Feb. 7, 1956 H. F. TOLLE 2,733,789

WATERTIGHT JOINTS FOR GLAZING AND THE LIKE

Filed May 16, 1950 2 Sheets-Sheet 1

Fig 1

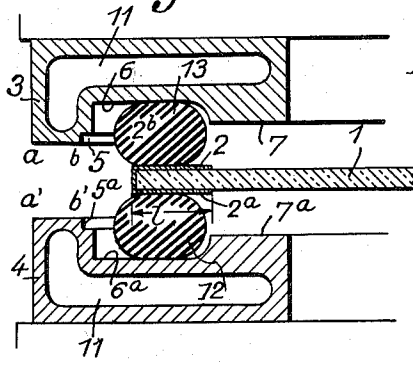


Fig 2

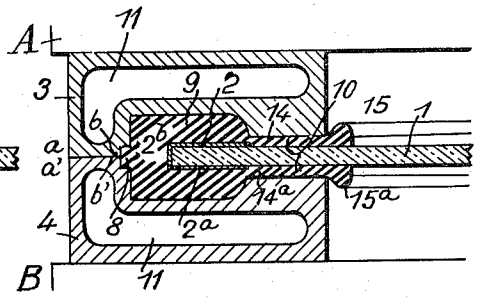


Fig 3

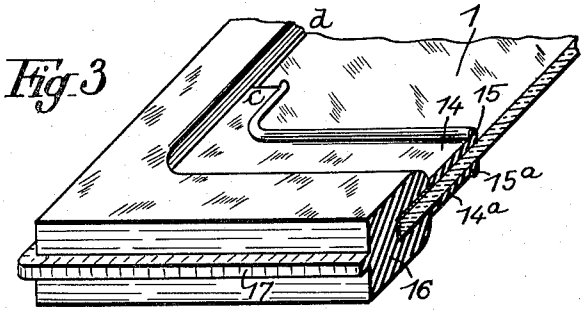


Fig 4a

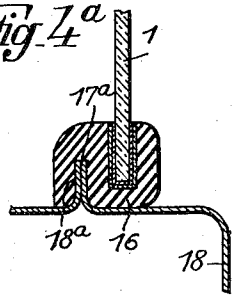


Fig 4

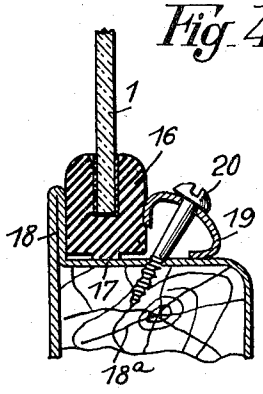


Fig 5

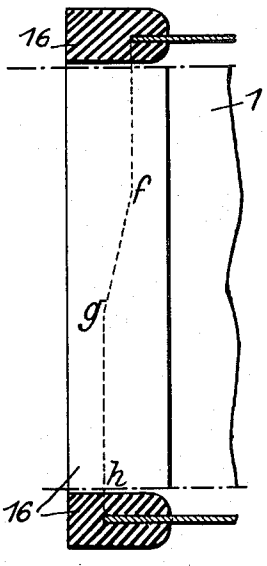
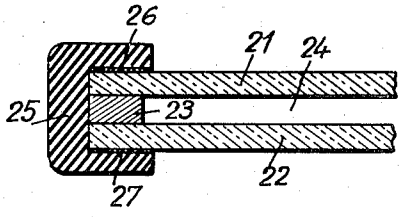


Fig 6



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WATERTIGHT JOINTS FOR GLAZING AND THE LIKE

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Fig. 7

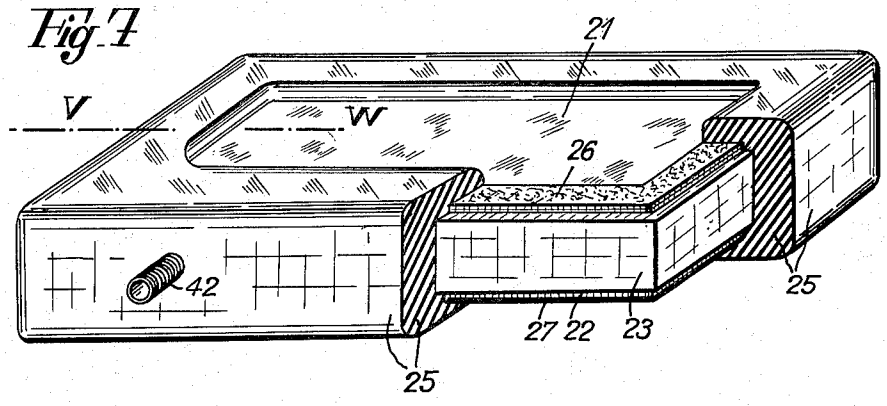


Fig. 8

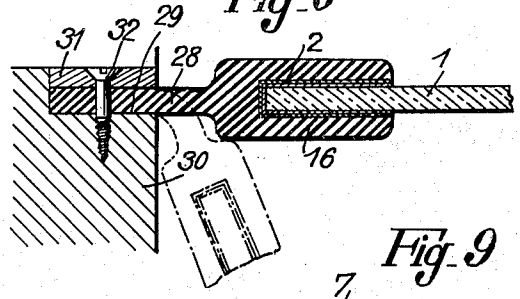


Fig. 9

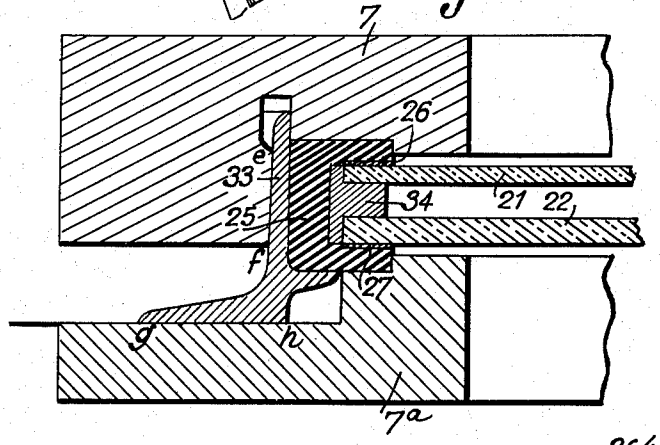


Fig. 10

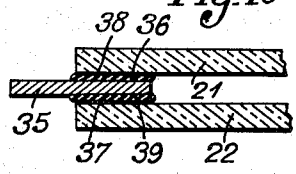
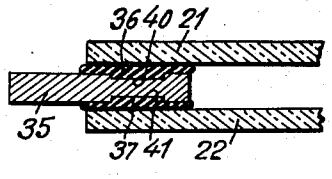


Fig. 11



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2,733,789

WATERTIGHT JOINTS FOR GLAZING AND THE LIKE

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Application May 16, 1950, Serial No. 162,230

Claims priority, application France May 20, 1949

9 Claims. (Cl. 189—78)

The invention relates to improvements in watertight joints for glazings and their process of manufacture. It relates more particularly to glazings for motor car bodies, such as wind-screens, rear windows, port deadlights, etc., as well as building glazings, consisting of one, two or several parallel panes.

The invention is concerned with glazings consisting of sheets or plates of conventional or hardened glass, safety laminated glass consisting of several glass sheets glued together by an intervening film of plastic material and it has for its object to provide at the periphery thereof a watertight rubber joint.

Considering the particular case where a wind-screen is to be mounted inside its frame, a specific object of the invention consists in providing a joint which, on the one hand, will have such a resiliency as to protect the wind-screen as much as possible against shocks and vibrations, and, on the other hand, will be thoroughly watertight in order to prevent rain from leaking into the car. The conventional method consists in engaging the edges of the wind-screen into the rabbet of a rubber joint member, a glue being interposed, and securing the whole in a metallic mounting. After the glue has been allowed to dry for a suitable time, the joint is supposed to provide the desired watertightness. Actually this method is not satisfactory, and the watertightness afforded by the glue is poor and precarious. Furthermore, it is practically impossible to make glazings having very accurate dimensions. Consequently, at some places, the glass incompletely fills the rabbet of the rubber joint or the later incompletely fills the rabbet of the frame, which in either case both reduces watertightness and strength.

The problem of providing a watertight joint over the periphery of a glazing is still more difficult for glazings made up of several parallel glass sheets, between which air is entrapped. It is well known that the possibility of using such glazings is tied with an efficient watertightness.

The process according to the invention is based on a double observation, viz: that, while rubber cannot be efficiently glued to glass, it will very strongly adhere to certain metals or alloys, and that glass can be coated with highly adherent metallic layers, according to well known processes.

The process according to the invention essentially consists in coating the marginal portions of the glazing with a strongly adhering metallic layer and causing a rubber joint to adhere to said metallic layer.

As a rule, between the metal and the rubber is interposed a glue which, by drying, baking, polymerization or vulcanization, etc. will adhere both to metal and natural or synthetic rubber.

Instead of moulding or otherwise preforming the rubber joint element, the vulcanizing operation, which requires a vulcanizing mould, will be advantageously combined with the moulding operation.

An important feature of the invention therefore consists in inserting into a suitably shaped vulcanizing mould the metal-plated margins of a glazing, either single or made up, of several glass panes separated by suitable marginal distance pieces, and unvulcanized rubber, in moulding said rubber in position around the glazing while simultaneously cementing the rubber to the metal-plated margins of the glazing by vulcanization.

This improved process not only avoids the necessity for a preforming operation (moulding, extruding or rolling) of the joint, but it affords some other important advantages: as the rubber joint is shaped over the periphery of the glazing, distortion and abnormal stresses which are often responsible for the lack of watertightness or the short duration of the joint, particularly in rounded parts having a small radius, are completely avoided.

Moreover, watertightness is as efficient with a glass sheet, the surface of which is formed with intaglio or relief designs (chequered, rippled, corrugated, hammered and the like) as with glass panes or plates having a smooth surface.

Moreover, the need for a cementing operation in order to assemble together the ends of the joint girdle is avoided.

Furthermore, this process permits of producing a rubber-framed glazing having the same precision in the dimensions as the frame adapted to accommodate the glazing.

The periphery of the joint may be formed with packing ribs adapted to be compacted within the rabbet of the frame upon mounting or with slits or grooves adapted to accommodate projecting ribs on the window or frame; these arrangements secure a perfect watertightness between glass and rubber and a satisfactory watertightness between the rubber joint and the rabbet of the frame.

Further features of the invention will be apparent from the following description, with reference to the attached drawings, which show, by way of example, several embodiments of the invention and in which:

Fig. 1 is a diagrammatic cross-sectional view of a mould used for manufacturing a joint according to the invention, the mould being shown in the open position.

Fig. 2 is a view similar to Fig. 1, showing the mould in the closed operative position.

Fig. 3 is a partial perspective view of a rubber-girdled glazing.

Fig. 4 is a cross-sectional view of a part of the glazing, mounted within its frame.

Fig. 4*a* is a view similar to Fig. 4, showing a modification.

Fig. 5 is a diagrammatical view of a length of such a joint, with cross-sections at the ends, to show a joint moulded on a glazing having an irregular edge.

Fig. 6 is a diagrammatical section of a joint formed on the edge of a double glazing.

Fig. 7 is a perspective view, with parts broken away, of a double glazing girdled with a joint according to the invention.

Fig. 8 is a cross-sectional view of a joint acting as a hinge.

Fig. 9 shows a mould for vulcanizing the rubber joint both on the glazing and on a metallic frame.

Fig. 10 is a cross-section of a double glazing wherein a part of the metallic frame forms a distance piece between the glass panes and

Fig. 11 is a similar cross-section of a modification.

Referring to Fig. 1 of the drawing, 1 denotes a glazing, on the edges of which a rubber joint is to be formed. For this purpose, a marginal portion of the glazing is coated over a suitable width *l* with a metal layer 2, 2*a*, on each face of the glazing, by one of the well known metal-depositing processes, in order to provide an anchorage for the rubber joint. Said metallic layer will generally be covered with a film of glue, in order to im-

prove the surface bonding of rubber by vulcanization, as is well known in the art. This glazing is then inserted into a vulcanizing mould, consisting for instance of two halves 3 and 4, which, when they are brought close together (Fig. 2), are in contact along their marginal walls *ab, a'b'*. Recesses such as 5, 5ª, 6, 6ª, 7, 7ª, facing each other are adapted to form, when the mould is closed, a small recess 8, a large recess 9 and a slot 10, the latter accommodating glazing 1 with a certain amount of clearance. The halves 3 and 4 of the mould are provided with heating means, for instance steam ducts 11.

To vulcanize a joint on the glazing, a strip 12 of non-vulcanized rubber is laid into recess 6ª, the glazing is laid in position, and another strip 13 of non-vulcanized rubber is laid on the metal-plated margins of the glazing. Then the mould is closed, and the required pressure is applied, for instance by inserting the moulds between the plates A and B of a hydraulic press (Fig. 2). The amount of rubber which is introduced into the mould should be in excess over the capacity of recesses 8 and 9, so that the surplus of plastic unvulcanized rubber is extruded or expelled, as the mould is closed, between the walls of slot 10 and of glazing 1, thus forming two thin films of rubber 14, 14ª and possibly two beads 15, 15ª. In this way, recess 9 will be with all security entirely filled with rubber.

Then the mould is heated under pressure to the vulcanizing temperature, for the required time; the mould is thereafter opened and the glazing, framed with a strongly adhering rubber joint, is removed. A portion of such a rubber-girdled glazing is shown in Fig. 3. The rubber joint proper 16, is strongly joined to the metal layers 2, 2ª, which, in turn, are joined to the glass in a very tenacious manner. On the contrary, the thin films 14, 14ª and beads 15, 15ª of extra rubber do not bind to the glass and they can be easily removed by cutting them flush with joint 16, as shown in *cd*, by means of any suitable cutting tool. In the small recess or groove 8 is formed a rib 17, the purpose of which will be apparent from Fig. 4. In this figure, the glazing 1 is shown as mounted in the rabbet of a metallic frame 18, covering a wooden frame 18ª, for instance, the joint 16 being pressed into the rabbet by a covering strip such as 19, held by screws 20. The peripheral dimensions of joint 16 and rabbet 18 are so selected as to leave the required clearance for an easy positioning of the glazing and to cause elastic deformation of the rib 17, which in this manner resiliently presses against the bottom of the rabbet.

Two or more ribs, such as 17, may also be provided, extending over one, two or three sides of the joint to improve the watertightness and to form a series of restricted passages opposing water leakage; these multiple ribs may form on the sides of the joint a kind of corrugation.

Instead of forming the joint with projecting ribs, it may be provided with grooves or slits such as 17ª (Fig. 4*a* formed upon moulding and adapted to accommodate, with a tight fit, ribs such as 18ª, projecting from the frame 18. This device both improves watertightness and provides for the attachment of the joint inside the frame.

Fig. 5 shows that watertightness is not affected by dimensional irregularities of glazing 1. It has been assumed in said figure that the edge of the glazing has an irregularity *efgh*, strongly magnified in the drawing. It is seen that such an irregularity has no other effect, as illustrated in the endwise cross-sections through *e* and *h*, than a more or less deep penetration of the glass into the rubber.

Figs. 6 and 7 show how the process is used for making a double glazing, consisting of two panes or sheets of glass 21, 22 which an intervening marginal distance bar 23, providing an air cushion 24, the rubber joint 25 sealing the edge of the assembly.

For the manufacture of such a joint, the margins of panes 21, 22 are metal coated on their external faces only, as shown at 26, 27. The assembly is then placed in a mould similar to that of Figs. 1 and 2, with the rubber strips 12 and 13, which are adapted to form the rubber joint 25, after moulding, vulcanization and removal of the surplus films such as 14, 14ª and beads such as 15, 15ª. Joint 25 may be provided with peripheral ribs such as 17 (Fig. 4).

It should be understood that the above mentioned process is by no means restricted to the embodiments previously described.

The glazing may be of any suitable shape, either flat, or cylindrical or otherwise curved.

By "glazing" is meant any transparent or translucid glass object which is to be connected in a watertight manner with adjacent structural elements.

Manufacture of multicolour stained-glass windows, cementing of glass blocks, etc. fall within the scope of the invention.

The nature of the metal to be deposited upon the glass surface will depend, of course, on its aptitude to binding with glass and rubber. Aluminum and its alloys, optionally plated with brass, is particularly well suited.

The thickness of the coating may be of about 0.5 to 0.15 mm. The metal layer in contact with glass may be deposited by any appropriate means. The preferred process consists in spraying molten metal with an oxy-acetylenic gun. This technique is well known and does not require any detailed description.

Worth notice is that adherence of metal to glass requires the thorough removal of grease from the surface to be metal-coated. Preheating of the glass pane to 250–350° C. generally improves adherence. If such a preheating is undesired or impossible, the surface to be metal-coated can be previously etched, for instance by means of a sandblast or with an acid.

If a double metal layer is used, the upper metallic coating, such as brass-plating for instance, may be obtained by the same process, but it is preferable to use electroplating, in accordance with the conventional technique. A brass containing 70% of copper and 30% of zinc has given good results.

In order to limit the area to be metal-coated, the adjacent areas can be protected by guards or stencil-plates. If required, panes can be metal-coated on their edge as shown in 2ᵇ in Figs. 1 and 2.

The kind of glue or cement to be used for ensuring surface-bonding of rubber on the metal depends on the nature of both materials. Solutions of rubber in solvents or other cements conventionally used in the technique of vulcanizing rubber on metal are suitable for this purpose.

A cement which has given good results consists in a solution, in a solvent, either of rubber hydrochlorate, or of the product of the reaction of acrylic nitrile and natural and chlorinated rubber, for instance the products known under the trade names of Ty-Ply "Q" on the United States market, and of "canite" on the French market.

When the rubber joint is preformed and heating is superfluous or to be avoided, cold gluing can be carried out with a glue or solution of rubber of the type used for cold gluing of rubber on metal.

If necessary, the metal-plated area should be cleaned of grease before glue is applied and it will consequently be advisable to apply the glue on the metal-plated area as soon as possible, in order to protect the latter against fouling and alteration and to ensure that the glue shall be thoroughly dry before the joint is moulded and vulcanized.

In the preceding description, it has been assumed that the plastic mass is placed in the mould in the form of more or less shapeless strips of cords 12, 13. However, the consistency and the form in which this mass is used may vary from a fluid or paste which is poured or injected into the mould, preferably under pressure, to a still plastic joint blank having approximately its final shape, preformed by moulding, extrusion, rolling, etc.,

through more or less roughly shaped blanks as the strips or cords above mentioned.

The mass of raw material may already possess substantially the same properties as the final joint, and for instance, it may be a preformed blank of vulcanized rubber, the heating under pressure having no other effect than to ensure surface bonding to the metal, but, as aforesaid, it is much more advantageous to use a raw material which, before being moulded, is plastic enough to be able to completely fill the mould, the surplus being expelled in the form of films 14, 14a and which, after hot moulding, is chemically altered to loose its plasticity and acquire the desired resiliency. Unvulcanized rubber and some synthetic rubbers undergo such a transformation.

Mixtures of natural or synthetic rubbers conventionally used for manufacturing moulded rubber objects, such as joints, spacers, engine supports, etc., can be advantageously used. These mixtures are usually vulcanized by heating at 140–150° C. for 15 to 20 minutes. They have a hardness of about 50–70° Shore.

By way of example, the following mixture has given satisfactory results:

Raw rubber in the form of a smoked sheet	100
Carbon black	30
Zinc oxide	5
Sulphur	3
Stearic acid	3

To this mixture, the usual small amounts of correctors, accelerators, anti-oxygen products, are added.

Similar mixtures, using synthetic rubbers, as for instance Neoprene, may also be employed to obtain better aging properties or a better resistance to atmospheric agents or to certain substances such as oils, solvents, etc.

In the case of laminated glass, use will preferably be made of rubber mixtures adapted to vulcanize at temperatures of about 100–110° C., since higher temperatures would affect the intermediate plastic layer.

Of course, the profile of the rubber joint will vary according to the profile of the frame or rabbet. The glazing frame may even be reduced to the rubber girdle itself: thus an opening window sash, or a skylight, etc., can be girdled by a rubber joint which, in the closed position of the window or skylight, is adapted to bear yieldingly and in a watertight manner against a fixed frame. In such case, taking advantage of the deformability and resiliency of the rubber material of the joint, the hinge of the opening sash may consist of an extension made integral with the joint by moulding, as shown at Fig. 8, wherein the joint is extended on a portion or on the whole of one of its sides by an extension or flap 28, engaged in a rabbet 29 of the fixed sash 30, a tightening strip 31 being secured over flap 28 by screws 42. As shown in dotted lines, the opening of the glazing causes a bending of the free part of flap 28, which forms a hinge and can be, if necessary, reinforced by a skeleton of canvas, or spring steel.

When the glazing is held in a metal frame, the joint may be vulcanized simultaneously to the glazing and to the metal frame during the moulding operation, as shown in Fig. 9, in which a double glazing 21, 22 is shown, on the periphery of which a joint is being moulded in a mould 7, 7a. The latter is so designed as to receive and position a metal bar 33 or other structural element of the frame, and it has surfaces such as *ef, gh* adapted to engage the metal bar 33 the latter, thus being in a heat conducting contact with the hot walls of the mould, in such manner as to bring the bar to the temperature of vulcanization and to provide for the watertight and strong surface bonding of joint 25 with bar 33. The structural bar may, of course, be of any suitable cross-section and shape, the mould being shaped accordingly.

The metallic parts of the frame bar, which are to be vulcanized to the joint, may be brass-plated, in order to improve surface-bonding. They must be cleaned of grease and are preferably covered by a glue or cement, as previously explained.

It will be noted in Fig. 9 that distance bar 34, which serves to keep the spacing between panes 21, 22 is T-shaped, so as to facilitate the correct positioning of the panes in the mould and to counteract the tendency of the rubber to flow back between the panes during pressure moulding.

This distance bar may be of any suitable rigid or semi-rigid material, able to withstand, without undergoing excessive deformation, the pressure, which, during moulding, tends to bring the panes close together and to cause rubber to be expelled into the space between the panes. It may be made, for instance, of a thermoplastic or thermosetting material, of ebonite, of hard vulcanized rubber, of fiber, of mineral or organic glass, of metal, etc.

Said distance bar will be advantageously glued on each pane to be assembled, by means of methods and products which permit a provisional assembly, strong enough to facilitate handling before moulding, and tight enough to permit moulding under pressure of the rubber joint on the periphery of the glazing without any penetration of the rubber into the space between the panes.

The following glues may be used, for instance, for this purpose: silicate glues, rubber glues, cellulosic glues, synthetic glues, vinylic glues, etc., glues capable of growing mouldy or fermenting being preferably excluded.

The distance bar 34 may consist of the inner web of a structural frame bar or the latter may be reduced to said distance bar, as shown in Fig. 10, in which 35 denotes said web, inserted between panes 21 and 22. On this example, the joint is reduced to two rubber strips 36, 37 vulcanized both on the metal-plated areas 38, 39 of the panes, and on web 35.

In the modification shown on Fig. 11 joints 36, 37 are housed in grooves 40, 41 of web 35.

In all devices embodying the invention, the glazing and the joint form an integral unit, manufactured in mass production in the workshop in the best conditions of rapidity accuracy and saving, and the contractor or user is supplied with standard elements of little fragility which can be mounted in turn in the best conditions. The precision obtained by the moulding operation, which can reach the hundredth of a millimeter, is such that the unit can be perfectly adjusted in mass production. It will be noted that the watertightness of the glazing so obtained is not dependent on any external tightening.

In all the above described double glazings, it is possible, when the panes are placed in the mould, to insert between these panes various materials and, particularly, insulating materials such as glass wool or materials capable of absorbing moisture, such as silica gel.

A valve or fitting 42 (Fig. 7) or any other appropriate device may be provided, extending through joint 25 and distance bar 23 and allowing the atmosphere within the space comprised between the panes and the joint to be conditioned, or permitting of evacuating said space or of establishing an overpressure or of introducing any suitable fluids.

One or both sides of the panes may be provided, by the process already mentioned of gun spraying, with metallic heating resistances, whereby simple or double glazings can be used as anti-dew or anti-frost devices.

The formation, by way of moulding, of a joint of some millimetres in thickness on the periphery of glazings permits the use of rough-cut panes, which need not be machined to very accurate dimensions, the excess of raw material used for providing the joint offsetting differences in sizes of the order of magnitude of the millimetre.

If the available moulding and vulcanizing outfit has not dimensions large enough to fit at one time the whole periphery of the pane, moulding and vulcanizing may be carried out on successive sections of the periphery by moving the glazing between the parts of the mould and the plates of the press.

Of course, the invention is not restricted to the details of execution above described, which have been given only as examples.

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

1. As a new industrial product, an integral unit comprising in combination a glass element, an adhering marginal metal coating extending along the periphery of said glass element and a rubber girdle vulcanized to said metal coating to form a watertight joint.

2. As a new industrial product, an integral rubber-girdled glazing comprising in combination a glass sheet, an adhering marginal metal coating extending along the periphery of said glass sheet and a channel rubber girdle vulcanized to said metal coatings to form a watertight joint.

3. The product claimed in claim 1, wherein said coating is of aluminium.

4. The product claimed in claim 1, wherein said coating comprises an aluminium underlayer and a brass upper layer.

5. As a new industrial product, an integral unit comprising in combination two parallel glass sheets, an intervening marginal spacing bar, adhering marginal metal coatings on the external faces of said glass sheets, and a channel rubber girdle vulcanized to said metal coatings to form a watertight joint.

6. The product claimed in claim 5, comprising means, extending through said spacing bar and rubber girdle, for temporarily connecting the space between said glass sheets with the exterior.

7. The product claimed in claim 2, wherein said girdle is formed with an integral hinge-like flap.

8. As a new industrial product, an integral unit comprising in combination a glazing, a surrounding metal frame and an intermediate rubber joint, the rubber whereof is vulcanized to the adjacent surfaces of said metal frame and to marginal metal coatings at the periphery of said glazing to secure a watertight connection between said glazing and frame.

9. The product claimed in claim 8, wherein said glazing comprises at least two parallel glass sheets, said frame having metallic webs extending between pairs of glass sheets to form distance pieces therebetween and said rubber joint being vulcanized to said webs.

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