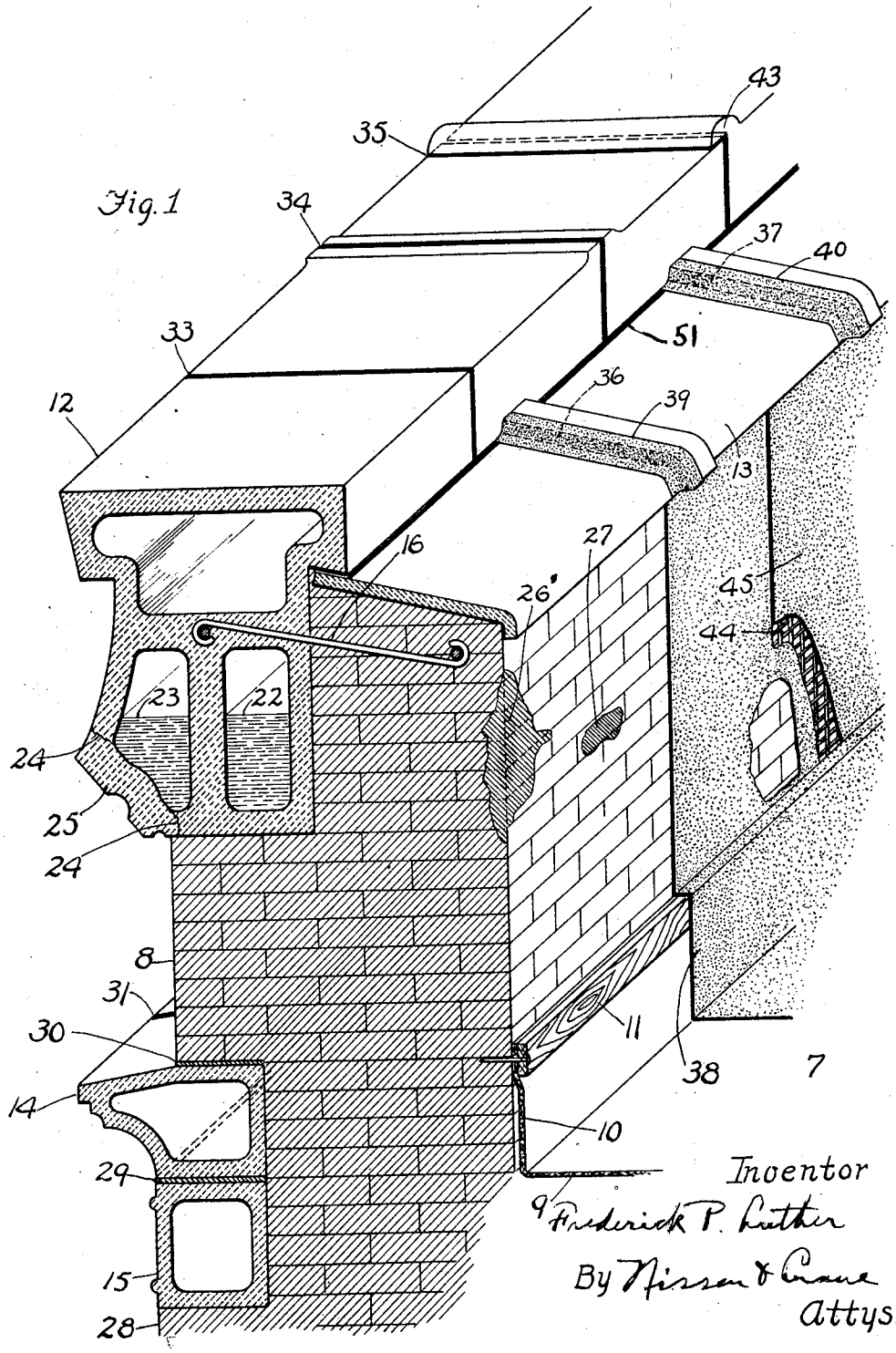
April 23, 1929. F. P. LUTHER 1,710,484

PARAPET AND FIRE WALLS ON ROOFS OF BUILDINGS AND METHOD OF WATERPROOFING SAME

Filed Jan. 14, 1924 2 Sheets-Sheet 1

Fig. 1



Inventor
Frederick P. Luther
By Nissen & Crane
Attys.

April 23, 1929. F. P. LUTHER 1,710,484

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Fig. 4

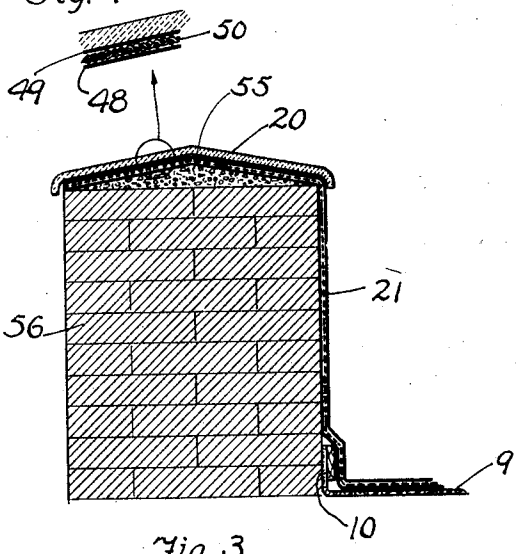


Fig. 3

Fig. 5

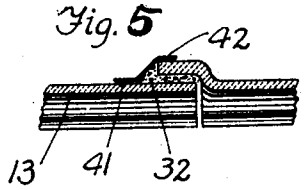
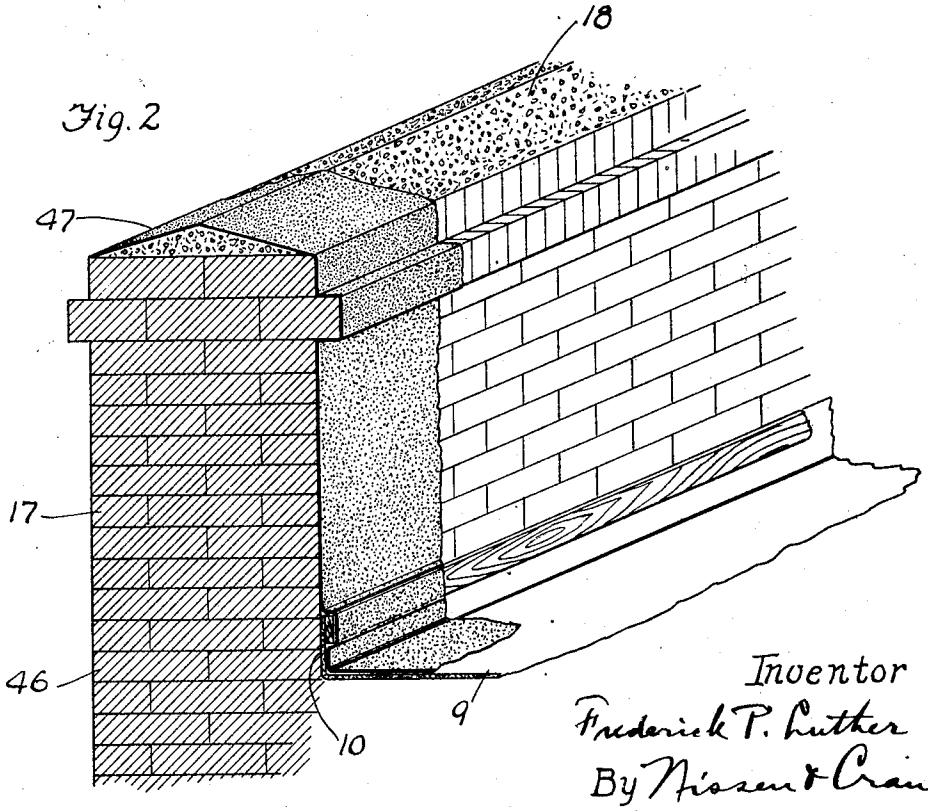


Fig. 2



Inventor
Frederick P. Luther
By Mason & Crane
Attys.

Patented Apr. 23, 1929. 1,710,484

UNITED STATES PATENT OFFICE.

FREDERICK P. LUTHER, OF CHICAGO, ILLINOIS.

PARAPET AND FIRE WALLS ON ROOFS OF BUILDINGS AND METHOD OF WATERPROOFING SAME.

Application filed January 14, 1924. Serial No. 685,943.

My invention relates to means and methods of waterproofing building construction at and near the roofs, particularly parapet and fire walls on the tops of buildings, and one of the objects of my invention is the provision of improved parapet and fire walls and the provision of an improved method of waterproofing such walls to preserve and protect the same against the elements thereby greatly prolonging their life.

A further object of the invention is the provision of a method of preventing damage to or destruction of parapet and fire walls of buildings and parts of such walls by waterproofing the body and top of such walls to prevent soaking and freezing which disintegrates the mortar in the joints, splits and crumbles the brick, and cracks pieces out of terra-cotta and other kinds of coping, as well as other parts which fall to the street and endanger the lives of the passers-by.

Another object of the invention is the provision of an improved method of waterproofing parapet and fire walls to prevent moisture from entering the walls and by unequal expansion due to the freezing of such moisture in the body of the walls cause the walls to lean outward beyond the face of the building and either fall to the ground or require their destruction and rebuilding.

In brick parapet and fire walls it has heretofore been the practice to use mortar exclusively for setting the bricks, tile terra-cotta, stone, etc. and sealing the joints between them. Mortar after becoming set and dry is hard and porous. A mortar joint is subject to two main destructive forces:

(1) Variation of temperature which causes a wall to expand and crack the hard mortar joint at nearly every tile where tile coping is mounted on top of the wall or is used in its construction; due to expansion the ends of the tile will be forced together by reason of the fact that in practice there is little or no mortar between the inner or lower ends of the tile, which movement will break the bond between the mortar and the tile, which results in cracks through which moisture can enter; or temperature variation may cause contraction and open a crack at nearly every joint in a row of tile, terra-cotta, brick or other kind of coping, such contraction breaking the bond between the mortar and the tile.

(2) Absorption of water which freezes the mortar and, with the assistance of acids carried in the atmosphere, disintegrates it and permits it to be washed out by the beating rain or blown away by the wind, thereby leaving an open joint.

One of the objects of the invention is the provision of a method of treating such walls partially disintegrated, to repair the same and prevent any further disintegration.

Other objects of the invention will appear hereinafter, the novel features and combinations being set forth in the appended claims.

In the accompanying drawings—

Fig. 1 represents a portion of a parapet brick wall on the roof of a building, with my improvements applied thereto;

Fig. 2 represents another type of parapet wall with my improved method applied thereto;

Fig. 3 shows a section of a parapet wall with a tile coping showing improved means for waterproofing the top and inside of the brick wall.

Fig. 4 is an enlarged sectional view of the waterproof covering shown in Fig. 3;

Fig. 5 is a view showing waterproofing material applied over the entire joint to cut off exposure of the mortar to the elements and to cover cracks previously opened by expansion and contraction.

Referring to Fig. 1 of the accompanying drawings, 7 designates the flat roof of an ordinary building with a parapet wall 8 extending upwardly from the periphery of the roof. A waterproof roof covering is shown at 9 which may be tarred paper or other material. This roof covering is extended partially upward at the base of the wall to form the flashing 10 which is secured to the wall by nailing the wooden laths or strips 11 thereto, as shown in Fig. 1.

On top of the parapet wall shown in Fig. 1 is a coping composed of a series of hollow terra-cotta blocks 12 on the street side and held in place by the anchorage rods 16. A series of half-tiles 13 are arranged on the roof side of the wall. On the street side there are also ornamental hollow terra-cotta blocks 14 and 15 arranged in courses extending across the entire street side of the building to form with the blocks 12 and the street side of the parapet wall, the ornamental design or finish for the top of the building. Copings on parapet walls and ornamentations at tops of buildings vary and include blocks of sandstone, limestone, concrete, marble, granite, etc.

In Fig. 2 is shown a brick parapet wall 17 with a brick coping ordinarily covered with Portland cement or other cement 18, the usual roof covering being shown at 9 and the flashing at 10.

In Fig. 3 is shown an ordinary brick parapet wall 19 with a tile coping 20 on top thereof, the usual roof covering being shown at 9 and the flashing at 10. The covering 21 shown applied to this wall will be hereinafter described.

Extending upward from the roofs of buildings in various places there are also fire walls similar in construction to the brick parapet walls but usually made entirely of comparatively soft brick on both sides while parapet walls are provided with hard or glazed brick on the street side. The usual coping tile, such as the half-tile 13 of Fig. 1 or the whole tile 20 of Fig. 3, is vitrified and therefore will absorb practically no moisture. The usual terra-cotta blocks 12 of Fig. 1 are glazed or hard burned on all surfaces exposed to the elements and will therefore absorb no moisture from the outside, but such blocks are hollow and by reason of the joints between the ends of the blocks water usually seeps into the hollow cavities, interior divisions or pockets in considerable quantites, as shown at 22 and 23 in Fig. 1. Upon freezing large portions of the terra-cotta blocks are broken away, as indicated at 24 in Fig. 1, and the broken pieces 25 fall into the street endangering the lives of the persons walking along the sidewalk below. The brick portions of the wall on account of the water seeping down through the joints at the top will also absorb moisture varying in amounts approximately inversely with the degree of hardness. When such absorbed moisture freezes the expansion caused thereby breaks away a great deal of the bricks, particularly on the inner or roof side of the wall, as indicated at 26 and 27 in Fig. 1. The freezing of moisture in the mortar in the joints also causes disintegration of the mortar and opening of the joints. Cracks are also caused by freezing of the moisture in the hollow terra-cotta coping, in the joints along the entire coping and in the bricks forming the body of the parapet wall or fire wall.

Through the cracks and open joints developed as above pointed out water enters into the body of the wall, and in the case of parapet or fire walls and projections making up part of the ornamentation or design on the face of a building, causes the accumulation of moisture to the point of saturation, particularly during cold weather when evaporation has decreased or ceased. For example, between the uppermost windows in the building and the ornamentations at the top of the buildng open joints at 30 and 31 in the courses 14 and 15 around such ornamentations and open joints at 31 in particular may permit sufficient water to seep into the upper portion 28 of the building that in cold weather disintegration of the mortar between the bricks may take place to such an extent due to freezing as to render the outside wall leaky. It should also be understood that this leaky condition of the outer wall may also occur below courses or horizontally extending ornamentations across the face of the building at lower levels than that shown in Fig. 1.

When moisture is absorbed by such a wall as that shown in Fig. 1, particularly at the inner surface thereof where the bricks are comparatively soft, the moisture freezes and sets up tremendous strains in the wall due to expansion, resulting in breaking away of sections of the brick as illustrated at 26 and 27 in Fig. 1, and the loosening of the mortar between the bricks or elsewhere wherever the mortar is used, and absorbs water and freezes. The softer the bricks the more likely this is to happen. On the inner surface of parapet walls disintegration is particularly noticeable because here the bricks are comparatively soft. Not only is the mortar ejected at the points between the bricks on the inner surface of the wall, but the brick itself is cracked and scaled off in pieces varying in thickness from that of paper to half a brick and this occurs over the entire inside face of the wall from the roof to the coping wherever cracks or open joints are found in the coping above. In the case of mortared joints, as shown in Fig. 5, the mortar will be broken or will become crumbled, thus opening the joints more and more upon each freezing operation as will be hereinafter more fully explained.

Hollow terra-cotta coping blocks are usually open at their ends and water seeping in at the joints 31, 33, 34 and 35 when mortared joints are exposed to the atmosphere, will partially fill interior pockets, freeze and crack away large portions of the tiling, as illustrated at 25 in Fig. 1.

Furthermore, expansion in parapet and fire walls due to freezing varies in different parts of the walls directly as the capacity of the materials of which it is built, to absorb moisture. Certain sections of the wall may vary in hardness as compared with those sections on each side and absorb moisture to a greater extent, and when frozen will heave to a greater extent than such adjacent sections, therefore, in addition to the effects above described, it is also found in practice that certain sections of the wall will heave above adjoining sections of the wall at different parts throughout its length, and such heaving will still further shatter the mortar and open up the joints throughout the heaved areas.

In practice, parapet walls on the front or street side of buildings are usually built of hard brick which absorb comparatively little

moisture. This hard brick facing is backed up with common or comparatively soft brick for the inner courses or roof side, which soft brick absorb a relatively large amount of moisture. As a result of the freezing of such absorbed moisture the wall expands unequally. There is very little expansion on the hard brick or street side due to the small amount of moisture absorbed, but the expansion is considerable on the roof side due to the large amount of moisture absorbed by the soft brick. In consequence the wall is bent or tilted outward over the street. This in turn also cracks the side parapet walls near the corners of the building, to which side walls the ends of the tilted wall are connected. Although the damage appears small at first, this condition becomes worse after every operation of freezing until eventually the parapet walls are liable to fall into the street and must be demolished and rebuilt entirely.

Furthermore, in practice, mortar in joints of cornices and other projecting courses and features, including window sills, where such parts are set in the wall singly or combined into courses with mortar at the cross joints as shown at 31 in Fig. 1, is subject to most of the destructive forces affecting mortar in copings, the result of which is to cause damage to the parts themselves in many of the ways above referred to. The cross joints on these projections after the mortar has disintegrated and been washed or blown away also concentrate the precipitation of water over those parts of the wall below them, which mars the appearance of the building and destroys the mortar joints between the bricks in the affected area to such an extent that water is driven by the wind into the wall and sometimes produces wet spots on the finished plaster of the rooms inside. When the walls are of common brick, as in the sides and backs of buildings, the brick itself is destroyed as in the case of the back or roof side of parapet walls.

Heretofore, in practice, no method of waterproofing such open or cracked joints in parapet walls and the other parts of the superstructure of buildings above described has been attempted. The usual method of repairing partially disintegrated walls has been to replace the completely destroyed brick and fill the open joints with new mortar on the back or roof side of the walls and to replace destroyed pieces of tile, terra-cotta, stone, etc. in the coping and tuckpoint the joints in all of such parts and also the brick work on the face of the building, with mortar, and let the process of disintegration begin again.

According to my improved method of repairing partially disintegrated walls at the tops of buildings all the places where water might enter are filled, not with mortar, but with an elastic or plastic waterproofing compound. Coating the under surfaces of the parapet walls from the flashing 10 to the coping is insufficient. It is essential to prevent moisture from entering the joints or other places at the top of the wall, as well as covering the whole surface of the exposed brick facing the roof. If the waterproofing is extended above the flashing 10 only to the coping, such as the tile 13 in Fig. 1, the walls are found to be rendered even more susceptible to disintegration because the moisture that seeps through the cracks and joints of the coping is kept from evaporating by the coating above the flashing with the result that when freezing takes place even larger areas of brick are broken away and scaled off than when the bricks are left exposed so that the moisture which seeps in through the coping could evaporate at least to some extent. In other words, by coating with waterproofing material the parapet wall over that portion facing the roof, while the wall would be protected from a small amount of moisture which could enter it by reason of rain driven against the side, it would shut off evaporation of the water which enters the wall through the open joints in the coping and retain this moisture until frozen which would split the brick more thoroughly than if there had been no coating there at all. The breaking away or flaking of the brick would, of course, carry with it any coating which was applied.

My invention is particularly applicable to parapet walls and superstructure at and near the roofs of buildings to prevent the beginning of any such disintegration as above pointed out, as well as to the repair of parapet and fire walls which have been partially disintegrated by the exposure to the elements as above explained, thereby greatly prolonging the life of any parapet wall or fire wall beyond that possible by treatments heretofore used in practice. My invention comprises an original method of preventing damage to or destruction of parapet walls of buildings and parts of such walls and to projecting courses and projecting parts of buildings due to water entering the body of such walls, courses and parts, which freezes and disintegrates the mortar in the joints, splits and crumbles the brick, cracks pieces out of the terra-cotta coping and other parts, which fall to the street and endanger lives and in freezing sets up unequal expansion in the body of a wall which causes parapet walls to lean outward, usually beyond the face of the building, and either fall to the ground or necessitate their demolition and rebuilding.

Not only should a coating of waterproofing compound be extended from the roof to the tile coping 13, as shown at 38 in Fig. 1, but all of the joints such as those designated 36 and 37 in Fig. 1, should have a waterproofing coating placed entirely over the joints at 39 and 40. The preferred method is to extend

the waterproofing coating over a certain area, as illustrated at 41 in Fig. 6 on one of the tiles 13 and also over a certain area on the overlapping tile, as illustrated at 42 in Fig. 6. If any of the mortar 32 has been displaced by the elements prior to the application of the waterproofing coating, such mortar may be replaced by the waterproofing material and not necessarily by new mortar. This is because the mortar itself absorbs sufficient moisture so that it can easily be cracked to pieces and cause open joints, whereas by means of an elastic or plastic waterproofing compound the joint may not only be made waterproof, but also sufficiently flexible to permit expansion and contraction without breaking or cracking the filling material as is the case with mortar. That is to say, due to changes in temperature the previous seal at the joints effected by the mortar is broken and the joint is opened and the tile sections may either pull away from each other or abut against each other causing a heaving of the tile over extended areas. When these conditions are repaired it is preferred to fill the open joints with the plastic waterproofing compound and extend the application to the overlapping joints in the manner illustrated in Fig. 6.

In the uppermost terra-cotta block 12 the joints 33 are cleaned of motar so far as removing the loose pieces is concerned and the crevices are filled with the plastic waterproofing compound not only on the top and rear sides of the terra-cotta block 12, but also on the side facing the street. Various kinds of joints between tile blocks are found in practice, such as those illustrated at 34 and 35, all of which are filled with the plastic waterproofing compound so as to fill all joints and allow a limited expansion and contraction of the blocks without endangering the opening of any of the joints. Where roll cover joints such as that illustrated at 43 in Fig. 1 are used, in practice, the settling of the wall below the terra-cotta coping or variation of temperature may cause the breaking of the roll cover from the terra-cotta block of which it is a part. By the use of plastic waterproofing compound, however, the filler below the roll cover 43 may be rendered sufficiently elastic to prevent such destruction and therefore the joint will be kept closed and moisture prevented from entering into the hollow spaces in the block or into the wall below.

By my improved method, instead of repairing the joints at 30, 31 and 29 by tuckpointing with mortar, the loose pieces of mortar are taken out and the joints filled and entirely covered with plastic waterproofing compound. This is done not only at the cross-joints 31, but also at the coursing joints 29 and 30 around the entire parapet walls. That is to say, where the mortar joints in the masonry have disintegrated, the joints are prepared for the plastic waterproof filling by first removing loose pieces of exposed mortar from between the bricks, tiles or stone at the various places illustrated in the drawing. Where the joints have become too widely opened or the mortar therein has become so disintegrated as to be no longer relied on for acting as holding joints the the masonry, fresh mortar should be inserted because the mortar must be relied on as the holding means between pieces of masonry. In any event, however, whether loose exposed mortar is removed from the joints or fresh mortar inserted to restore the joints, a groove is provided of sufficient depth and width to permit a sufficient amount of elastic waterproofing material to be placed in the grooves above the mortar to fully restore the joints and render them impervious to moisture even during contraction of the masonry due to wide changes of temperature of the atmosphere. It is preferable, as shown in Fig. 1, to apply the elastic waterproofing material into the grooves above the mortar in the joints so that the waterproofing material will be entirely within such grooves and its surface flush with the surface of the masonry and not spread over the latter because it is preferred to have the elastic waterproofing material of sufficient area of contact with the masonry and of sufficient body to enable the waterproofing material to be maintained in adherence with the masonry throughout the wide range of difference of temperature and the consequent contraction of such masonry, the object being to maintain the joint impervious to moisture under all of the various weather conditions.

In applying the waterproofing coating 38 to comparatively new walls or to walls which have been only slightly damaged by disintegration due to the elements a single coating is sufficient in practice when combined with the waterproofing of all of the joints in the coping such as at the joints 39, 40, 46, 33, 34 and 35 and the coursing joints 29, 30 and 31. When a wall is to be repaired which has been considerably damaged by the elements the loose and partly scaled off pieces are first removed and the plastic compound applied from the roof 9 over the flashing 10 up to the coping 13 as illustrated at 38 in Fig. 1 and while the compound is still in a semi-liquid condition a coating of fabric 44 is applied directly to the soft semi-liquid coating of waterproofing compound so as to partially absorb the compound and adhere thereto. Then over the top of the coating of fabric 44 is applied another coating 45 of the waterproofing compound so as to apply to the wall two coats of water proofing compound with an intermediate layer of fabric as a binder and so as to more thoroughly protect the wall which has been already injured to a considerable extent, but which is to be protected from further disintegration by keeping the moisture not only

from entering at the side facing the roof, but also from any joint in the coping of the wall.

Parapet walls are found in practice consisting of brick as shown at 17 in Fig. 2 with the top or coping composed of brick with a layer of cement 18 above. This cement is disintegrated by the elements so as to expose the joints in the bricks below and water seeping in and freezing tends to rapidly destroy the whole wall. To prevent the starting of such destruction or to repair a wall which has been partially disintegrated a coating of plastic compound as illustrated at 47 in Fig. 2 is extended from the roof covering 9 not only to the coping, but entirely over the top of the same. This is done after the loose pieces of concrete and flaked brick have been removed from the wall.

Where the walls have been considerably damaged by exposure to the elements two coatings of the waterproofing compound with an intervening layer of fabric may be applied, as illustrated in Fig. 1. This is also illustrated in Fig. 3 at 21. These waterproofing layers including the fabric are also extended from the roof covering 9 not only over the inner surface of the wall, but over the entire top of the same. As heretofore explained, the faces of the brick at the left side of Figs. 1, 2 and 3 are usually glazed or hard brick and therefore absorb little or no moisture, but in case of fire walls which separate sections of buildings the waterproof coating is applied to both sides of the wall, as well as the top; such walls not being easily visible, such coatings are not objectionable from the standpoint of appearance.

Fig. 4 is a section of a portion of the top of Fig. 3 to show two layers of waterproofing compound 48 and 49 with an intervening layer of fabric 50. On top of the waterproofing layers is shown coping tile 20, although other forms of coping may occur in practice. When the coping on a wall is in such dangerous condition that it has to be removed, such portions of the mortar bed as shown at 55 in which the tiles were set as may itself be loose or broken are also removed and new mortar approximately to conform to the shape of the portions of mortar which were not removed or which is approximately the shape of the tile or other coping material, is then applied and the waterproofing layers and fabric applied over the top of this as shown in Fig. 3 at 21. The tile is then re-set. The coping joints are then filled with mortar in the usual way and the waterproofing material applied over the mortar as shown at 41, 42 in Fig. 6, or the joints may be filled with the waterproofing material itself. When a wall in addition to the coping, it is such condition that it has to be torn down and rebuilt the waterproofing coating and fabric are carried up over the top of the brick wall. Mortar to form the bed for the coping tile or other coping material is then applied over the waterproofing material on top of the wall and the coping re-set in the soft motar. The joints in the coping are then filled and waterproofed as above described.

It should be particularly noted that in practice prior to the application of my improvements to walls which are to be treated, the space between the ends of such tiles as shown in Fig. 5 is usually empty or without mortar at the place designated by the reference number 52 in Fig. 5. Upon expansion of the tile sections the mortar seal at the overlapping joint is broken particularly along the surface 53. When the tiles contract the overlapping portion of the right hand section tends to pull away from the other section and therefore break the mortar seal at 54. The expansion and contraction which occurs in practice will therefore open the joint and permit water to seep into the top of the wall. As the result of contraction only in other forms of coping the joints are also opened up as last above described.

Waterproofing compounds or plastics which could be used for the purpose of carrying out my invention are offered for sale on the open market. A compound suitable for this purpose may be prepared by slowly adding to asphaltum, boiled and refined at about 400° F., a certain amount of linseed oil. This is done by mixing the linseed oil with the asphaltum when sufficiently heated and also mixing with the asphaltum a certain amount of pine oil. 41 parts by weight of asphaltum may have added to it 10 parts of linseed oil and 10 parts of pine oil. This mixture is then given body by the admixture of about 39 parts of Portland cement. Generally the proportions may be varied to change the consistency of the mass for application at different seasons of the year. Other materials may be substituted, such as coal tar, pitch, etc., for the asphaltum. Other oils may be used, such as fish oil or paraffine. Plaster of Paris or other cement or asbestos fibre may be uesd instead of the Portland cement. For a practical batch having a predetermined weight 41% may be asphaltum, coal tar or pitch, 10% linseed oil, 10% pine oil, fish oil or paraffine, and 39% Portland cement, plaster of Paris, asbestos fibre or other cement. When originally applied it is in a semi-liquid condition, but soon becomes sufficiently hard for practical purposes although it remains relatively soft and plastic so as to yield to expansion and contraction while at the same time permanently sealing the joints and thereby waterproofing the entire parapet wall not only at that side facing the roof, but also at the top and front side and thereby preventing any moisture whatever from entering the wall where it is likely to do damage when it is frozen.

Obviously those skilled in the art may make various changes in the details and arrangement of parts without departing from the spirit and scope of the invention as defined by the claims hereto appended and I wish therefore not to be restricted to the precise constructions herein disclosed.

Having thus fully disclosed an embodiment of my invention, what I desire to secure by Letters Patent of the United States is:

1. Method of treating old brick parapet tile coped walls of buildings which consists in removing the tile coping and loose cement or mortar and applying a coating of waterproof material not only to the upright face of the wall extending upwardly from the roof but also over the entire top of the brick wall proper, applying over the same area to such coating a layer of fabric, applying another coating of waterproof material over said fabric, replacing the tile coping, and applying waterproofing material to the joints between the coping sections to assist the said coatings to render impervious to moisture the upper surface of the brick wall proper as well as the face thereof adjacent the roof.

2. The method of treating old brick parapet walls having tile coping to preserve the wall by rendering the same impervious to moisture not only the inner face adjacent the roof but also on top of the wall, which consists in removing the tile coping, removing loose cement or mortar and broken pieces of brick, applying coatings of waterproof and fibrous material not only over the entire top of the brick wall proper but also over the entire inner face of the wall down over the roof flashing to the roof covering, replacing the tile sections as coping, and applying waterproofing material to the joints of the sections.

3. The method of treating parapet walls of buildings to render such walls impervious to moisture not only on the faces adjacent the roof but also on top thereby protecting the walls against the elements and preserving the walls against disintegration, which consists in removing loosened material from the wall, applying a coating of waterproofing material to the vertical surface facing the roof, and covering the joints of overlapping sections of half tile coping with plastic waterproofing material, and filling the joints of the terra-cotta tile coping with waterproofing material not only on top but also on that side distant from the roof to render impervious to moisture the entire wall proper and also the hollow interiors of the terra-cotta tiling.

4. The method of preparing exterior walls of buildings comprising outside elevated ornamental courses composed of sections with mortar joints between the same, which consists in removing exposed mortar from the joints to form grooves between such sections and filling such grooves with non-hardening plastic waterproofing material to complete the joints and render such elevated courses impervious to moisture at the joints, leaving the masonry uncovered adjacent the joints.

5. The method of treating outside masonry on the exterior of building structures in elevated positions above ground, which consists in removing exposed mortar at the joints to form grooves, and filling such grooves with non-hardening plastic waterproofing material to form joints impervious to moisture from the outside, while leaving the adjacent masonry exposed.

6. The method of repairing building parapet walls having a wall proper and a tile coping, which consists in removing exposed loose mortar from the joints in the wall proper and in the coping and from under the tile, replacing loose mortar with fresh mortar in the wall proper and on top thereof, applying a non-hardening plastic waterproofing material to the wall proper and top of the same, replacing the tile and applying mortar to the joints between the same and covering the mortar of the joints with such non-hardening plastic waterproofing material to render impervious to moisture the entire parapet wall including the tile coping thereof.

7. The method of repairing building parapet walls having a wall proper and a tile coping mortared to the top of the wall, which consists in removing the tile coping for access to the mortar on top of the wall, then removing the loose mortar from the top of the wall and from that side facing the roof, replacing the removed mortar with fresh mortar to restore the wall proper, applying non-hardening plastic waterproofing material on that side of the wall facing the roof from the coping to the roof, replacing the tile on the fresh mortar on top of the wall, mortaring the joints between the tiles and applying non-hardening plastic waterproofing material to cover the mortar of the joints between the tiles.

In testimony whereof I have signed my name to this specification on this 11th day of January, A. D. 1924.

FREDERICK P. LUTHER.