Sept. 4, 1928. 1,683,309

V. SELLIEZ

TUNNEL KILN FOR CERAMIC INDUSTRY

Filed Dec. 2, 1925 2 Sheets-Sheet 1

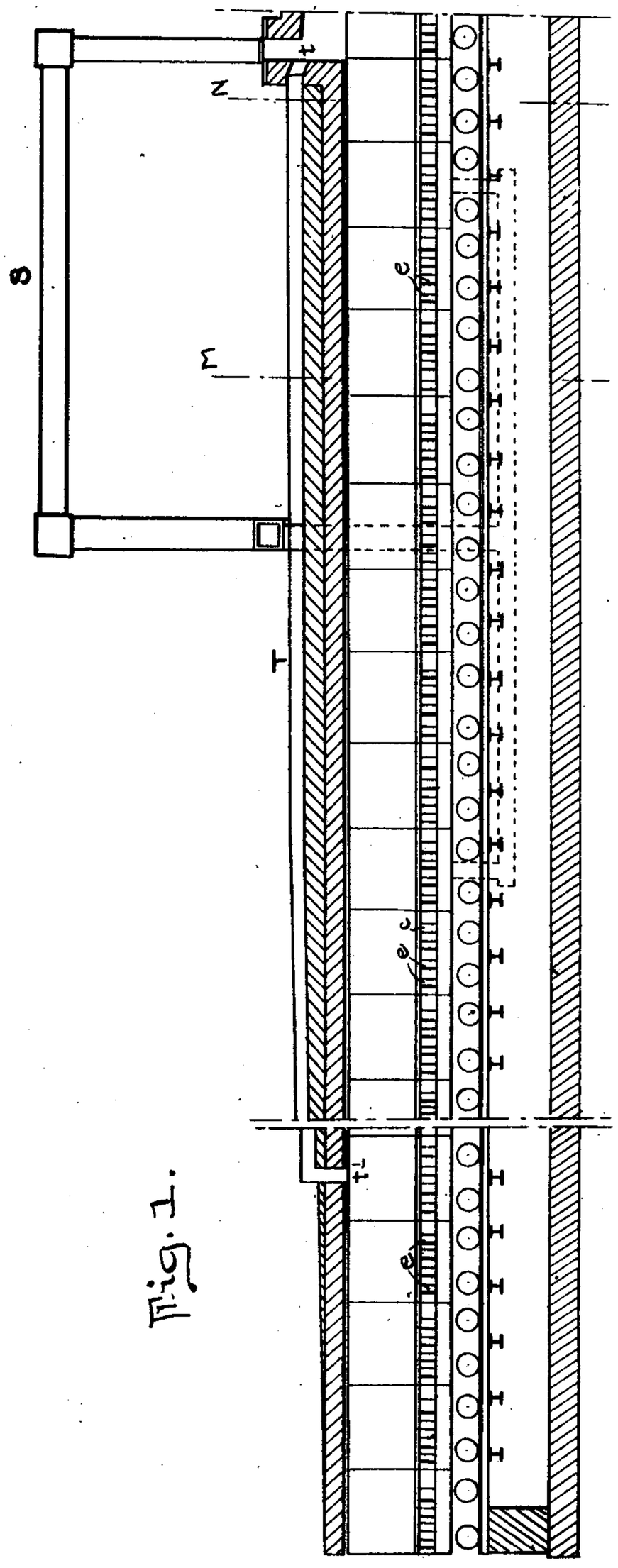

Fig. 1.

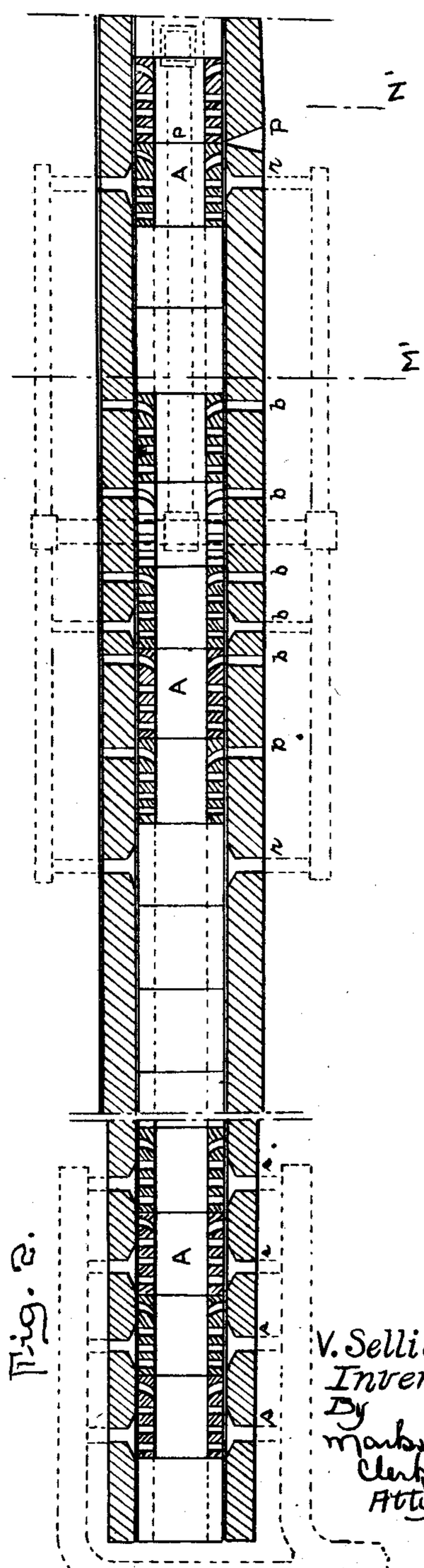

Fig. 2.

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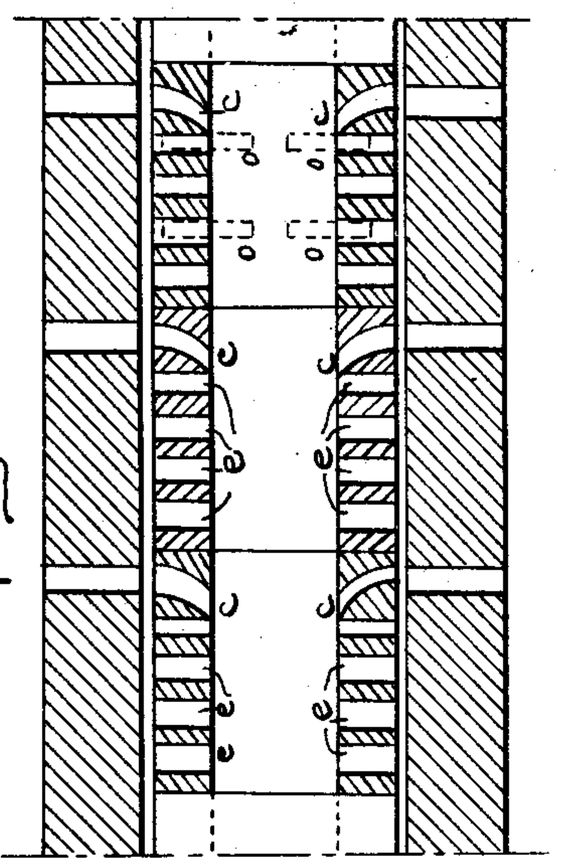

Fig. 4.

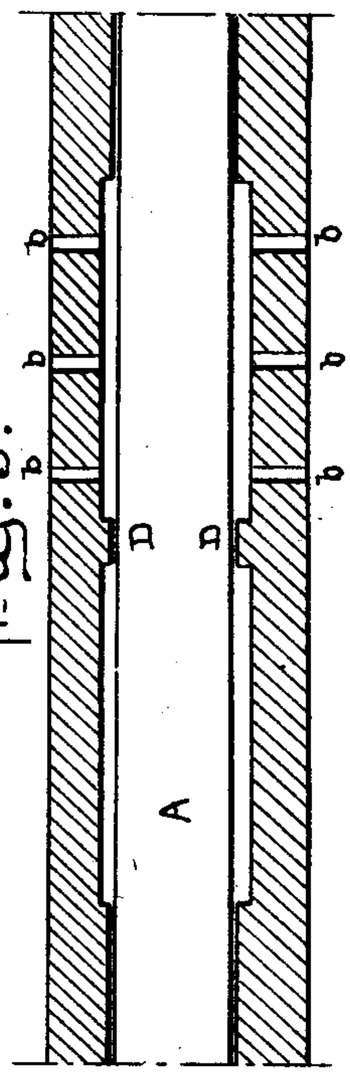

Fig. 5.

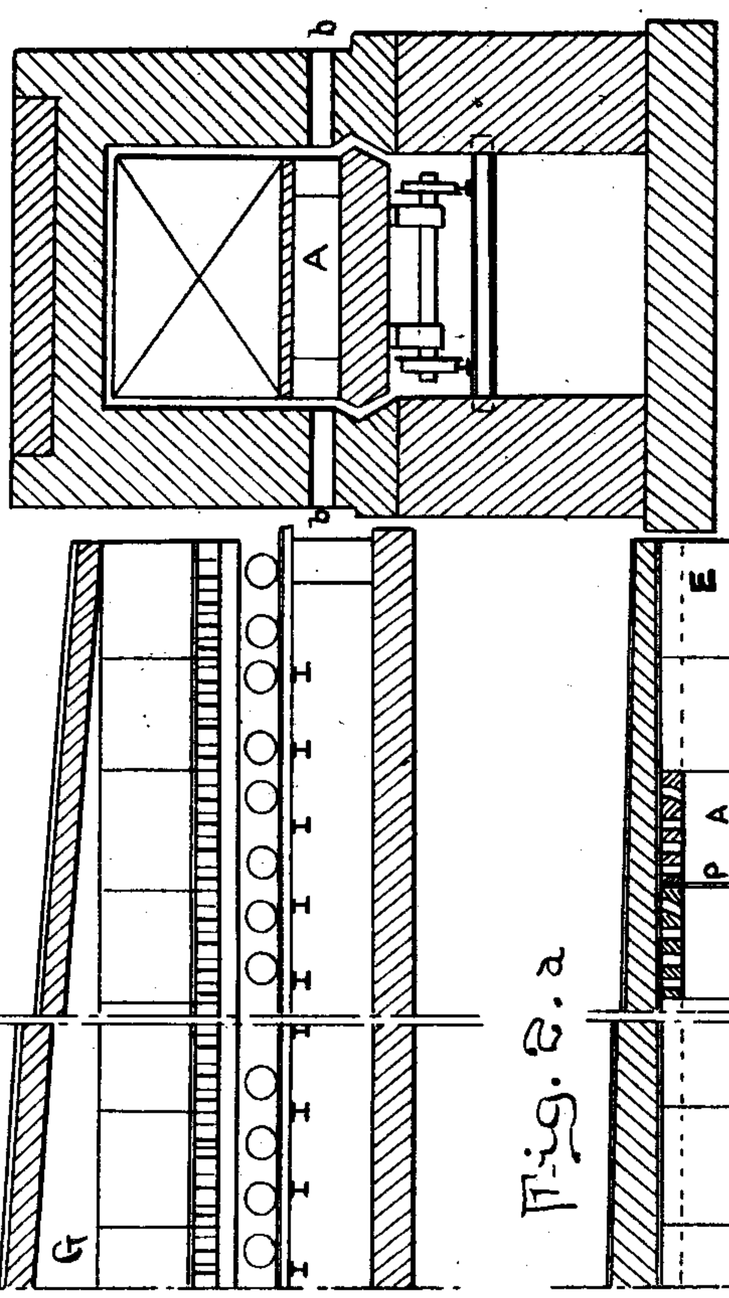

Fig. 3.

Fig. 1.

Fig. 2.

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UNITED STATES PATENT OFFICE.

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TUNNEL KILN FOR CERAMIC INDUSTRY.

Application filed December 2, 1925, Serial No. 72,843, and in Belgium December 2, 1924.

This invention relates to the baking of ceramic products and has for its objects:

1.—A uniform heating of the articles to be baked, obtained by conducting and localizing in the lower part of the kiln, a large percentage of the burned gases;

2.—The successive and rational cooling of the baked articles, by compelling the air, that takes their heat off, to circulate in the upper part of the tunnel;

3.—The possibility of varying, as desired, the temperature and conditions in the kiln, by judiciously proportioning the combustible gases and the combustion air and deflecting from the combustion chamber a large part of the air coming from the cooling zone.

Tunnel-kilns, notwithstanding the advantages of the baking method, rarely work satisfactorily.

In the later times, there has been a tendency to draw the combustion products towards the lower part of the kiln. But this operation can be very dangerous for the cooling of the baked products, when the air, used for such cooling, can freely pass through the same ways as the burned gases. In fact, when in the cooling zone, the cold and heavy air, will of course circulate in the lower part of the kiln and the baked products, because they cannot cool by convection with such air, will only lose, a small part of their heat by radiation, towards the outer walls of the kiln.

Moreover, such secondary air, entering in large quantity and at low temperature the zone of combustion will of course strongly lower the required temperature and, simultaneously, oppose any easy modification of the kiln conditions.

Figures 1 and 1ª represent the left and right hand portions, respectively, of a tunnel kiln constructed in accordance with the invention, the view being a vertical sectional view.

Figures 2 and 2ª are the left and right hand portions, respectively, of the kiln shown at horizontal section.

Figure 3 is an enlarged vertical transverse section.

Figure 4 is an enlarged fragmentary horizontal section corresponding to Figure 2 and showing the floors of several of the cars in section.

Figure 5 is a fragmentary horizontal section of a modification of the kiln.

It is assumed the working-principles of tunnel-kilns is well known and as will be understood the advance-motion of the cars is intermittent. For a better comprehension of this description, we will suppose the articles to be baked forming a pile covering the whole of the surface of the cars and assuming the shape of a parallelopipedon.

The floor of the cars is hollow and is provided with a large central canal A and lateral ducts *d* and *e* (Fig. 3).

The cars being placed end to end, the canals A form a continuous flue, reaching from one extremity of the kiln, to the opposite one. In the combustion and pre-fire zones, the vault of the kiln is straight (Fig. 3).

Without entering into details of the combustible gases production, it is noted they pass the kiln walls through channels *b*; in front of which the flues *c* will be alined at every stoppage of the cars. As soon as they enter the kiln, said gases will take the proportion of combustion air, they may lack.

Owing to the high temperature produced, the combustion products will expand considerably; one part of same will follow canal A and escape towards the chimney; the other part, flowing through the flues *c*, will fill the room between the pile, the lateral walls and the kiln vault.

Owing to the rule of stratification according to gravity, vertically directed currents will arise in the whole course of the gases, the cold gases descending towards canal A and the hot ones ascending to the vault. At last the burned gases drawn in by under pressure, will flow towards the chimney and be sucked in by the flues *s*, which will be provided with regulation claps.

Before examining the conditions of cooling of the goods, let us state that the vault, in this zone, is sloping from E to G; besides, between the cooling and the fire zones (thus between M N and M′ N′) the spaces between the pile, on one part, and the vault and lateral walls on the other part, will be as much reduced as the free passages of the goods will allow. Now, if the cars, when leaving the fire were to pass directly in the cooling zone, the secondary air aspirated through E, would merely flow into the canal A, without carrying away the heat of the baked goods; and therefore the arrangement is such that the aperture P between two of the cars, may be closed by a rectangular plate *p* for obstructing the canal A.

Said plate may be withdrawn at P′, a short time before taking the cars out.

As the cold air can no longer travel in the cooling zone by passing through the car floor, it is compelled to flow along the lateral walls and through the vault. The stratification processes, as stated above, will produce interchanges of heat between the upper and the lower parts of the kiln and the hot gases, following the vault, will collect in G. The cold air, throttled in its passage in the longitudinal direction, owing to the narrowing of the walls towards the pile between M N and M′ N′, will be aspirated through a siphon and returned into the kiln at the level of the floor-flues by channels *r* provided with regulation claps and located either between the burners, or before or behind the fire, according to the conditions to be obtained, i. e. oxydizing neutral or reducing effects.

The height and length of the horizontal pipe of the siphon shall be calculated in accordance with the pressure required for forcing the air down to the floor level. Alternatively, a given part of the air can be passed directly from the cooling zone to the pre-fire zone, without using the siphon; by forcing same to pass through a pipe T and to reenter under the vault, the difference of under-pressure between points *t* and *t′* being as a rule, sufficient for overcoming the resistance in such pipe.

It should be noted that the air blown in through the siphon, at R (between M N and M′ N′) will cool the floor, thus making the slipping in of plates *p* easier.

In case of a tunnel of reduced length, the travel of the flames could be lengthened by the following arrangement (Fig. 5) : in the combustion zone, the lateral walls and the vaults are somewhat spaced from the pile, but two baffle-plates rise vertically along the lateral walls, immediately after the last introduction of gas; as a result, all the flames escaping out the flues *e* will ascend to the vault and only flow towards the chimney along the vertical walls, after having passed the baffle plates D. A kind of reversed circulation will thus be produced in this zone.

For facilitating the description, it has been assumed that the piled-up goods form a massive parallelopipedon, covering the whole area of the cars. But if said cars are very large, the piles may be separated by spaces perpendicular to the furnace axis; ports *o* (Fig. 4) through the upper part of the floor place canal A in communication with such spaces and with the vault.

In the drawing and description all features relating to the production of combustible gases, as not falling within the scope of this invention. However, whatever may be the class of fuel used (solid, fluid or gaseous), it will be evident the siphon may readily feed same with combustion air.

Claim:

In a baking apparatus, a tunnel kiln, cars movable through the kiln, said cars having hollow floors provided with central communicating canals and lateral ducts communicating with the canals for receiving combustible gas, and means for admitting combustible gas to said ducts.

In testimony whereof I have signed my name to this specification.

VICTOR SELLIEZ.