W. F. POTTHOFF.

FIREPROOF CONSTRUCTION.

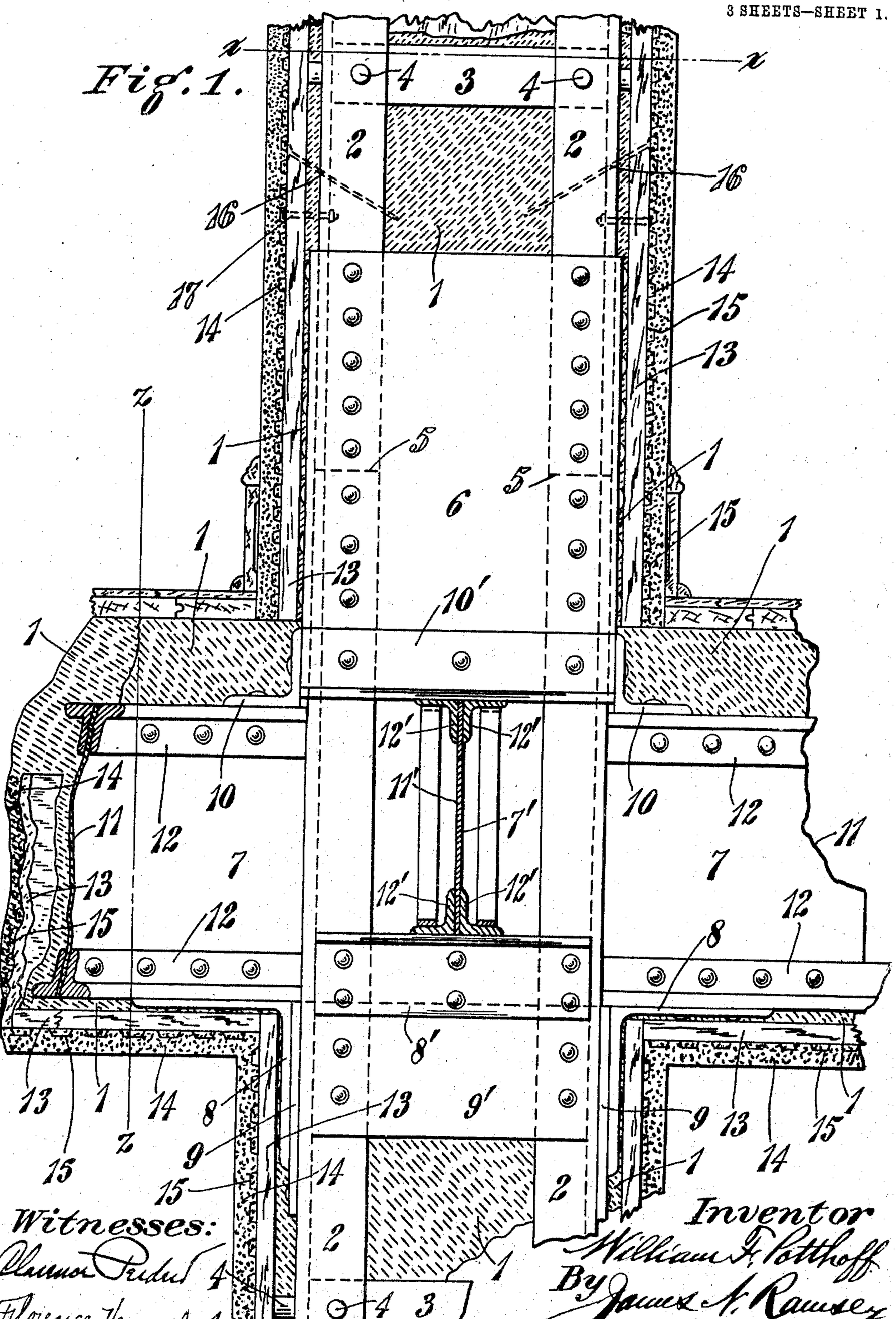
APPLICATION FILED FEB. 23, 1909.

928,153.

Patented July 13, 1909.

3 SHEETS—SHEET 1.

Fig. 1.



Witnesses:

Clarence Prideaux

Florence Hammel

Inventor

William F. Potthoff

By James A. Ramsey

Attorney

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3 SHEETS—SHEET 2.

Fig. 2.

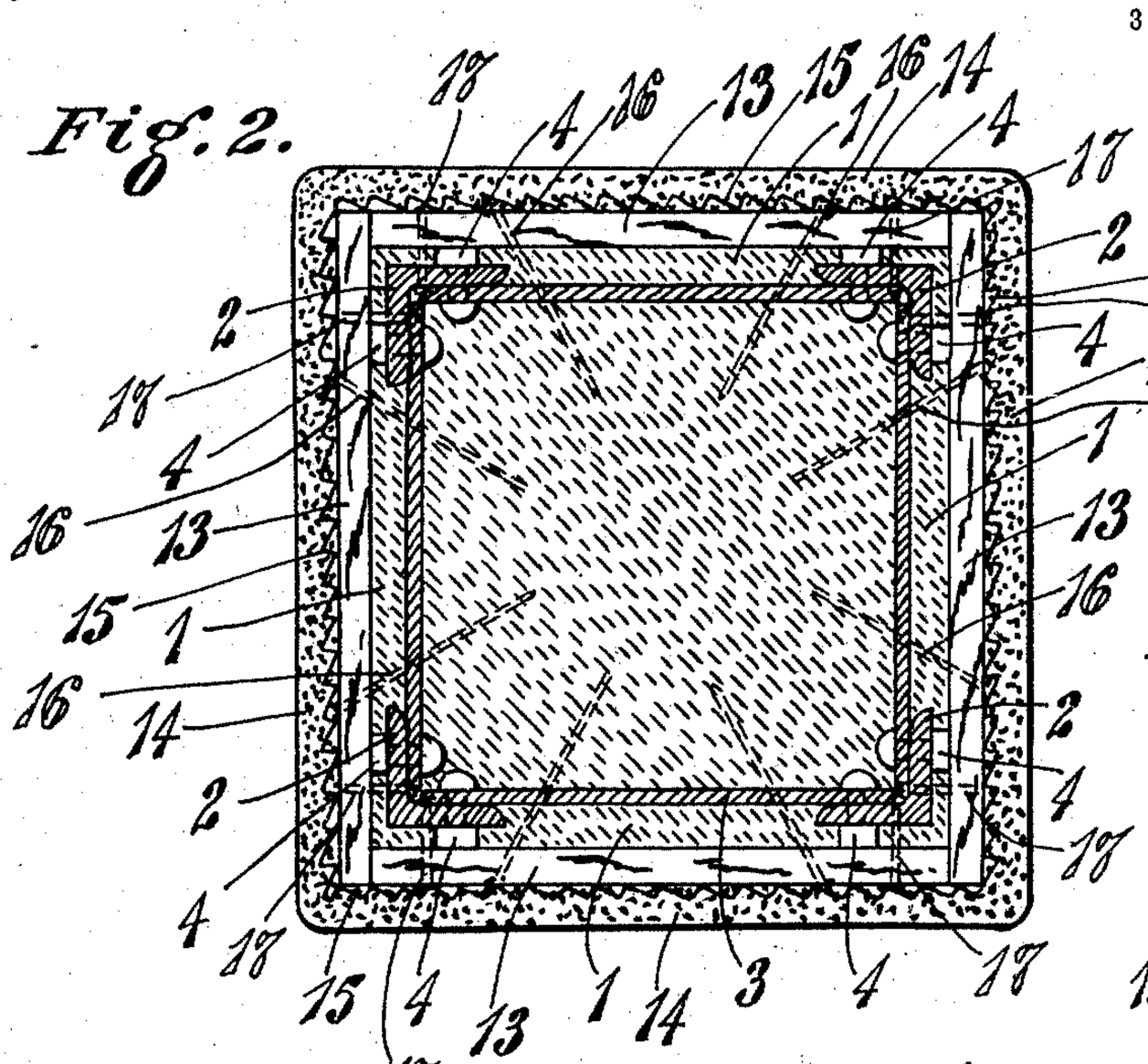

Fig. 3.

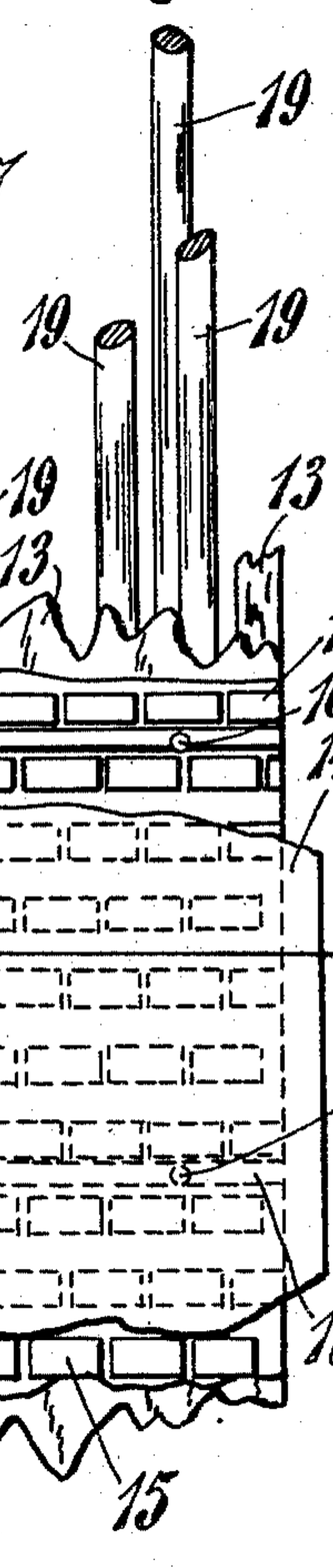

Fig. 4.

Witnesses:

Clarence Prideaux

Florence Hammel

Inventor

William F. Potthoff

By James N. Ramsey

Attorney

ANDREW. B. GRAHAM CO., PHOTO-LITHOGRAPHERS, WASHINGTON, D. C.

W. F. POTTHOFF.

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3 SHEETS—SHEET 3.

Fig. 5.

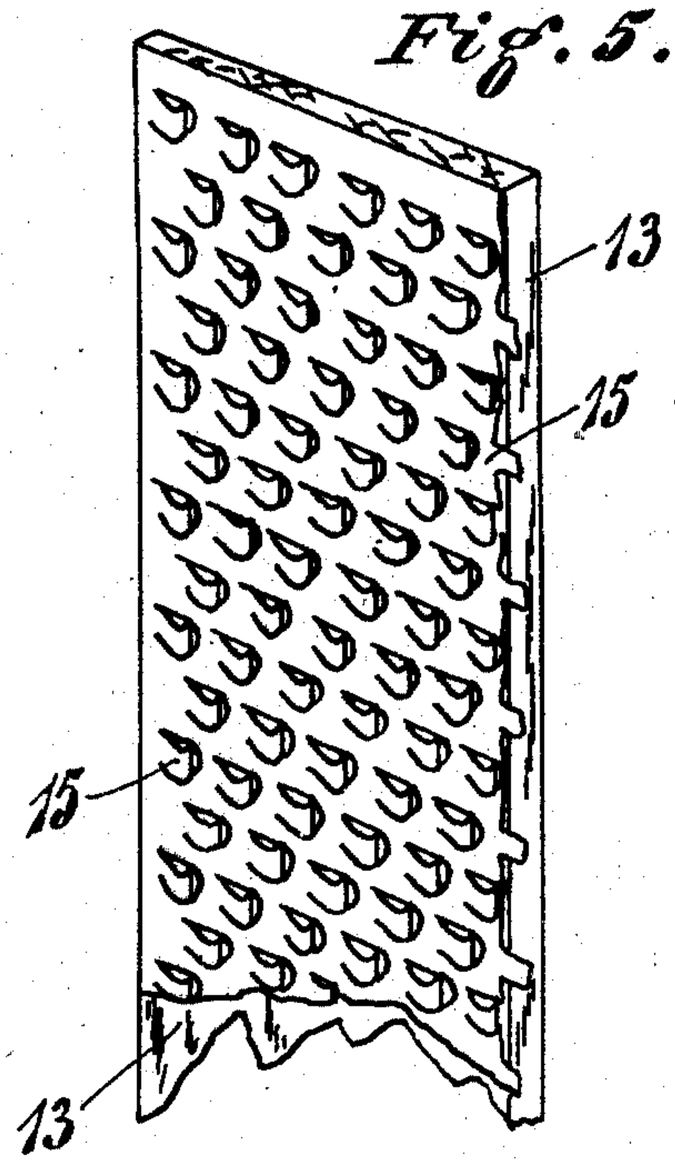


Fig. 6.

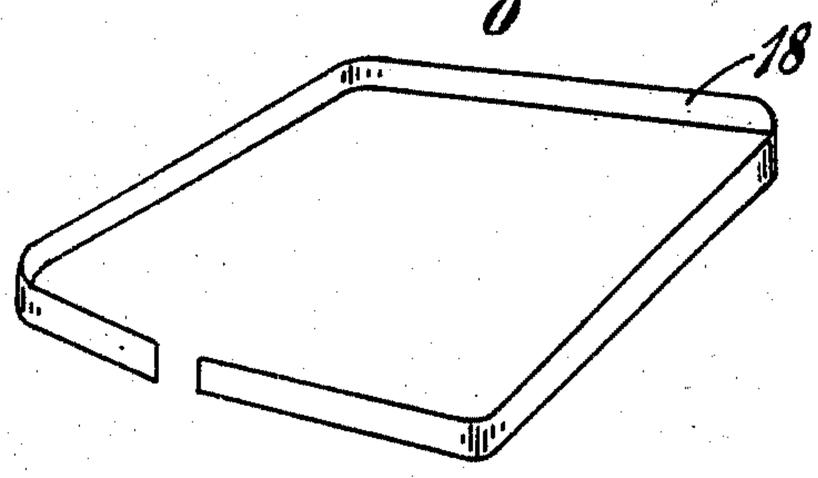


Fig. 7.

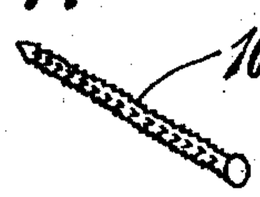


Fig. 8.

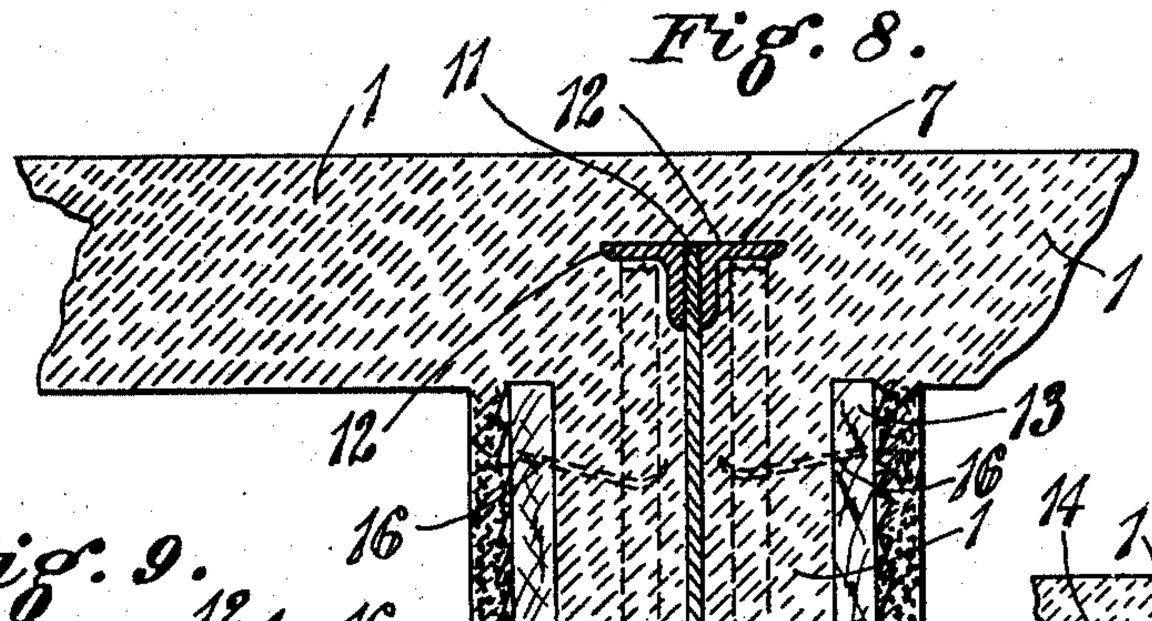


Fig. 9.

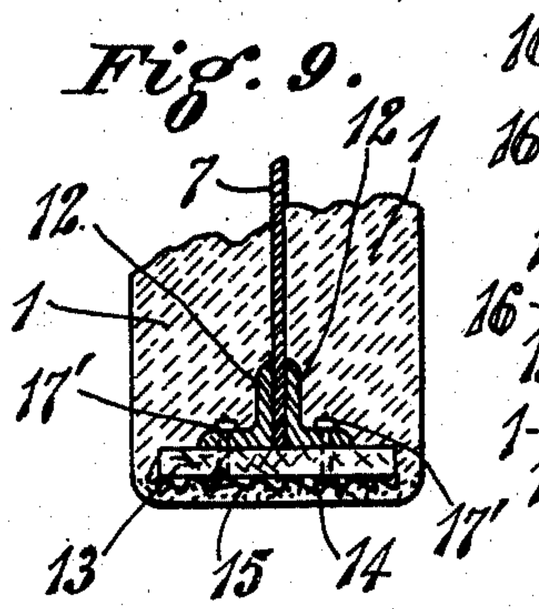
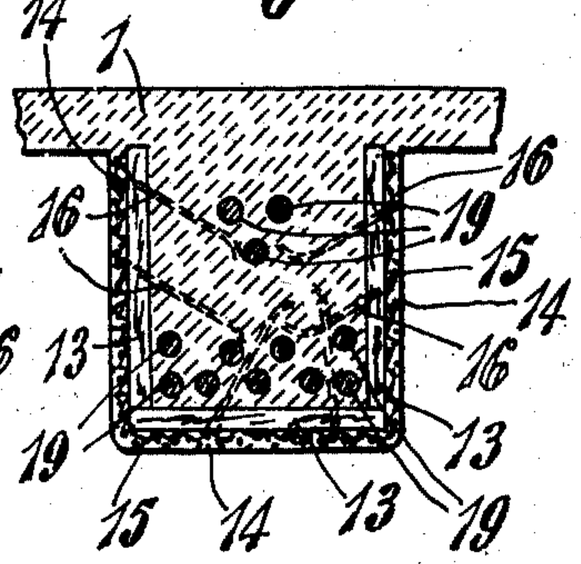


Fig. 10.



Witnesses:

Clarence Seidel

Florence Hammel

Inventor

William F. Potthoff

By James A. Ramsey

Attorney

UNITED STATES PATENT OFFICE.

WILLIAM F. POTTHOFF, OF CINCINNATI, OHIO.

FIREPROOF CONSTRUCTION.

No. 928,153. Specification of Letters Patent. Patented July 13, 1909.

Application filed February 23, 1909. Serial No. 479,427.

To all whom it may concern:

Be it known that I, WILLIAM F. POTTHOFF, a citizen of the United States, residing at Cincinnati, in the county of Hamilton and State of Ohio, have invented certain new and useful Improvements in Fireproof Construction, of which the following is a specification.

My invention relates to fireproof buildings, and its object is to provide an insulation for the weight supporting members of a building, such as the columns and beams, which may be of a minimum thickness, but which will provide the required insulating properties and which will have such insulating properties increased under the action of heat.

My invention consists in the combination with concrete and a metallic reinforcement incorporated therewith, of a thickness of carbonaceous material outside the body formed by the incorporation of the concrete and the reinforcement, and an air excluding thickness of material outside the carbonaceous material, with means for holding the various thicknesses of material together.

My invention also consists in the parts and in the details of construction and arrangement of parts as will hereinafter be more fully described and claimed.

In the drawings: Figure 1 is a vertical cross section through part of a structure embodying my invention, the reinforcement comprising part of the weight supporting body being shown in elevation. Fig. 2 is a horizontal cross section on a line corresponding to the line *x*—*x* of Fig. 1. Fig. 3 is a side elevation of a structure with parts broken away, illustrating a modified construction. Fig. 4 is a horizontal cross section on the line *y*—*y* of Fig. 3. Fig. 5 is a detail perspective view of part of one of the boards with the metallic lath applied thereto. Fig. 6 is a detail perspective view of one of the bands. Fig. 7 is a detail perspective view of one of the fastenings adapted to extend into and be incorporated with the concrete. Fig. 8 is a partial cross section on a line corresponding to the line *z*—*z* of Fig. 1, illustrating the application of my improved construction to a beam or girder. Fig. 9 is a partial cross section illustrating a modification of the construction illustrated in Fig. 8. Fig. 10 is a similar cross section illustrating the application of my invention to the construction of a beam or girder corresponding to that for a column illustrated in Figs. 3 and 4.

My improved fire proof construction is preferably embodied in the construction illustrated in Figs. 1 and 2 of the drawings, as concerns the fire proofing of a column, and as illustrated in Figs. 8 and 9 of the drawings, as concerns the fire proofing of a beam or girder. In this construction, the weight supporting body is composed of concrete 1 and a framed metallic reinforcement incorporated therewith. As herein illustrated, this framed metallic reinforcement for the column is of lattice construction comprising the vertically extending members 2, of angle shaped cross section, and horizontally extending members or plates 3, rigidly secured to the vertically extending members 2 by means of rivets 4. The part of the structure illustrated in Fig. 1, it will be seen, is the upper part of a column of a lower story of a building, and the lower part of a coincident column of the next story above, together with the floor beams or girders secured to the columns. It will thus be noted that the columns comprised by the members 2 and 3 of the lattice work held together by the rivets 4 have their ends abutting to form joints 5, and are secured together in the usual manner by fish plates 6, while the beams or girders 7 and 7′ are joined to the columns by means of the brackets 8 and 8′, respectively, on plates 9 and 9′, respectively, below, and by brackets 10 and 10′, respectively, above. The beams or girders 7 and 7′, it will be noted, are built up of web plates 11 and 11′, respectively, and angles 12 and 12′, respectively, forming the flanges, according to well known principles of metallic framing of buildings either in conjunction with the use of concrete or independently thereof. In producing my improved construction, however, the casing or mold provided for confining the concrete 1 around the framed metallic reinforcement of the supporting body is composed of boards 13, which, in the column, completely surround the weight supporting body composed of the concrete 1 and the metallic frame incorporated therewith, while in the beams or girders, as illustrated in Figs. 1 and 8, these boards are placed to form a trough-like mold under the bottom and at the sides of the beam. In either case these boards are thus placed around the metallic

framing and the concrete introduced as usual, surrounding the metallic framing and filling the space within the casing formed by the boards, so that the metallic framing forming the reinforcement is incorporated with the concrete and forms a practically continuous weight supporting body in conjunction therewith, while the inner sides of the boards are in intimate contact with the concrete which extends around the metallic framing. The boards are then left in position and receive a coating or thickness of material, such as plaster 14, outside and surrounding them, to exclude the air from the boards and thereby prevent complete combustion thereof under the action of heat from the outside.

It will be understood that with such a construction comprising the weight supporting body of concrete and its metallic reinforcement which is incorporated with it, both of which materials are of low combustibility but of relatively high conductivity when compared to the material forming the boards which constitute the casing, said weight supporting body will be insulated by the casing surrounding it. However, in order that the boards may have the right insulating properties, it is desirable that they be of a fibrous material which, for economic reasons, should be some organic or carbonaceous substance, such as wood or paper. Wood is the more practical material for such purpose, paper being too expensive. I prefer to use for such material the cheaper kinds of wood, such as hemlock, and such as pine and similar soft woods of low grade. With the use of such material for the insulating thickness, it will be seen that it is necessary to employ it in the construction under such conditions that it will not only not be completely consumed under the action of heat from the exterior of the structure, but that it will not be allowed to separate from the weight supporting body of the structure, such as by warping or disintegration. With this end in view, I apply to the outside of the boards 13, forming the casing, a metallic lath 15, of any well known formation, outside of which the plaster 14 is applied, and by means of which said plaster is secured to the boards.

It is to be understood that the plaster is not depended upon to prevent the combustion of the wood by insulating it from the exterior heat, but is only applied, aside from its use as an interior finish for the building, to exclude the air from the surface of the wood, and therefore prevent complete combustion of the wood, as above mentioned. Neither is the wood expected to independently retain its integrity under the action of the heat, but is only intended to act as an insulator efficiently enough to prevent serious damage to the metallic reinforcement of the concrete. Therefore, in order that the insulating thickness 13 and its air excluding thickness of plaster 14 may remain in position around the weight supporting body of the structure, I secure both the insulating thickness 13 and the air excluding thickness of plaster to the weight supporting body or column proper. This is done by passing spikes or nails 16 through the metallic lath and through the boards 13 on the interior of the casing, adjacent to the metallic reinforcement before the concrete is introduced. Preferably, these spikes or nails 16 are barbed similarly to the one illustrated in Fig. 7 of the drawings. They are driven obliquely into the interior of the casing, as shown, so that when they are surrounded by concrete 1, and incorporated therewith, they will extend in a direction at an angle to the direction of their withdrawal should the boards tend to separate from the column proper. Also, when the framed metallic reinforcement is used, as illustrated in Figs. 1 and 2, and as above described, bolts 17 may be passed through the metallic lath and through the boards 13 and secured to the vertical member 2 of the framing. Thus, the insulating casing and its air excluding thickness of plaster are permanently secured to the weight supporting body and the fastenings thus securing them, being embedded in the insulating boards and in the concrete, are protected against action of the heat and will remain intact, acting, together with the metallic lath by means of which the plaster is held on the boards, to maintain the entire protective structure in operative position. The efficiency of the spikes or nails 16 may also be increased by bending their ends interiorly of the casing, as shown, before introducing the concrete. This is especially desirable in the modified structures illustrated in Figs. 3 and 4, as concerns columns, and in Fig. 10, as concerns beams or girders, should these spikes or nails 16 be depended upon entirely to maintain the casing in position against displacement through the action of the heat. The efficiency of the fastening of the insulating casing and its air excluding covering may be increased by passing metallic bands 18 around the outside of the metallic lath on the boards and passing the nails or spikes 16 through these bands into the interior of the casing as above described, in such a manner that the nails or spikes will hold the bands securely around the structure. This is ample substitute for the bolts, when the loose rods 19 are employed, in the well known manner, as shown in Figs. 3, 4 and 10. However, it will also be understood that the metallic bands may be employed in conjunction with the bolts 16 and the framed metallic reinforcement.

Where a beam or girder is to be insulated

and the insulation carried up around the sides of the beam or girder, the nails or spikes 16 are used to hold the boards in place at the sides while the board at the bottom of the girder may be bolted directly to the flange thereof by means of the bolts 17′, as illustrated in Fig. 8 of the drawings. These boards, having the metallic lath 15 applied to their outer sides, may then receive a coating of the plaster 14 so that the sides and bottom of the girder are fully protected, the concrete 1 occupying the trough-like structure constituted by the boards and incorporated with the metallic beam or girder, and the nails or spikes 16. Where it is not desired to carry the insulation up around the sides of the girder, only the bottom board 13 need be applied, being bolted directly to the flange of the girder with metallic lath on its lower or outer surface to receive the plaster 14. The sides of the girder are formed by the exposed concrete which is molded in the usual manner. Such a construction is more especially applicable in connection with an arched floor construction, covering the sides of the girders, which, being well understood need not be herein illustrated or fully described.

In the employment of my improved fire proof construction, it is convenient to have the boards 13 with the metallic lath 15 applied to one side, as illustrated in Fig. 5 of the drawings. These boards are applied to the sides of the columns or to the beams or girders in the manner usual in erecting forms for constructing reinforced concrete structure, and the nails or spikes are driven through the boards and the boards bolted, or otherwise fastened, as hereinbefore set forth.

It will thus be seen that the cheapest material may be used for the insulating thickness and the necessity of removing the material as is the case in the employment of wooden molds in such practice is avoided, which expense may amount to nearly as much as the value of the lumber. Therefore, the expense of providing this construction is not greatly increased, while the convenience of applying the metallic lath to a surface composed entirely of wood, as is the case when the boards surround the columns and girders, is greatly increased. While thus possessing increased advantages with regard to economy and convenience in construction, the superior insulating properties of the material thus surrounding the columns or girders are such that the thickness of this material may be considerably reduced from that necessary in the employment of the concrete only as a fire proof covering for the metallic reinforcement, so that the bulk of the finished column or girder is greatly lessened, adding to the capacity of the interior of the building in which my improved construction is employed without reducing the strength of the weight supporting body, or the column or girder proper. The insulating thickness of wood or other carbonaceous material surrounded by the air excluding thickness of plaster or similar material, it will be noted, owing to the exclusion of the air, will not be completely consumed but will only char or carbonize, in which condition it becomes a more efficient insulator. The metallic lath and the other metallic fastenings employed are ample to maintain the integrity of such a charred insulating thickness and to also maintain the air excluding thickness of material in position on the outside of the insulating thickness to prevent the complete combustion thereof.

Having fully described my invention, what I claim as new and desire to secure by Letters Patent is:

1. In fire proof construction, the combination with concrete and a reinforcing member incorporated therewith, of a thickness of carbonaceous material surrounding the concrete and the reinforcement, an air excluding thickness of material surrounding the thickness of carbonaceous material, and fastenings securing the thickness of a carbonaceous material to the concrete and reinforcement, the carbonaceous material being adapted to insulate the inclosed concrete and reinforcement and the fastenings, and to have its insulating properties increased by charring under the action of heat when inclosed by the air excluding thickness, substantially as and for the purposes herein set forth.

2. In fire proof construction, the combination with concrete and a reinforcing member incorporated therewith, of a thickness of carbonaceous material outside said concrete and reinforcing member, fastenings securing the carbonaceous material to the concrete and reinforcing member, and an air excluding thickness of material outside the thickness of carbonaceous material, fastenings extending through the carbonaceous material and being attached to the material forming the air excluding thickness, substantially as and for the purposes herein set forth.

3. In fire proof construction, the combination with concrete and a reinforcing member incorporated therewith, of a thickness of carbonaceous material outside the concrete and reinforcing member, an air excluding thickness of material outside the thickness of carbonaceous material, means for securing the air excluding thickness to the thickness of carbonaceous material, and fastenings extending through the carbonaceous material into the concrete interiorly, and into the air excluding thickness through the attaching means thereof, exteriorly, substantially as and for the purposes herein set forth.

4. In fire proof construction, the combination with concrete and a metallic reinforcement incorporated therewith, of a thickness of carbonaceous material outside the concrete and the reinforcement, metallic lath outside the thickness of carbonaceous material, fastenings passing through the metallic lath and through the thickness of carbonaceous material and secured within the body formed of the concrete and the reinforcement, and a thickness of plaster outside of and secured to the thickness of a carbonaceous material by said metallic lath, substantially as and for the purposes herein set forth.

5. In fire proof construction, the combination with concrete and a framed metallic reinforcement incorporated therewith, of boards of carbonaceous material outside the body formed by the incorporation of the concrete and the reinforcement, fastenings passing through the boards and into the metallic reinforcement, and a thickness of plaster outside the boards, substantially as and for the purposes herein set forth.

6. In fire proof construction, the combination with concrete and a reinforcement incorporated therewith, of a casing of carbonaceous material, fastenings for securing the carbonaceous material to the body formed by the incorporation of the concrete and the reinforcement, and an air excluding thickness of material surrounding the casing, said casing constituting the mold for retaining the concrete around the reinforcement during the incorporation of the reinforcement with the concrete, substantially as and for the purposes herein set forth.

7. In fire proof construction, the combination with concrete and a reinforcing member incorporated therewith, of a thickness of carbonaceous material outside the body formed by the incorporation of the concrete and reinforcement, fastenings extending through the thickness of carbonaceous material to secure it to said body, an air excluding thickness of material outside the thickness of carbonaceous material, the thickness of carbonaceous material being adapted to form a mold for retaining the concrete during the incorporation of the reinforcement therewith, and the fastenings being extended within the mold thus formed before the concrete is introduced, whereby said fastenings are incorporated with the concrete, substantially as and for the purposes herein set forth.

8. In fire proof construction, the combination with a weight supporting body of low combustibility but of relatively high conductivity, of a thickness of material of higher combustibility but of relatively low conductivity outside the weight supporting body, an air excluding thickness of material of low combustibility outside the thickness of more highly combustible material, and fastenings incorporated with the weight supporting body and securing the outer thicknesses thereto, substantially as and for the purposes herein set forth.

9. In fire proof construction, the combination with a weight supporting body of low combustibility but of relatively high conductivity, of a casing of boards of carbonaceous material, of relatively high combustibility but of relatively low conductivity, outside the weight supporting body, metallic lath outside the casing, metallic bands passing around the metallic lath, fastenings extending through the bands and lath and casing into and incorporated with the weight supporting body, and an air excluding thickness of material outside of and secured to the casing by said metallic lath, substantially as and for the purposes herein set forth.

10. In fire proof construction, the combination with concrete and a framed metallic reinforcement incorporated therewith, of a casing of boards of carbonaceous material surrounding the body formed by the incorporation of the concrete and the reinforcement, metallic lath outside the casing, metallic fastenings extending through the metallic lath and casing and into the concrete, and an air excluding thickness of plaster outside of and secured to the casing by said metallic lath, said casing being adapted to form a mold for confining the concrete to the reinforcement during the incorporation of the reinforcement therewith, and the fastenings which extend into the concrete being inserted into the mold before the concrete is introduced therein, whereby they are incorporated therewith, substantially as and for the purposes herein set forth.

WILLIAM F. POTTHOFF.

Witnesses:
JAMES N. RAMSEY,
CLARENCE PEADENT.