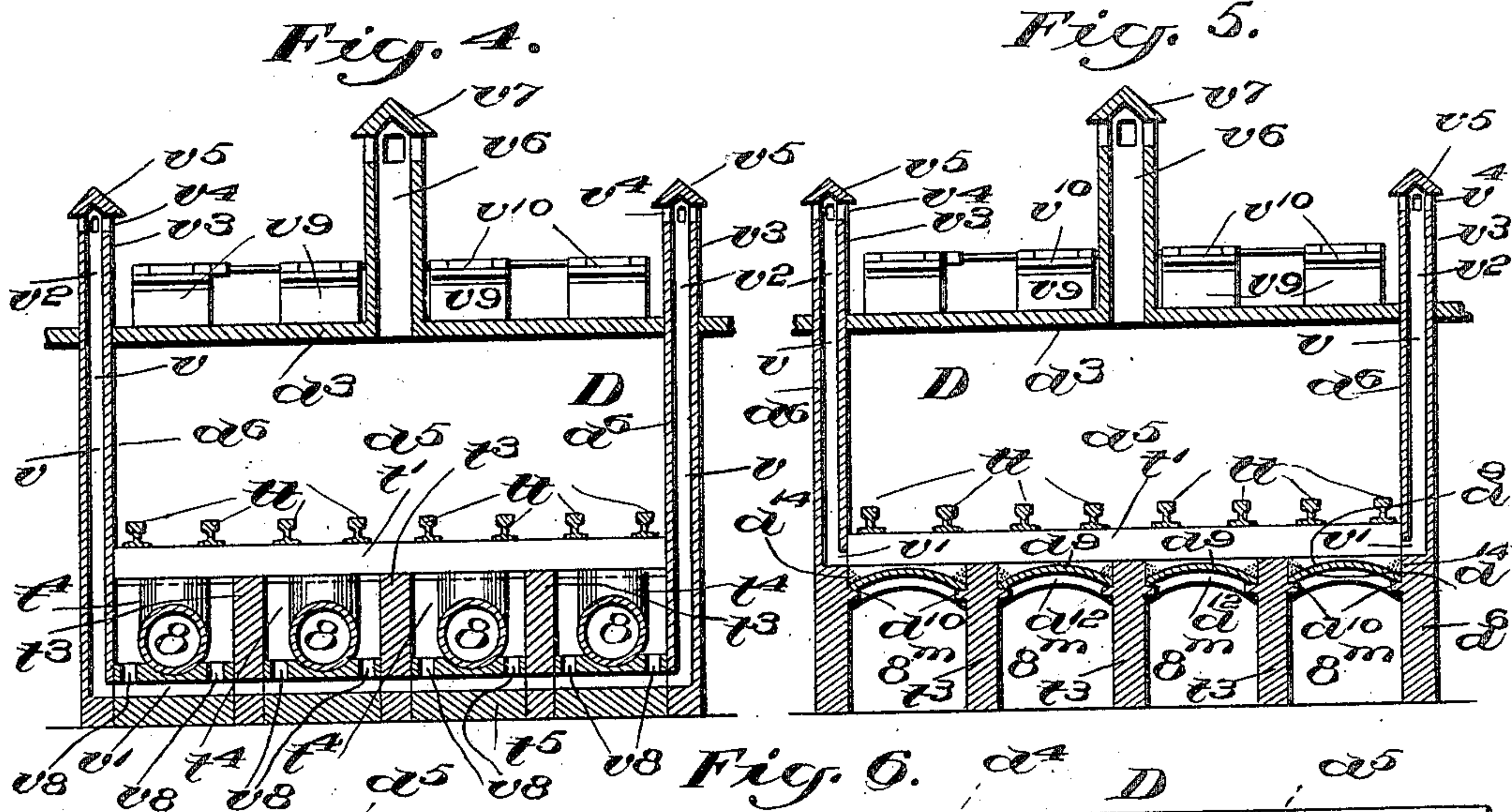
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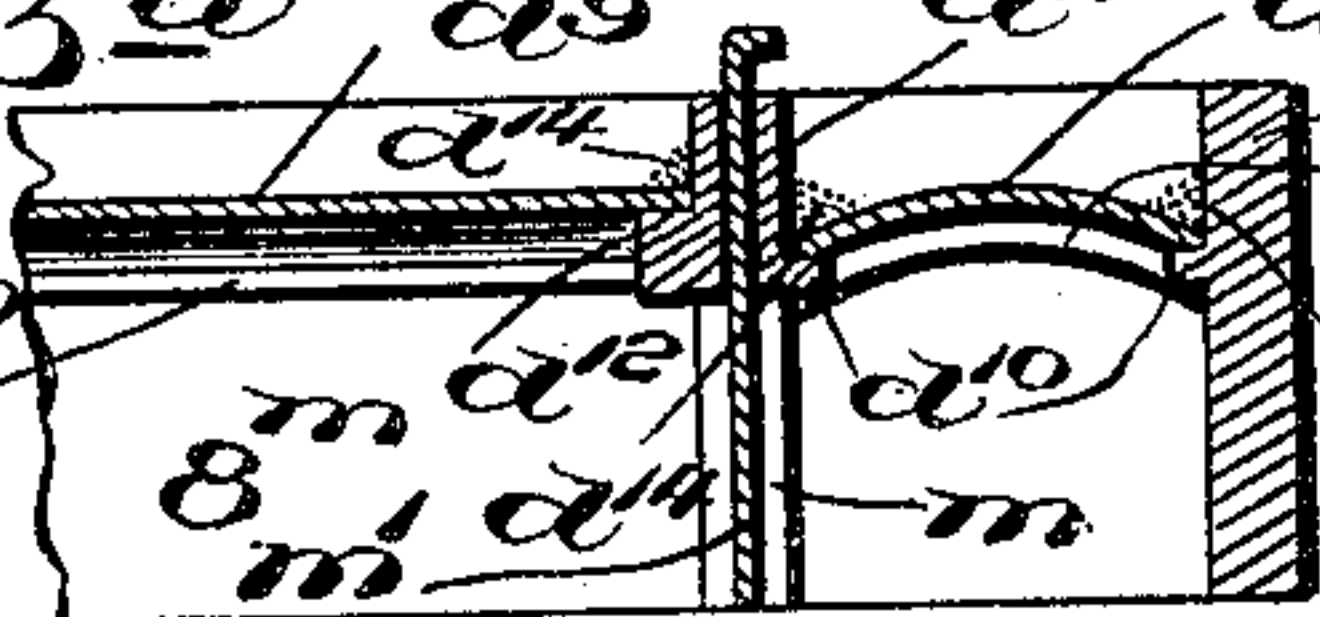
4 SHEETS—SHEET 3.



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4 SHEETS—SHEET 4.

Fig. 8.

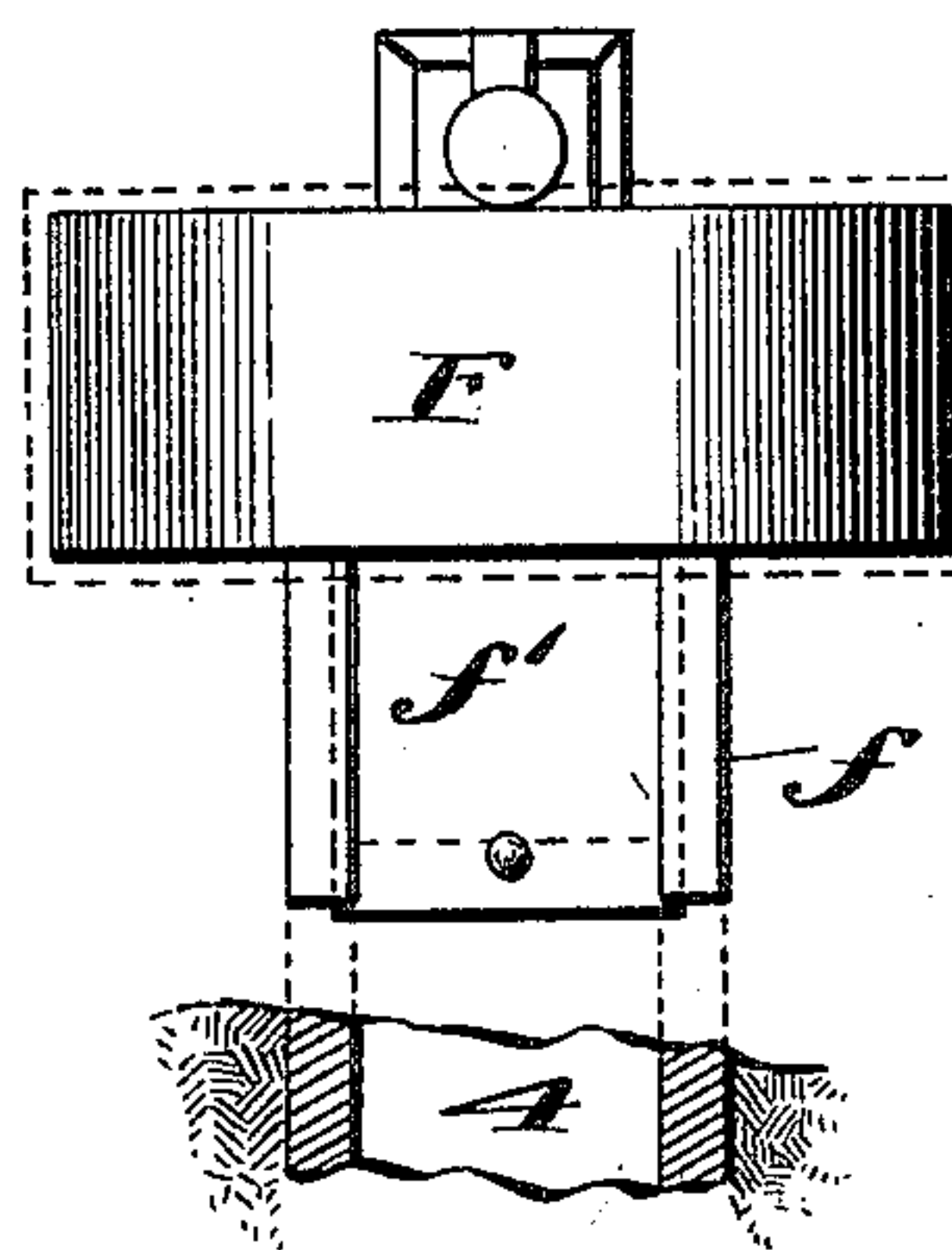


Fig. 9.

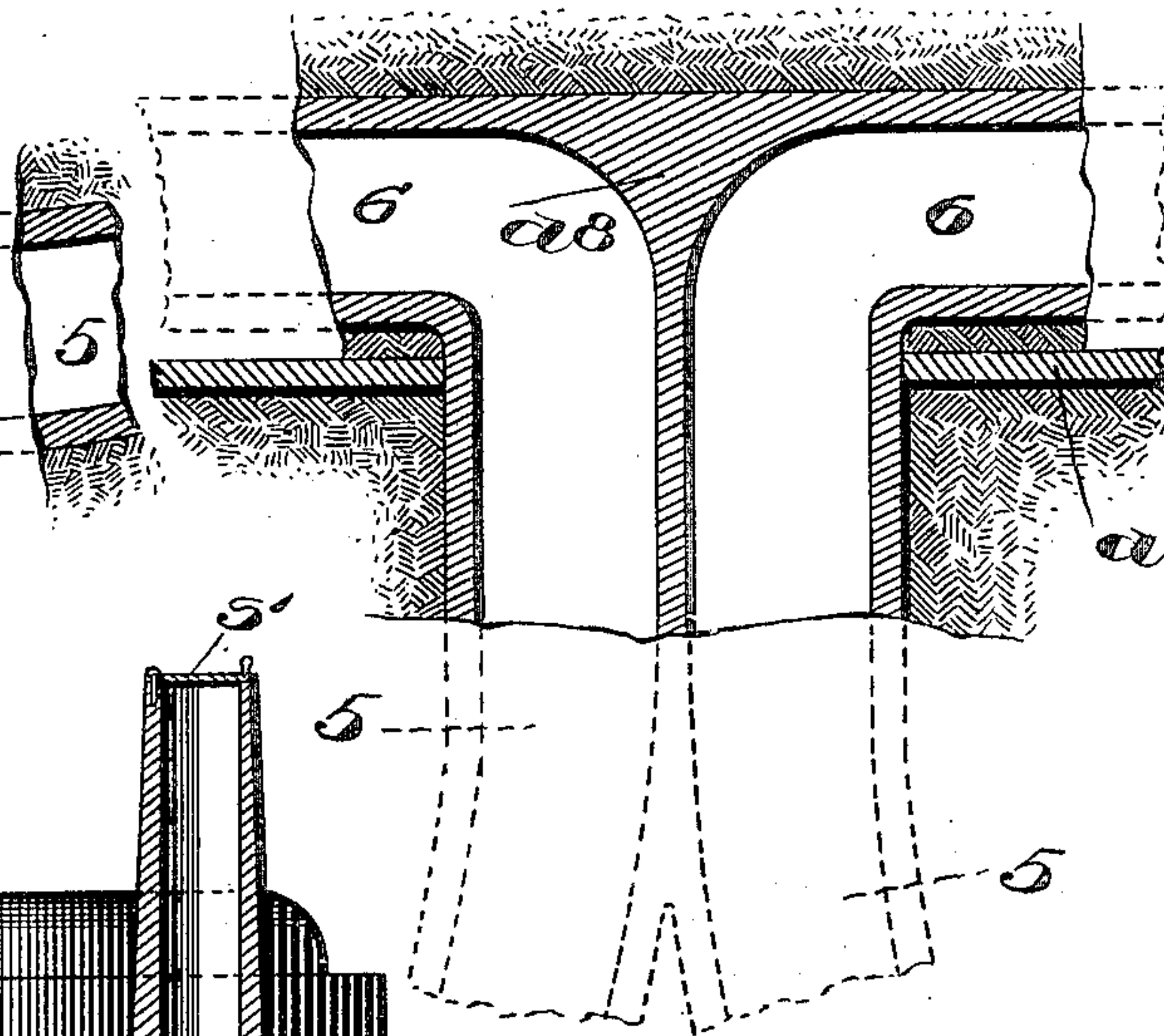


Fig. 10.

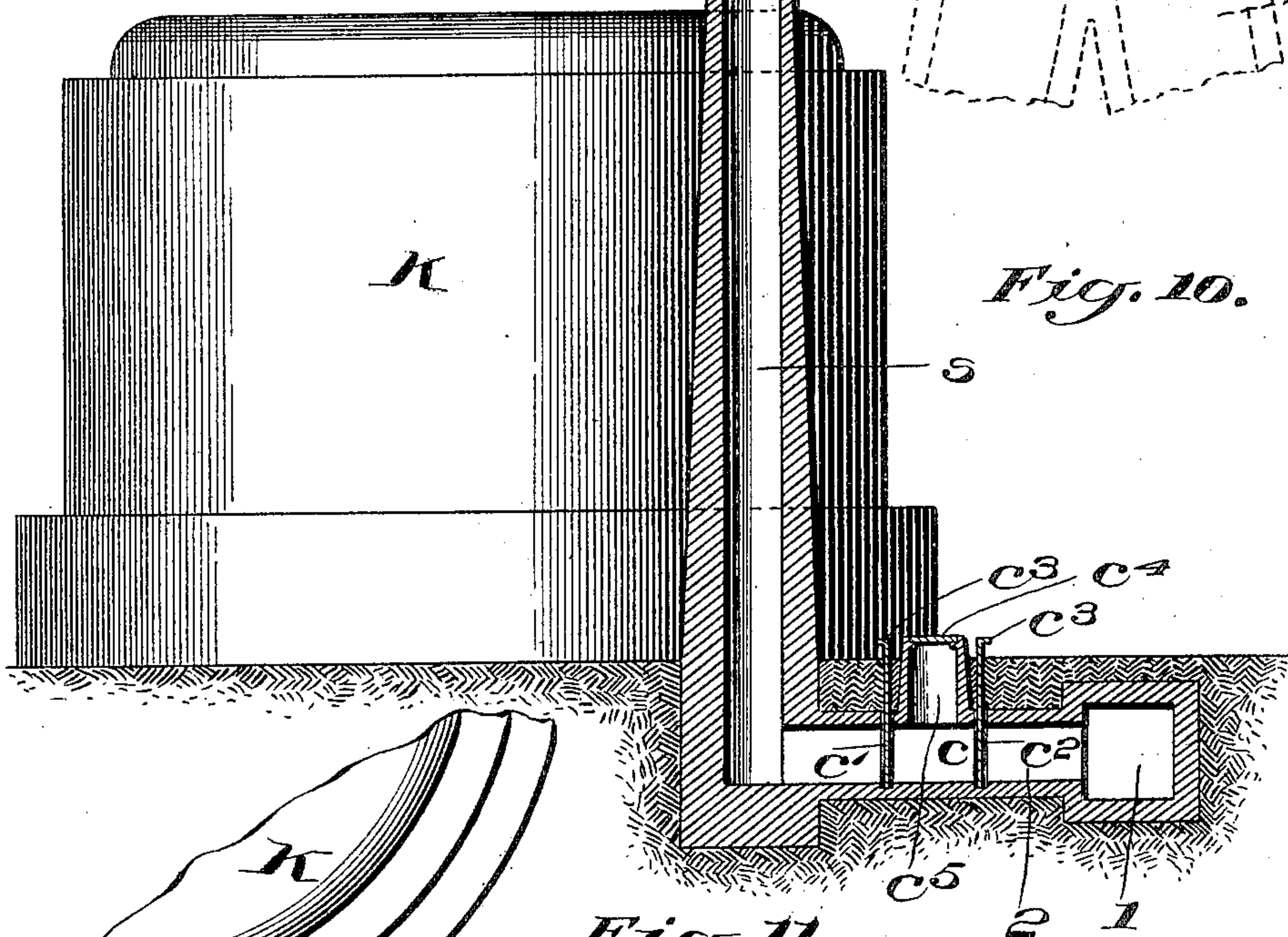
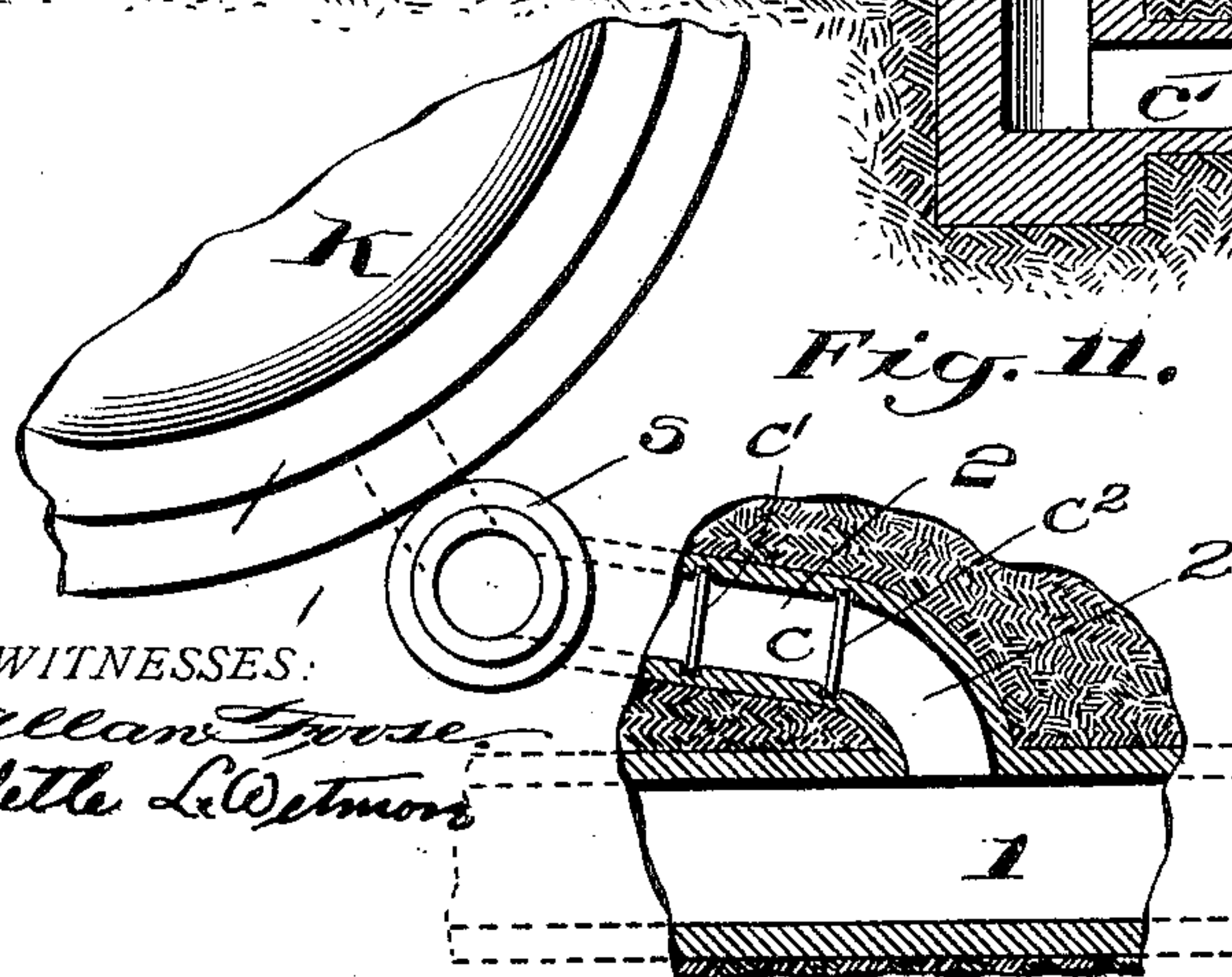


Fig. 11.



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UNITED STATES PATENT OFFICE.

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SYSTEM AND MEANS FOR DRYING AND BURNING CLAY PRODUCTS.

No. 812,509.

Specification of Letters Patent.

Patented Feb. 13, 1906.

Application filed November 10, 1904. Serial No. 232,072.

To all whom it may concern:

Be it known that I, ROBERT W. LYLE, a citizen of the United States, and a resident of New York, in the county and State of New York, have invented certain new and useful Improvements in Systems and Means for Drying and Burning Clay Products, of which the following is a specification.

This invention relates to systems and means for drying and burning vitrified-clay products, especially such products as are salt-glazed in process of manufacture—for instance, underground-conduit sections and other articles employed in the electrical and analogous arts.

Vitrified-clay products are first dried after formation by the factory machines or presses in the "green" state, the drying process being usually provided in a compartment or dry-house under heat, and then they are kiln-burned and usually salt-glazed.

Heretofore the drier has been provided with independent heating media—for instance, furnaces at the ends of the drying tunnels or compartments, feeding-flues in the latter—which is expensive both in consumption of fuel and labor required. A limited percentage of the products of combustion in the kilns has also heretofore been conveyed to the drier and introduced into the interior area of the tunnels or chambers or compartments containing the conduit-sections or articles to be dried, thus economizing to a limited extent in the utilization of waste heat; but the products of combustion so used deposit upon the articles to be dried and preclude the operation of workmen in the drying-compartments. Furthermore, the noxious gases in the products of combustion from the kilns, especially during the process of salt-glazing, render it entirely impracticable to so use the products of combustion in the drying-chambers except during only a limited part of the time the kiln is being operated; but a relatively small percentage of the heat from the kilns can therefore be utilized in the method just set forth, and when the heat value of the kiln is highest during the period of salt-glazing it is impossible to use products of combustion from the kiln at all in the manner stated. The drying-compartment, furthermore, cannot stand the conditions of the highest heat value of the kiln under this method of introducing the products of com-

bustion directly into the compartment, and thus the most valuable elements in economization are not utilized.

The object of my present invention and improvements is to provide a system and means whereby absolutely all the products of combustion in the heat value of the kiln can be utilized at all times and when the heat value is highest during the salt-glazing for the purpose of drying the green product in the drier, which will without an independent and expensive heating media for the drier avoid the deposit of any products of combustion upon the drying articles and enable the operation of workmen in the drying tunnels or compartments, which will provide for the convenient and effective control of the utilization of all or part of the heating value of any number of kilns, as desired, and also the effective, convenient, and economical control of the heating conditions in the drier at all times, whereby the maximum of efficiency will be insured and economy in operation and construction and compactness in the arrangement of the plant effected, and which will, furthermore, possess advantages in point of simplicity, durability, ease of operation, and general efficiency.

In the general arrangement of plants for the manufacture, drying, and burning of vitrified-clay products the factory, drier, and kilns are generally arranged in successive series—first, the factory, in which the clay products are formed by machinery and dies; second, the drier, to which the products are passed in the green state from the factory, and, third, the kilns, to which the dried product is passed for burning and salt-glazing.

A further object of my present invention and improvements is to provide for a more compact and economical arrangement of the manufacturing, drying, and burning elements of the plant in close relative series, to reduce the structural expense, to simplify and economize the maintenance and operation, and to secure maximum convenience and effectiveness in operation, these objects and results being associated in the general construction and arrangement under which I provide for the control and utilization of all the products of combustion and heat value of the burning elements of the plant for the service of the drying elements.

In the drawings, Figure 1 is a diagram-

matic plan view illustrating the association of the main elements comprised in my improved system and means for drying and burning vitrified-clay products, the roof of the drier being removed. Fig. 2 is a detail horizontal sectional view illustrating one of the drying tunnels or compartments of the drier and taken on a plane above the heat-radiating elements, half of said view having the track-
 5 age removed and parts being broken away to show features of construction. Fig. 3 is a detail vertical sectional view taken through the drier on the plane of one of the drying tunnels or compartments and through one of the longitudinal heat-radiating flues therein. Fig. 4 is a detail vertical sectional view taken through the drier on a plane transversely of one of the drying tunnels or compartments. Fig. 5 is a sectional view corresponding to
 20 Fig. 4 and illustrating a modification in the construction of the longitudinal heat-radiating flues in the drying tunnel or compartment. Fig. 5^a is a detail vertical sectional view illustrating the relationship of the modified longitudinal heat-radiating flues shown in Fig. 5 to the transverse heat-radiating flues of the drier. Fig. 6 is a top or plan view of part of the roof of the drier, illustrating the ventilating elements therein. Fig. 7 is a detail vertical sectional view illustrating the construction of the expansion and contraction and fume-proof joint at the end of the top plate of the main transverse heat-radiating flues of the drier. Fig. 7^a is a sectional
 35 view corresponding to Fig. 7 and illustrating a modified construction of said end joint. Fig. 8 is a detail plan view, partly broken away, showing one of the fans and the products-of-combustion flues connecting therewith. Fig. 9 is a detail plan view, partly broken away, showing the connection of the products-of-combustion flues from the fans with the main transverse heat-radiating flue of the drier. Fig. 10 is a detail vertical sectional view taken through the connection-flue from one of the kilns to the main products-of-combustion flue for the set of kilns and showing the double damper in the connection-flue. Fig. 11 is a detail horizontal sectional view of
 50 the construction illustrated in Fig. 10.

Corresponding parts in all the figures are denoted by the same reference characters.

Referring to the drawings, K designates the kilns, of which any suitable or desired number may be employed. The kilns may be of any adapted construction, the down-draft type being preferably used in connection with the system and construction embodied in my invention. Each kiln is provided independently with a stack *s*; but in my invention this stack is only a supplementary adjunct, designed to be used only when the kiln is cut off from the series or for any purpose independently operated, and the
 65 stack may therefore be relatively small and

of reduced height, thus economizing construction. The actual kiln-stack for general service is provided (one or more) at the outlet termini of the drier, as at S, which drier stack or stacks S S serve for the whole series
 70 of kilns and the small respective kiln-stacks *s* are only supplementary and provided as an adjunct under specific and independent conditions of use. Each small stack *s* is provided with a suitable damper *s'*, preferably located at the top of the stack, which can be closed when the kiln is working in connection with the main stack S and through the drier D, which is intermediate between the stack S and the kilns K. The arrangement of the
 80 damper *s'* at the top of the stack *s* removes it from the intensity of heat.

The set of kilns are "staggered" in their relative position and arrangement in the usual manner to save yard-space; but in my invention the staggered set of kilns are arranged in their longitudinal series transversely of the yard or parallel with the drier D, which preferred transverse arrangement saves yard-space, provides for a more convenient and simple arrangement of the track-
 90 age between and to and from the kilns, as represented at *yt*, and also facilitates the direct utilization of the heat value of the kilns in service of the drier. The usual arrangement of the kilns in their staggered series longitudinally of the yard or at right angles to the drier increases trackage and brings the outer kilns of the set at a greater distance from the drier, which would not be desirable
 95 in the heat system comprised in my present improvements.

Any desired plurality of transverse staggered sets of kilns may be employed in my improvements, as indicated in the drawings, the sets being parallel and transverse of the yard.
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1 designates a main flue extending underground and longitudinally between the kilns of each staggered set, and an underground branch flue 2 extends from the flue 1 to each kiln K. The small supplementary stack *s* preferably extends from this flue 2. The branch flues 2 may be curved to the kilns or extend at an acute angle from the main flue 1, as shown, to give said flues 2 suitable length and increased efficiency. The longitudinal main flues 1 of each staggered parallel set of kilns, when a plurality of sets are employed, are connected by underground main connection-flues, as at 3.
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A damper arrangement, whereby each kiln may be independently operated or shut off from the series when the kilns are operating through the drier D, is provided and preferably located in the branch flue 2. When the kilns are connected in series by the flues 1 and 2 and it is desired to shut off and independently operate or use one or more of the series kilns, it is desirable that all back-suc-
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tion to the independent kiln be avoided and an effectively tight damper be insured. This can best be done by cementing around the damper after it is closed and set. To enable the operation just set forth, I provide in the damper arrangement c for the respective kilns in the flue 2 a double damper, as at c' and c^2 , the damper c' being nearest the kiln. These dampers c' and c^2 preferably operate vertically and are adapted to be operated from above the ground by any suitable means, as indicated at c^3 . Intermediately between said dampers a manhole c^4 is provided in the flue 2. By means of the damper construction and arrangement just described when the dampers are closed a workman can go down in the manhole intermediately between the double dampers and cement or pack the same, as desired, the outer damper c^2 serving to protect him from back draft in the flue. It will be understood that the operation and control of the kilns under the varying circumstances heretofore mentioned, can be effected while the kilns are under fire and operating either in series or independently. The manhole-cover c^5 provides for the operative status of the flue 2.

To draw the products of combustion from the kilns and force the same to their operative service in the drier, one or more fans F are suitably located beyond the underground main flue 1 nearest the drier and are connected with said flue 1 by an underground connection-flue 4. I prefer to employ two fans, as shown, which may be of any usual or adapted construction and operated by any suitable power, the fans being located centrally with relation to the longitudinal extension of the flue 1, so that they respectively draw from each end thereof and having each a respective connection-flue 4. The connection-flues 3 between the main flues 1 are also centrally arranged with relation to the longitudinal extension of the flues 1, and the fan-flues 4 extend from the nearest flue 1 at a point from the center beyond the intersection of the flues 3 with the flue 1. The most direct and effective draft operation is insured by the improved relative arrangement of the kilns, flues, and fans, as hereinbefore set forth.

The fans are provided with a suitable air-intake, as represented at f , preferably located with relation to the kiln connection-flue 4, which may be controlled by a suitable damper or regulating device, as at f' , for the purpose of regulating and controlling as desired the degree of heat produced from the products of combustion in the kilns under varying conditions of kiln operation before it is forced to service in the drier. From the outlet of the fans extends an underground connection-flue 5 to the heating means in the drier.

Damper arrangements, such as the double

damper and manhole construction described in connection with the flues 2, could be provided in the main flues 1 or connection-flues 3 or other flues to enable regulation of the extent of operation or service of any special number of kilns, as desired.

The drier or drying-house D is arranged transversely with respect to the kiln system and in close relationship thereto. It involves a building comprising end walls d and d' , respectively, extending transversely of the kilns and factory system, and side walls d^2 d^2 , extending from front to rear, a suitable roof d^3 being provided. The drier may be in its main structure of any suitable or adapted construction and preferably has a central compartment d^4 extending from front to rear and forming a storage-room or trackage-space, suitable trackage for the hand-cars carrying the product being provided in this compartment, as at st , which trackage is in operative association with a storage-trackage, as at st^2 , provided in the kiln-yard centrally with relation to the first set of kilns and communicating with the general kiln-yard trackage yt , extending between the kilns. At each side the central compartment d^4 is provided a series of drying tunnels or chambers, as at d^5 , in parallel relationship and extending from front to rear, said drying-tunnels being divided by partitions or walls, as at d^6 . Any desired capacity in the number of drying-tunnels may be employed, and each tunnel is provided with a series of parallel longitudinally-extending tracks, as at tt , for the hand-cars carrying the product to be dried. Any desired number of tunnel-tracks tt may be employed, and the whole set of the same can communicate with the central compartment-trackage st and with the yard-trackage st^2 by means of a transfer-track, as at tt^2 , extending transversely with respect to the compartments or chambers of the drier.

Within the drier D , extending transversely of the whole series of drying tunnels or chambers and at each end thereof, are flues 6 and 7, respectively, built below ground or floor plane. These flues 6 and 7 may be constructed of brick or masonry or other suitable material, as may also the other leading flues 1, 2, 3, 4, and 5. Suitable doors or closed openings, as at d^7 , may be provided for the compartments or chambers of the drier in the walls d or d' of the latter. The fan-flues 5 extend to one of the main transverse drier-flues 6, preferably entering the latter at a common central point, as shown, and at this point the drier-flue 6 is preferably provided with a double deflector, as shown at d^8 , so that the heating products from the fans will be diverted in opposite directions to feed the series of drying-tunnels at each side the central compartment of the drier.

The main underground yard-flues 1 to 5,

inclusive, are designed to retain the heat and are consequently of such uniform structure that they will not radiate the same, the whole heat value of the kilns being designed for use in the drier; but the drier-flues 6 and 7 are designed to radiate the heat, and for this purpose they are provided with radiating-tops d^9 . These radiating-tops are preferably formed of bowed or arched longitudinal metallic plates d^9 , resting upon continuous shoulders or offsets d^{10} on the masonry side walls d^{11} of the flues 6 and 7, and their ends can rest upon curved shoulders or offsets d^{12} upon the end-walls d^{13} of said flues, as shown in the modification illustrated in Fig. 7^a. To form a tight joint against the escape of the heating products or noxious gases or fumes into the interior of the drying-chamber and to further provide for the contraction and expansion of the metallic plate d^9 , I fill in above the edges of the arched plate, where they rest upon the supporting-shoulders, with sand, as shown at d^{14} , which forms an effective joint for both purposes mentioned. Any other suitable joint means may, however, be employed. In constituting the joint at the ends of the arched plates d^9 the terminal ends of the plates, as at d^{15} , can be received by corresponding recesses d^{16} in the end walls d^{13} of the flues 6 and 7, which permits of contraction and expansion of the plates in said end recesses and, furthermore, does not permit of escape of gases or fumes, this construction being shown in Fig. 7. In connection with the joint means described it will be understood that the force of the draft in the drier-flues is continuous to the main stacks S and overcomes any tendency to emission of gases or fumes at the joint-points.

In the drying tunnels or chambers d^5 are provided flues 8, extending from front to rear longitudinally of the tunnel and communicating at their ends with the main drier intake-flue 6 and outlet-flue 7, respectively. The flues 8 are radiating-flues and may be of tubular cylindrical form and constructed of metal. They are arranged below ground or floor plane, one or more tubes extending longitudinally under the tunnel-track upon which stand the cars carrying the product to be dried, and when more than one track is provided in the tunnel the flues 8 are correspondingly arranged under each track. With a plurality of tracks and their under flues 8 the flues may be divided or separated by masonry walls or partitions, as at t^3 , which divide the space under each tunnel-track into separate flue-compartments t^4 , and said partitions can also serve as a rest or support for the ties or sleepers t' , upon which the tunnel-tracks tt are laid. The flues 8 may be supported intermediately of their ends by masonry cross-walls, as at t^5 , extending between the partition-walls t^3 , or in any other suitable manner.

To provide a tight joint against escape of gases or fumes and to furthermore effectively meet contraction and expansion of the metallic tunnel-flues 8 at their point of connection at each end with the main drier-flues 6 and 7, I prefer to employ a construction in which a supplementary wall t^6 , of masonry or other suitable material, is arranged a short distance beyond the inner side walls d^{11} of the flues 6 and 7, and the end portions t^7 of the flues 8 pass through corresponding openings t^8 in both of the walls t^6 and d^{11} . A gasket or ring, of asbestos or other suitable material, may surround the flues 8 in the openings t^8 , as shown at t^9 , and the space between the walls t^6 and d^{11} may be filled in with a packing t^{10} of sand or other suitable material. The joint thus produced is not affected by contraction or expansion of the flues 8, and the sand packing avoids escape of gases or fumes.

The tunnel-flues 8 are provided, preferably at each end, with suitable dampers t^{11} , whereby the flues may be shut off from heat connection and the tunnels independently governed as desired. When a plurality of flues 8 are provided in each tunnel, the set of dampers t^{11} may be connected and simultaneously operated by any suitable operating mechanism, such as a connecting-rod t^{12} . Manholes t^{13} may also be provided at suitable intervals in the flues 8 to enable cleaning and inspection, as desired.

A circulation of the hot air in the drier and tunnels or chambers may be effected in any suitable manner. I prefer to employ the construction herein illustrated, which comprises a series of vertical air vents or passages v , extending downwardly in the partition-walls d^6 , which divide the drying tunnels or chambers, these walls being constructed of brick or masonry. At their lower ends the passages v have an outlet connection v' , opening into the space or flue compartment t^4 , surrounding the flue 8 and on a plane below said flue. At their top ends the passages v open through the roof of the drier D and may be continued, as at v^2 , through extensions v^3 , projecting above the roof, the inlet end v^4 of the passage being protected against the weather by a suitable cap v^5 . These passages may be governed by dampers, say, at their top ends, if desired. The hot air ascending in the tunnels will create a strong draft for drawing in the cold air through the passages v and delivering it adjacent to the flues 8. In the roof of the drier over the tunnels are provided hot-air-outlet chimneys, as at v^6 , to enhance the draft and circulation, which outlets may be protected by a suitable cap v^7 and may be governed by dampers, if desired.

When a plurality of flues 8 and flue-spaces or compartments t^4 are employed in each drying-tunnel, the outlet connection v' of the air-passages v may be continued transversely of

the tunnel in the intermediate cross-walls t^5 under the flues 8 and through the dividing-partitions t^3 , under which circumstances the outlet-openings v^8 for the air-passages v will extend from the outlet connection v' upwardly in the cross-walls t^5 , as shown.

To enable very quick cooling of the drier D or its respective tunnels or compartments, a series of skylights v^9 are provided in the roof of the drier over each compartment and have a top v^{10} , which may be opened or closed and governed by suitable regulating mechanism, as at v^{11} . The general construction of the drier thus involves provision for thoroughly opening up and cooling it, as desired. The provision of damper arrangements, as hereinbefore mentioned, at suitable points in any of the main kiln-yard flues before they reach the inlet drier-flue 6 will enable the quick and entire shutting off of heat to the drier, as desired.

The main outlet drier-flue 7, which corresponds in construction and arrangement to the inlet-flue 6, has at each end an outlet extension 9, opening into the main kiln-stack S. In lieu of two stacks S one may be employed. The stacks S are located intermediately between the drier D and the factory Fc, and the drier D is intermediately between the main stacks S and the kilns which the stacks serve. The outlet extension-flues 9 are underground and are preferably provided with dampers sd , which may be closed to shut off the heat circulation in the flue system of the drier. Said circulation is also effectively governed by the starting or stoppage and speed of the fans F. The factory Fc is located adjacent to the drier D, or the drier and factory may be simply extensions of each other.

In lieu of the flue construction and arrangement in the drying tunnels or chambers as hereinbefore described I may employ in the tunnels a flue arrangement practically the same in construction as the main drier inlet and outlet flues 6 and 7, as shown in the modification illustrated in Figs. 5 and 5^a of the drawings. In this modified construction a flue 8m is provided under each tunnel-track and is the same in construction as the flues 6 and 7 with the metallic top plate d^9 and the same construction and arrangement for providing for contraction and expansion of the plate and the sand packing at the joints for providing against the escape of gases and fumes. The flues 8m communicate at their ends with the main flues 6 and 7 through openings m in the side walls d^{11} of the latter, and the side walls of the flues 8m are formed by the walls or partitions t^3 , which support the tunnel-tracks, and by the tunnel walls or partitions d^6 . When this modified arrangement is employed, the outlet connection v' of the air-passages v will open on a plane above the metallic top plates d^9 of the flues 8m, (see

Fig. 5,) and the dampers for the tunnel-flues, as at m' , can be provided at the openings m .

In the drying-tunnels the usual point of least heat, and consequently the point where heat is most needed, is at the ends of the tunnel, and it is to effectively meet this requirement and overcome the objection just noted that I provide the main transverse drier-flues 6 and 7 at the ends of the tunnels.

When the dampers t^{11} of the tunnel-flues 8 are independently mounted in their operative relation to the respective flues 8, the latter can be cleaned of any deposit of the products of combustion therein automatically and without the use by workmen of the man-holes t^{13} by employing the high-power draft of the fans F through one or more of the flues 8, the flues to be cleaned being individualized by shutting off the dampers of the other flues 8.

I do not herein specifically claim the construction of the drier itself, as this constitutes the subject-matter of a separate application for patent divided from this application and filed February 25, 1905, Serial No. 247,384.

The operation and advantages of my invention will be readily understood by those skilled in the art to which it appertains. It provides a system and means under which all the manufacturing elements are compactly and closely associated—to wit, the factory, drier, and kilns—in successive operative arrangement and for correlative operation in which all heat values are utilized. It enables the use of absolutely all the products of combustion from the kilns at all times of kiln operation for service in the drier. It employs but one heating expenditure for the use of both the drier and kilns and for both the operations of drying and burning. It makes the drier an intermediate part of the kiln system. It obviates the disadvantage of having any products of combustion free within the interior area of the drier and enables safe and convenient operation within the drying-tunnels at all times desired. It provides for the convenient regulation of degrees and circumstances of operation in both the drying and burning elements at all times, and it secures maximum utility and economy in construction and in operation.

I do not desire to be understood as limiting myself to the detail features of construction and arrangement as herein shown and described, as it is evident that variations and modifications may be made in the features of construction and arrangement in the adaptation of the invention and improvements to various conditions of use without departing from the spirit and scope of my invention. I therefore reserve the right to all such variations and modifications as properly fall within the scope of my invention and the terms of the following claims.

I claim and desire to secure by Letters Patent—

1. In a system and means for drying and burning clay products, a drier, a set of individual kilns, a main stack for all the products of combustion of the entire set of kilns, a flue extending through the drier and connecting the kilns with said main service-stack common to the set, an adjunct or supplementary stack for each of the individual kilns, and cut-off means for isolating the respective individual kilns from the set, the kilns having no connection with the main stack except through the drier.

2. In a system and means for drying and burning clay products, a drier, a set of individual kilns, a main stack for all the products of combustion of the entire set of kilns, a flue extending through the drier and connecting the kilns with said main service-stack common to the set, an adjunct or supplementary stack for each of the individual kilns, and means for closing said supplementary stacks, the kilns having no connection with the main stack except through the drier.

3. In a system and means for drying and burning clay products, a drier, a set of individual kilns, a main stack for all the products of combustion of the entire set of kilns, a flue extending through the drier and connecting the kilns with said main service-stack common to the set, an adjunct or supplementary stack for each of the individual kilns, cut-off means for isolating the respective individual kilns from the set, and means for closing said supplementary stacks, the kilns having no connection with the main stack except through the drier.

4. In a system and means for drying and burning clay products, a drier, a kiln having a main outlet for its products of combustion, said main outlet being in connection with the drier, an adjunct or supplementary stack, and means for closing the latter, the kiln having no connection with said main outlet except through the drier.

5. In a system and means for drying and burning clay products, a drier, a kiln having a main outlet for its products of combustion, said main outlet being in connection with the drier, an adjunct or supplementary stack, and closure means at the top portion of the latter, the kiln having no connection with said main outlet except through the drier.

6. In a system and means for drying and burning clay products, a drier, a set of individual kilns, a main stack for all the products of combustion of the entire set of kilns, a flue extending through the drier and connecting the kilns with said main service-stack common to the set, an adjunct or supplementary stack for each of the individual kilns, closure means for said supplementary stacks, and closure means for the main stack.

7. In a system and means for drying and

burning clay products, a drier, a set of individual kilns, a main stack for the set, a flue extending through the drier and connecting the kilns with said main service-stack common to the set, an adjunct or supplementary stack for each of the individual kilns, cut-off means for isolating the respective individual kilns from the set, closure means for said supplementary stacks, and closure means for the main stack.

8. In a system and means for drying and burning clay products, a drier, a set of individual kilns, a main products-of-combustion flue for the set, said flue being in connection with the drier, branch products-of-combustion flues extending from the individual kilns to said main flue, and means for isolating a section of the draft-channel of said branch flues and closing said isolated section at both ends while the kiln is under fire.

9. In a system and means for drying and burning clay products, a drier, a set of individual kilns, a main products-of-combustion flue for the set, said flue being in connection with the drier, branch products-of-combustion flues extending from the individual kilns to said main flue, two dampers in said branch flues, and a manhole-chamber between said dampers, for the purpose set forth.

10. In a system and means for drying and burning clay products, a kiln system, a flue for carrying all the products of combustion of the kiln system and leading to a main stack, an adjunct or supplementary stack for each kiln of the system, a drier, and heat-radiating flues communicating with said products-of-combustion flue and having a portion contained within the drier and externally closed, whereby all the products of combustion from the kiln system pass through the drier without access to its interior, the kilns having no connection with said main stack except through the drier.

11. In a system and means for drying and burning clay products, a kiln system, a main stack therefor, an adjunct or supplementary stack for each kiln of the system, a flue for carrying all the products of combustion of the kiln system extending between the latter and the stack, a drier intermediate the kiln system and its stack, and heat-radiating flues comprised in the products-of-combustion flue and having a portion contained within the drier and externally closed, the kilns having no connection with said main stack except through the drier.

12. In a system and means for drying and burning clay products, a kiln system, a main stack therefor, an adjunct or supplementary stack for each kiln of the system, a flue for carrying all the products of combustion of the kiln system extending between the latter and the stack and externally closed throughout its length, and a drier intermediate the kiln system and its stack and containing a

portion of said flue, the kilns having no connection with said main stack except through the drier.

13. In a system and means for drying and burning clay products, a kiln system, a flue for carrying all the products of combustion of the kiln system and leading to a main stack, an adjunct or supplementary stack for each kiln of the system, a drier, and heat-radiating flues communicating with said products-of-combustion flue and extending longitudinally of the chambers or tunnels of the drier and externally closed within the drier, whereby all the products of combustion from the kiln system pass longitudinally through the chambers or tunnels of the drier without access to the interior thereof, the kilns having no connection with said main stack except through the drier.

14. In a system and means for drying and burning clay products, a kiln system, a main stack therefor, an adjunct or supplementary stack for each kiln of the system, a flue for carrying all the products of combustion of the kiln system, a drier, heat-radiating flues communicating with said products-of-combustion flue and extending longitudinally within the drier at the ends of the drying chambers or tunnels and externally closed, and heat-radiating flues communicating with said end flues and extending longitudinally of the chambers or tunnels of the drier and externally closed.

15. In a system and means for drying and burning clay products, a set of kilns, a flue for carrying all the products of combustion of the set of kilns, a main stack for said flue, a drier, heat-radiating flues communicating with said products-of-combustion flue and having a portion contained within the drier and externally closed, adjunct or supplementary stacks for each of the respective kilns, and means for isolating the respective kilns from the main products-of-combustion flue, the kilns having no connection with the main stack except through the drier.

16. In a system and means for drying and burning clay products, a kiln system, a main stack therefor, an adjunct or supplementary stack for each kiln of the system, a drier intermediate the kiln system and its stack, and flues for carrying all the products of combustion of the kiln system extending between the latter and its stack and passing through the drier and having the portion within the drier externally closed.

17. In a system and means for drying and burning clay products, a set of individual kilns, a products-of-combustion flue extending from said set of kilns, means for isolating the individual kilns from said flue, forced-draft means communicating with said flue, a drier, heat-radiating flues communicating with said products-of-combustion flue and

having a portion contained within the drier and externally closed, a main stack communicating with said products-of-combustion flue beyond the drier, and an adjunct or supplementary stack for each kiln, the kilns having no connection with said main stack except through the drier.

18. In a system and means for drying and burning clay products, a set of individual kilns, a products-of-combustion flue extending from said set of kilns, means for isolating the individual kilns from said flue, adjunct or supplementary stacks for each of the individual kilns, means for closing said stacks, forced-draft means communicating with said products-of-combustion flue, a drier, heat-radiating flues communicating with said products-of-combustion flue and having a portion contained within the drier and externally closed, and a main stack communicating with said products-of-combustion flue beyond the drier.

19. An improved system and means for drying and burning clay products, comprising a drier, a flue extending through the drier, kilns, a main service-stack in connection with the terminal end of the drier-flue and constituting the only stack-outlet in common for the kilns, a flue extending in common from the kilns to the initial end of the drier-flue and constituting the only connection between the kilns and said main service-stack, and an individual or supplementary stack for the respective kilns whereby the kilns may be individually operated independent of said main service-stack and independent of the kilns which are collectively operating through the drier and said main service-stack.

20. An improved system and means for drying and burning clay products, comprising a drier, a flue extending through the drier and externally closed within the drier, kilns, a main service-stack in connection with the terminal end of the drier-flue and constituting the only stack-outlet in common for the kilns, a flue extending in common from the kilns to the initial end of the drier-flue and constituting the only connection between the kilns and said main service-stack, and an individual or supplementary stack for the respective kilns whereby the kilns may be individually operated independent of said main service-stack and independent of the kilns which are collectively operating through the drier and said main service-stack.

21. An improved system and means for drying and burning clay products, comprising a drier, a flue extending through the drier and terminating at the rear thereof, kilns at the front of the drier, a main service-stack at the rear of the drier and in direct connection with the terminal rear end of the drier-flue and constituting the only stack-outlet in common for the kilns, a flue extending in com-

mon from the kilns to the initial end of the drier-flue and constituting the only connection between the kilns and said main service-stack, and an individual or supplementary stack for the respective kilns whereby the kilns may be individually operated independent of said main service-stack and independent of the kilns which are collectively operating through the drier and said main service-stack.

22. An improved system and means for drying and burning clay products, comprising a drier, a flue extending through the drier, kilns, a main service-stack in connection with the terminal end of the drier-flue and constituting the only stack-outlet in common for the kilns, a flue extending in common from the kilns to the initial end of the drier-flue and constituting the only connection between the kilns and said main service-stack, an individual or supplementary stack for the respective kilns whereby the kilns may be individually operated independent of said main service-stack and independent of the kilns which are collectively operating through the drier and said main service-stack, and forced-draft means in connection with the flue constituting the main outlet in common for the

kilns and intermediate between the kilns and the main service-stack.

23. An improved system and means for drying and burning clay products, comprising a drier, a flue extending through the drier, kilns, a main service-stack in connection with the terminal end of the drier-flue and constituting the only outlet in common for the kilns, a flue extending in common from the kilns to the initial end of the drier-flue and constituting the only connection between the kilns and said main service-stack, and means for independently isolating the respective kilns from the drier-flue and the main service-stack and from the kilns which are operating in connection with the drier-flue and said main service-stack and for operating said isolated kilns independent of the main service-stack and the drier and entirely independent of the system of kilns discharging through the drier and said main service-stack.

In testimony whereof I have signed my name in the presence of the subscribing witnesses.

ROBERT W. LYLE.

Witnesses:

W. A. SNOW,
F. W. CAMERON.