

March 29, 1949.

H. H. HAMAN ET AL
WATERPROOF FABRIC SEAM

2,465,374

Filed March 20, 1944

3 Sheets-Sheet 1

FIG. 1.

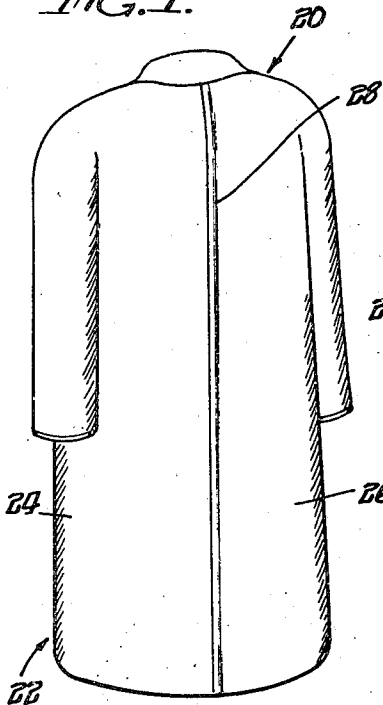


FIG. 2.

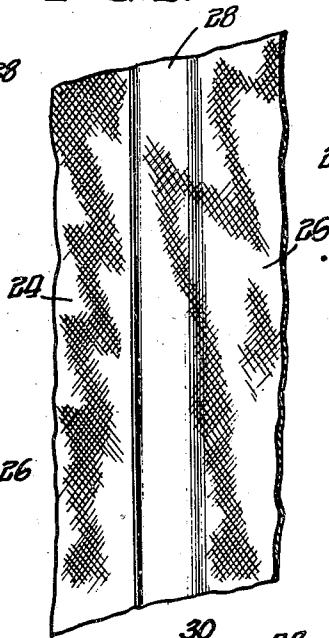


FIG. 3.

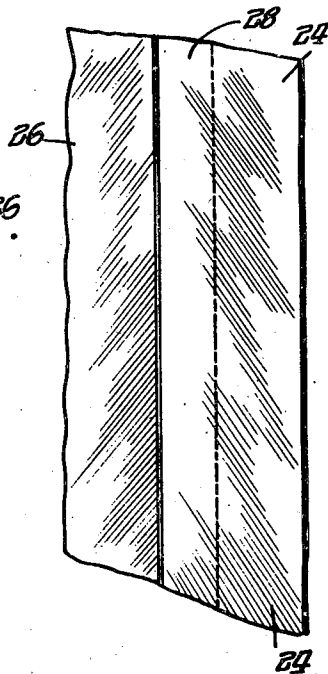


FIG. 4.

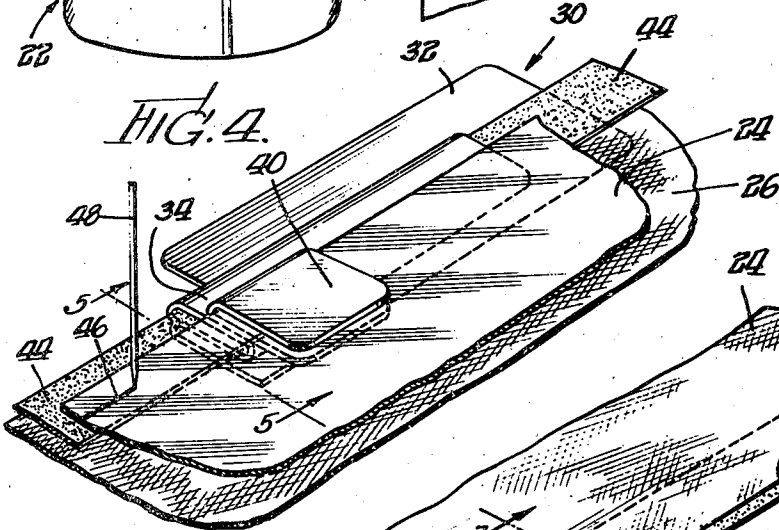


FIG. 6.

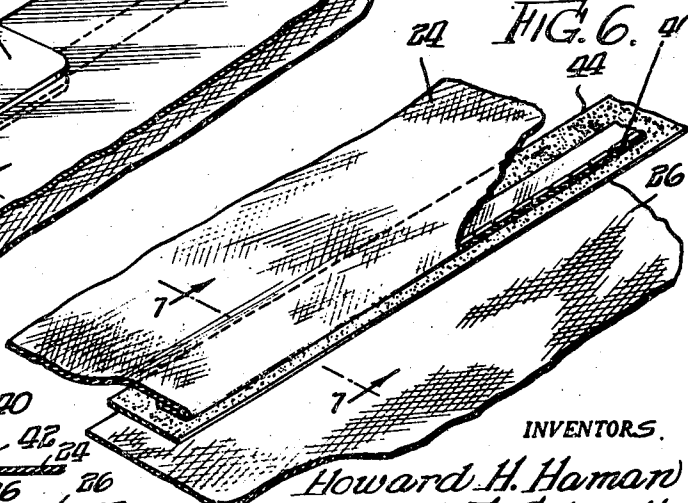
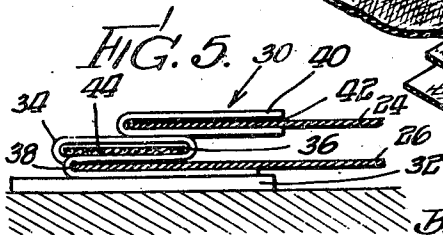


FIG. 5.



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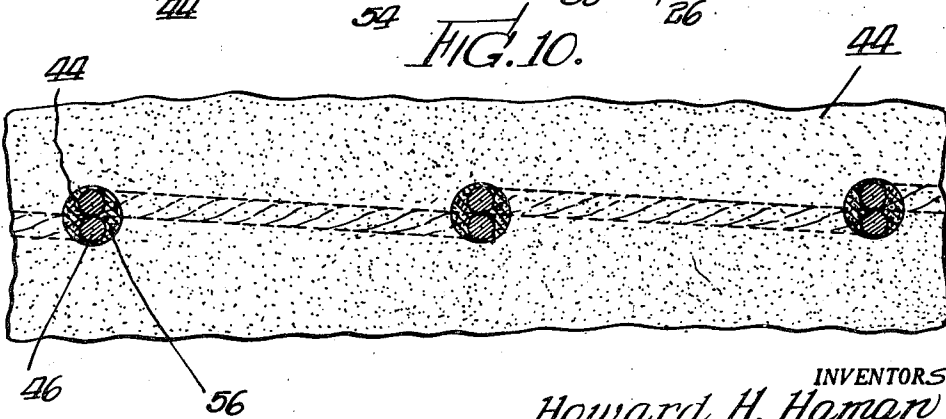
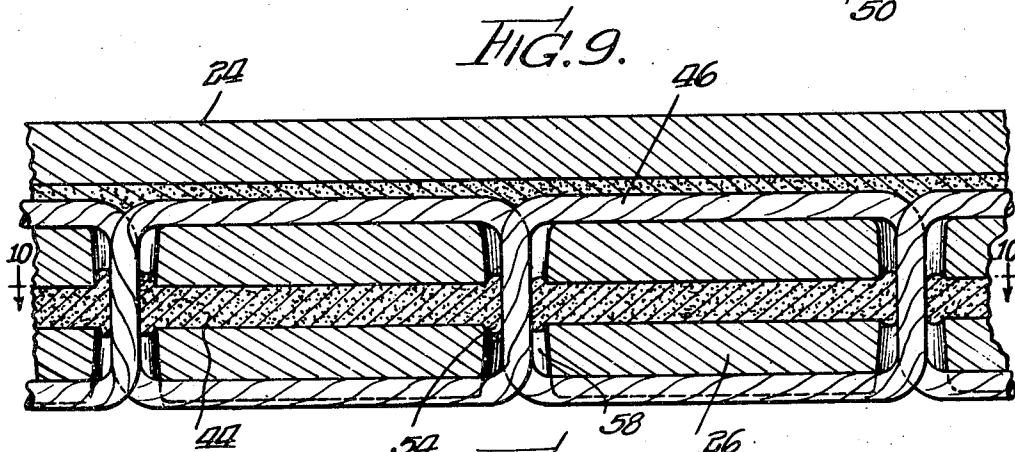
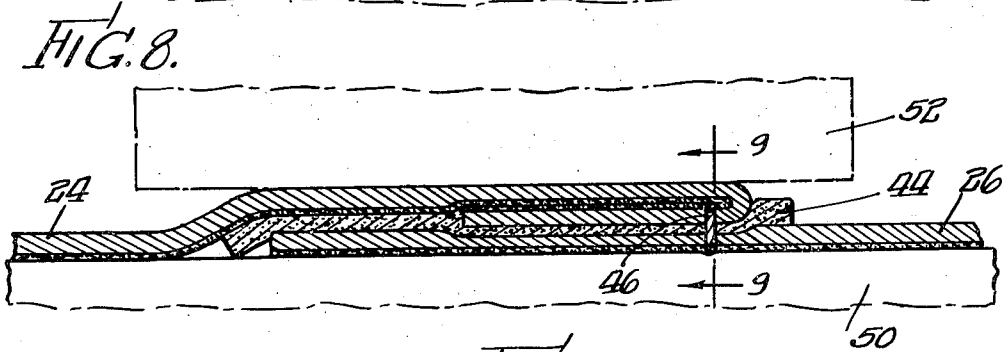
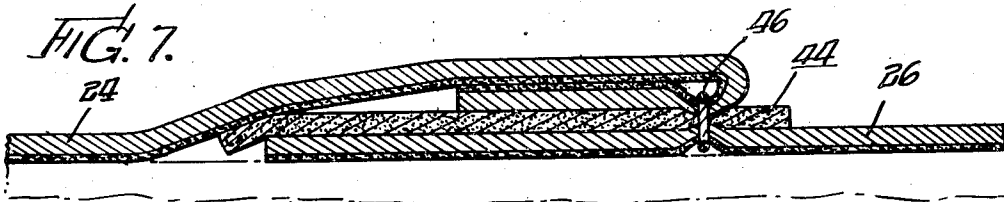
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3 Sheets-Sheet 2



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H. H. HAMAN ET AL
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3 Sheets-Sheet 3

FIG. 11

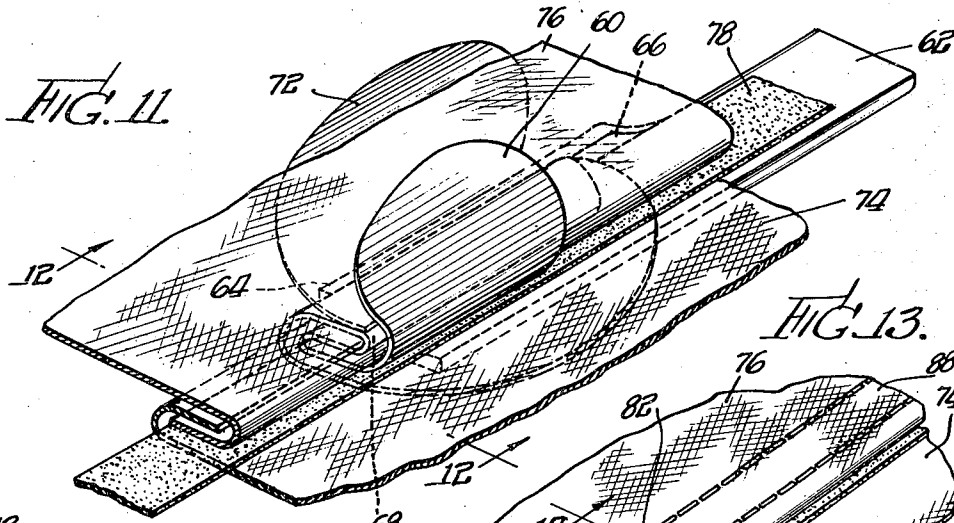


FIG. 13.

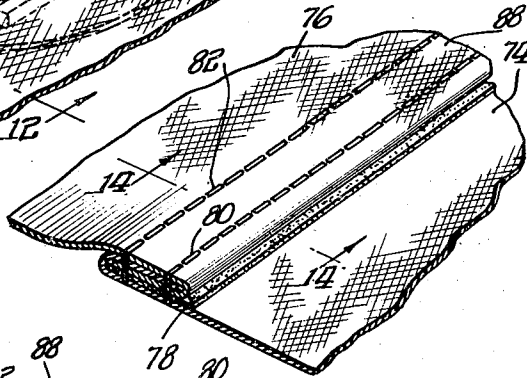


FIG. 12.

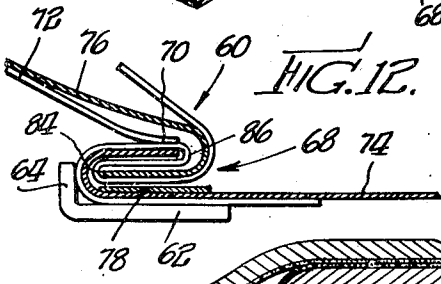


FIG. 14.

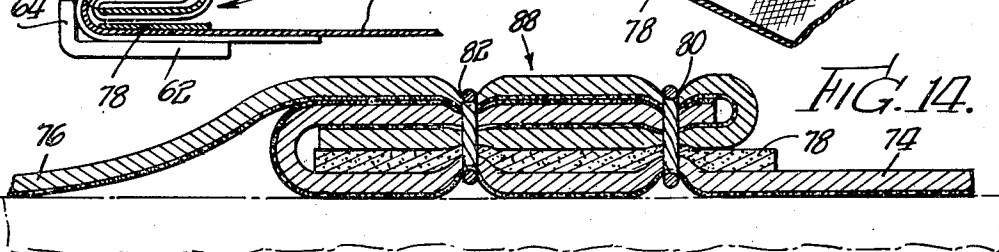


FIG. 15.

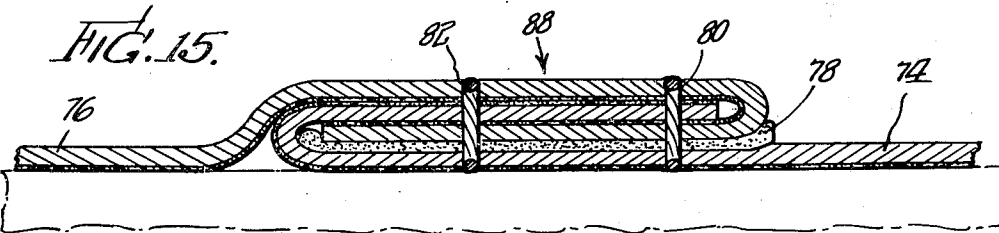
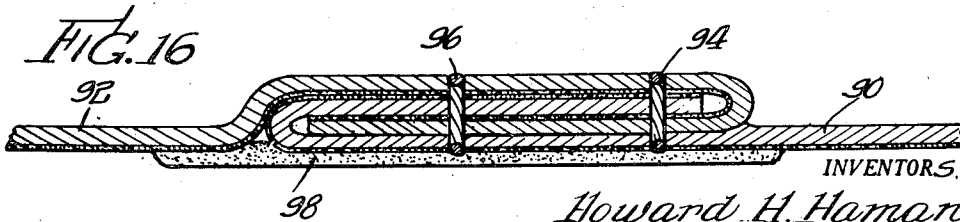


FIG. 16



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WATERPROOF FABRIC SEAM

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Application March 20, 1944, Serial No. 527,246

7 Claims. (Cl. 154—43)

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This invention relates to composite waterproof articles and to a method of making the same. More particularly, it relates to a method for providing strong waterproof connections between pieces of waterproof material and two composite waterproof articles, the parts of which are so secured together.

In the manufacture of waterproof articles, such as raincoats, from waterproofed fabric, for example, fabric coated with plasticized polyvinyl chloride, difficulties are encountered in connecting or securing together the various parts of these articles in such a manner that the seams or joints are strong and also waterproof. Where the various parts are secured together by sewing, even though multiple rows of stitches are used, the connection, while it may be strong, is not waterproofed. The stitches which penetrate clear through the article provide a means by which water can pass through.

On the other hand, no satisfactory method of sealing together the pieces of waterproof material has been provided, despite numerous attempts to discover such a method. Securing the parts together by sealing avoids the difficulty encountered where the pieces of waterproof material are stitched together, but is in turn attended by other disadvantages. Whether the parts be sealed by heat or with the aid of solvents or liquid cement, the seal, even though it is waterproof, does not have adequate mechanical strength to stand up where the waterproof article is required to undergo any substantial strain.

It is an object of the present invention to provide a method for securing together pieces of waterproof sheet material to form composite waterproof articles in which the parts or pieces are joined by strong waterproof connections.

A further object is to provide composite waterproof articles comprising pieces of waterproof sheet material secured together by a strong waterproof connection.

Still another object is to provide raincoats and a method of making the same from waterproofed fabric by which method the various pieces of fabric forming the raincoat are secured together by strong waterproof connections.

A still further object is to provide raincoats, the principal parts of which are a fabric provided with a waterproof coating of plasticized polyvinyl chloride, and to provide a method of securing together the pieces of fabric forming parts of said raincoat by strong waterproof connections.

A more general object is to provide composite

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waterproof articles including pieces of fabric provided with a waterproof coating of plasticized polyvinyl chloride, and a method of making such articles in accordance with which strong waterproof connections between the pieces of fabric are provided.

A still further object is to provide composite waterproof articles comprising pieces of waterproofed sheet material stitched together and to provide a method for making the stitched connections waterproof.

Other objects will appear hereafter.

It has now been found that the foregoing objects are accomplished by stitching together the adjoining edges of the pieces of waterproof sheet material of which the composite article is formed and by applying to the connection a relatively thin thermoplastic self-sustaining tape of synthetic rubberlike material adherent to said waterproofed sheet material, pressing the tape firmly in place over the area in which the stitches are formed and curing the tape to an elastic state.

In order that the invention may be better understood, reference is made to the accompanying drawings which form a part of this specification and in which:

Figure 1 is a view of the back of a raincoat embodying the features of the present invention;

Figure 2 is an enlarged fragmentary view of a small section of the inside face of the joint or connection in the middle of the back of the raincoat shown in Figure 1;

Figure 3 is a view similar to Figure 2 of a small section of the outside face of the joint in the back of the raincoat shown in Figure 1;

Figure 4 is an enlarged detail view in perspective showing the manner in which the parts of the raincoat shown in Figure 1 are assembled and secured together;

Figure 5 is a vertical section on the line 5—5 of Figure 4;

Figure 6 is an enlarged fragmentary detail view in perspective showing the connection on the back of the raincoat shown in Figure 1 at an intermediate stage of its formation;

Figure 7 is a greatly enlarged vertical cross section on the line 7—7 in Figure 6;

Figure 8 is a greatly enlarged view similar to Figure 7 showing the final step in the formation of the connection on the back of the raincoat shown in Figure 1;

Figure 9 is an enlarged vertical section taken on the line 9—9 of Figure 8;

Figure 10 is a horizontal section on the line 10—10 in Figure 9;

55 10—10 in Figure 9;

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Figure 11 is a view similar to Figure 4 showing another method of assembling the parts of a raincoat;

Figure 12 is a vertical section on the line 12—12 in Figure 11;

Figure 13 is a view in perspective of the connection made by assembling the parts as in Figure 11 and stitching them together;

Figure 14 is an enlarged vertical section on the line 14—14 in Figure 13;

Figure 15 is a view similar to Figure 14 of the connection after it is fully formed; and

Figure 16 is a view similar to Figure 15 showing still another embodiment of the present invention.

Referring now more particularly to the drawings, the raincoat 20 shown in Figure 1 includes a main body portion 22 formed by joining together two pieces of waterproofed sheet material 24 and 26. In order to simplify the description only one seam or connection is shown in the illustration of the raincoat 20. It will be understood, however, that the raincoat 20 is intended to be generally of any desired construction and to be formed of any desired number of pieces, the seams or connections not shown being preferably formed in the same manner as the seam or connection 28 shown.

The raincoat 20 may be made from any desired waterproof sheet material, but preferably a fabric coated with a synthetic polymeric waterproofing material is employed, such as a polyvinyl chloride or polyvinyl butyral. A particularly preferred waterproofing material is a plasticized polyvinyl chloride sold under the trade name "Koroseal." A fabric carrying a waterproofing coating of "Koroseal" and suitable for making into raincoats is offered for sale by the manufacturer of "Koroseal," and since this material has given very good results in accordance with the present invention when embodied in raincoats in the manner described herein, the further description of the present invention will be particularly concerned with it.

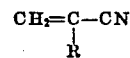
For convenience in assembling the two pieces of waterproofed fabric in position to be fastened together, a guide 30, shown in Figures 4 and 5, is employed. The guide 30 includes a rectangular base plate 32 upon which is mounted a sheet of material 34 bent to have the cross sectional shape shown in Figure 5 and provide a closed channel 36 and a lower open channel 38. The bent portion 34 is welded or soldered or otherwise secured to the base 32 in the position indicated in Figure 4 with a portion of the member 34 extending out beyond one end of the base 32. Mounted on the bent portion 34 is another piece of sheet material 40 bent to have a generally U-shaped form in cross section and provide still another open channel 42 opening in the same direction as the channel 38. The portion 40 is secured to the portion 34 in the position indicated in Figure 5 so that the inner edge of the channel 42 is spaced inwardly a considerable distance from the closed end of the channel 38. Attention is also directed to the fact that although the closed channel 36 is in the main located directly above the open channel 38 toward the closed outer edge, it extends slightly beyond this closed outer edge as best seen in Figure 5. The bent portion 40 is conveniently made considerably shorter than the portion 34, as shown in Figure 4, since the material passing through this bent portion is uppermost and is thus more easily guided. The guide 30 is em-

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ployed in the manner shown in Figure 4 to aid in assembling the two pieces of "Koroseal" coated fabric 24 and 26 for the purpose of forming the joint, seam or connection 28. As may be seen in this figure, the portion 26 which is to overlap the portion 24 on the outside is assembled in the channel 38 with its edge at the inner edge of the channel 38 and with the face carrying the waterproof "Koroseal" coating lowermost. The portion 24 is similarly assembled in the channel 42, but with the exception that its "Koroseal" coated face is uppermost. The closed intermediate channel 36 receives the sealing strip 44 which in this embodiment of the invention is positioned between the portions 24 and 26 in forming the joint or connection 28.

The nature of this sealing strip or tape 44 is broadly set forth above. A preferred tape, particularly when "Koroseal" coated fabric is to be joined, comprises a synthetic rubber composition sold under the trade name "Hycar OR." Although there is little definite information as to the chemical nature of "Hycar OR" available, it is stated to be a co-polymer or inter-polymer or cross-polymer or butadiene and one or more other polymerizable materials. In the published data "Hycar" rubbers generally are stated to be formed by polymerizing butadiene with either styrene or acrylonitrile. As between these two, it appears by analogy to the known facts regarding the "buna" rubbers that "Hycar OR" is formed by polymerizing a major amount of butadiene with a minor amount of acrylonitrile and is the same as or generally similar to "Perbunan" being, for example, co-polymer of about seventy-five parts of butadiene with about twenty-five parts of acrylic nitrile. The latter would be expected to form more oil-resistant compounds than styrene. "Hycar" rubber also probably includes small amounts of compounds added to aid in the polymerization as well as plasticizers and preservers such as antioxidants. It is an uncured thermoplastic composition which is capable of being cured to an elastic state with the aid of suitable curing agents and generally with the application of heat.

A particularly preferred tape for use with "Koroseal" coated fabric is one comprising "Hycar OR" and polyvinyl chloride. Tapes formed from materials other than "Hycar OR" may be used, however, particularly where the sheets to be joined are waterproofed with a material other than "Koroseal." For example the tape may be a synthetic rubber-like polyvinyl butyral or may comprise any of the class of co-polymers formed in the butadiene and unsaturated nitriles having the structural formula



in which R is hydrogen or an alkyl group. This whole class of co-polymers is particularly suitable where fabric coated with "Koroseal" or the like is also employed. By the way of further example, such co-polymers would include combinations of butadiene with methacrylic nitrile, ethacrylic nitrile, isopropyl-acrylic nitrile, etc., and preferred proportions are from about 10% to about 35% of the nitrile by weight based on the total weight of butadiene and the nitrile.

The tape 44 is of such size as to extend over all the stitches and a substantial distance beyond them on each side. While the tape 44 may vary in thickness as desired, it is preferably about the same thickness as the sheets to be

joined. A tape 44 having the minimum thickness consistent with filling openings around the stitches is preferred because this results in less bulky joints.

Referring again to the drawings, Figure 4 indicates the manner in which the two pieces of material 24 and 26 and the sealing strip 44 are positioned by the guide 30 to facilitate fastening them together. While the sheets 24 and 26 and the tape 44 are so positioned they are stitched together forwardly of the guide as at 46. The needle 48, shown in Figure 4, indicates how the guide 30 is positioned relative to the needle during the sewing operation. As the stitching progresses, the guide 30 is moved away from the needle 48, while at the same time the two pieces 24 and 26 and the tape 44 are kept in their proper positions in the guide 30. The stitching 46 is continued until the two pieces of material 24 and 26 are sewed together along their entire length.

When the stitching 46 is complete, the sheet 24 is flopped over to form a fold adjacent the line of stitches 46, as illustrated in Figures 6 and 7. The assembly, with the sheets 24 and 26 in the position illustrated in Figures 6 and 7 is placed in a press having a lower platen 50 and an upper heated platen 52 (Fig. 8). As shown in this figure, pressure is applied to the overlapping portion of the sheets 24 and 26, causing the sealing strip 44 to flow slightly. The heat from the platen 52 then aids in curing the strip 44 to form the completed seal 28. As the strip 44 is cured under pressure it becomes tightly bonded to the sheets 24 and 26, thus sealing them together with a strong waterproof seal.

The pressure to be applied to the platens 50 and 52 is preferably moderate. As a matter of fact, a satisfactory joint can be formed with the minimum of pressure required to bring the sheets 24 and 26 and the tape 44 into intimate contact throughout their length. Generally, the pressure employed is above the minimum, however, and is sufficient to insure not only that the parts to be joined will be in firm contact, but also that the sealing strip 44 is caused to flow slightly. Excessive pressure is generally to be avoided because it would result in excessive flowing of the strip 44.

The amount of heat used will be that which is required by the composition from which the strip 44 is formed. More particularly, this strip 44 may be compounded for curing at relatively high temperature, or on the other hand, it may be so compounded as to cure without any application of heat, if desired.

Figures 9 and 10 illustrate the manner in which the tape 44 flows around the stitches 46 when so subjected to heat and pressure. As may be seen at 54 in Figure 9 and 56 in Figure 10, the material of the sealing strip 44 flows into the needle holes 58 and about the stitches 46 where they extend through the sealing strip 44, forming a tight seal about the stitches 46 and preventing any moisture from passing through the needle holes 58.

Figures 11 to 16 illustrate an alternative method of sealing together strips of waterproof material, as for example, in making a raincoat. In practicing this method, a guide 60 is employed which differs somewhat in construction from the guide 30. As best seen in Figures 11 and 12, the guide 60 includes a generally rectangular base member 62 having an upturned flange 64. The flange 64, while extending up to the forward end of the base 62, terminates short of the rear end thereof as at

66. Secured upon this base is the body portion 68 of the guide which is formed from a single sheet of rigid material such as metal. This guide has the general configuration illustrated in Figure 12.

The body 68 is secured to the base 62 in any suitable manner, as for example, by welding. Secured to the top of the body portion 68, as at 70, and extending upwardly at a substantial angle is a wing 72, the purpose of which is hereinafter indicated more fully.

As indicated above, the guide 60 serves to position two sheets of waterproof material 74 and 76 and a sealing strip 78 in the overlapping relation in which they are to be secured together by stitching. In this embodiment of the invention two rows of stitches 80 and 82 are provided in order to give greater strength. The materials are stitched forwardly of the guide 60 in the manner indicated in Figure 4 with respect to the guide 30.

Referring again to Figure 12, it will be seen that the guide 60 is so constructed as to provide a folded over edge on each of the sheets 74 and 76 and to position the free edge of the sheet 74 inside the fold of the sheet 76 and vice versa. As best seen in Figure 12, the sealing strip 78 is positioned in the fold formed on the sheet 74 and below and outside of the fold formed on the sheet 76. The wing 72, which maintains that portion of the sheet 76 adjacent the fold in an elevated position, has a tendency to cause the edge of the sheet 76 to be pressed against the stop 84 in the guide 60, thus causing the sheet 76 to assume the proper position in the guide 60. The sheet 74 is kept in the proper position by pushing into the guide so that its free edge rests against the stop 86. Lastly, the sealing strip 78 is positioned so that its inner edge lies along the fold in the sheet 74.

The connection 88 as it appears immediately following the stitching operation is shown in Figures 13 and 14. To complete the operation of securing together the sheets 74 and 76, the assembly as illustrated in Figures 13 and 14 is placed in a press such as that shown in Figure 8 and preferably with the aid of heat is pressed to the form shown in Figure 15. This causes the material of the sealing strip to flow into the needle holes about the stitches 80 and 82, providing a tight seal, and at the same time insures that the sealing strip will firmly bond together the sheets 74 and 76. It will be understood that the final step in the formation of the connection 88 may be accomplished in any of the various ways described above with respect to the connection 28.

Still another embodiment of the invention is illustrated in Figure 16. In this embodiment, two strips of material 90 and 92 are stitched together, as at 94 and 96, without any intervening sealing strip. In this particular embodiment the sheets 90 and 92 are overlapped in the same manner as the sheets 74 and 76 in the connection 88, and for the stitching operation the guide 60 illustrated in Figures 11 and 12 may be employed. The sealing strip 98, which is formed of the same type of material as the strips 78 and 44 described above, is then applied to the outer face of the connection 88, preferably with the aid of heat and pressure. As may be seen in Figure 16, the strip 98 covers the stitching and thus seals up the stitch holes, and at the same time the strip becomes bonded to each of the sheets 90 and 92, securing them together. More consistently good results are obtained if at least one of the surfaces to be joined, preferably the "Hycar," is treated

with a solvent or with a cement formed from the material of one of the surfaces, also preferably the "Hycar." This treatment is not essential for good adhesion. The connection such as the connection 28 or the connection 38 is preferred, however, since a narrower sealing strip can be used and since the appearance of the connection is the same as it would be if the sealing strip were not used.

A tape such as has been described herein and made, for example, from "Hycar OR" or another one of the above described butadiene-unsaturated nitrile copolymers is also useful for sealing together waterproof materials, particularly fabrics waterproofed with a plasticized polyvinyl chloride composition such as "Koroseal" even without stitching. Although the connections are not as strong as those obtained where stitching is also employed, they are, nevertheless, very satisfactory due to the excellent adhesive properties of the tape.

The bonding of the butadiene-unsaturated nitrile copolymer tape to the waterproofed sheet material is facilitated by brushing the surface with a suitable solvent such as methyl ethyl ketone or a mixture of 70 parts of methyl ethyl ketone and 30 parts dibengyl ether. This can be very readily done where the tape is applied to the outside surface of the waterproofed sheet materials.

While this invention has been described above with particular reference to the formation of waterproof connections between the various pieces of material which are joined together to form a raincoat, it will be understood that it is applicable generally to the formation of waterproof joints between sheets of waterproof material. It is particularly adapted to the formation of strong waterproof stitched connections between sheets of waterproofed fabric.

An outstanding advantage of the present invention is that it provides a method of forming a strong waterproof connection between sheets of waterproofed material, particularly fabric coated and/or impregnated with a waterproofing material, such as plasticized polyvinyl chloride or the like.

In the above described preferred form of the invention in which the sealing tape described herein is used in connection with stitched seams as a means of joining together sheets of waterproofed fabric, there is the further advantage that the connection so formed has the desirable characteristic of strength associated with stitched seams along with waterproof qualities which are entirely absent from stitched seams heretofore known.

The invention has special advantage in the formation of raincoats in that it provides for the first time a strong waterproof seam which is not bulky and has the general appearance of seams which lack its waterproof characteristics.

Still another important advantage is that the novel connection is formed by a method which is simple and relatively easy to carry out.

Other advantages will be apparent from the foregoing description.

It is apparent that many widely different embodiments of this invention may be made without departing from the spirit and scope thereof, and therefore it is not intended to be limited except as indicated in the appended claims.

The invention is hereby claimed as follows:

1. A composite article comprising at least two sheets of fabric material each coated on one face

with a coating of polyvinyl resinous material and the coatings of said fabrics facing in the same direction, one of said sheets having its end folded back upon itself with the coatings of said folded back portion in contact and the other fabric having its end overlapping the doubled back end of the first mentioned sheet with the polyvinyl coating of said second mentioned sheet located on that face of the second sheet that is further away from said first mentioned sheet, and a tape of polyvinyl resin disposed between said first and second sheets with one end of said tape located beyond the folded end of said first mentioned fabric and the opposite end of said tape being located beyond the opposite end of said second mentioned fabric, and a row of stitching passing only through the short folded end of said first mentioned fabric and thence through the layer of polyvinyl coating of said short end, thence through the tape of polyvinyl material, thence through the second fabric and through the polyvinyl coating thereof, the polyvinyl coating of said short, folded over end and the polyvinyl tape and the polyvinyl coating of the second fabric flowing into the stitching holes of the row of stitching and forming a watertight plug therefor.

2. A composite article comprising at least two sheets of fabric each sheet being coated with a coating of polyvinyl resin, the coatings facing in the same direction, one of said fabric sheets having its end folded upon itself with the coating of said fabric disposed inwardly, the second fabric sheet likewise having its end folded over with the coating thereof located on the outside, the folded end of one sheet lying within the folded end of the opposite sheet, and a strip of polyvinyl resinous material located between the short end of the folded end of one fabric and the adjacent longer folded wall of the other fabric, stitching passing through the interfolded layers of fabric and polyvinyl coating and polyvinyl tape, the edges of said stitching terminating at the opposite outside surfaces of said interfolded fabrics, said fabric material and polyvinyl coatings and tape being pressed under heat to cause said polyvinyl material to flow into and seal the rows of stitching.

3. A composite article comprising at least two sheets of fabric each sheet being coated with a coating of polyvinyl resin with the coatings facing in the same direction, one of said fabric sheets having its end folded upon itself with the coating of said fabric fold disposed inwardly and facing the confronting portions of the confronting faces of the fold, the second fabric sheet likewise having its end folded over with the coating thereof located on the outside, the folded shorter end of one sheet lying within the folded end of the opposite sheet, and a strip of polyvinyl resinous material located between the short folded end of the first sheet and between the adjacent folded wall of the second sheet, and stitching passing through the interfolded layers of fabric and polyvinyl coating and polyvinyl tape, the edges of said stitching terminating at the opposite surfaces of said fabric material, said fabric material and polyvinyl coatings and tape being pressed under heat to cause the polyvinyl material to flow into and seal the rows of stitching, the polyvinyl material flowing outwardly beyond the folded over end of the first fabric and the confronting wall of the second fabric.

4. A pair of fabrics each coated with polyvinyl resin, said fabrics having their ends looped over with the free end of one fabric inserted in the

looped portion of the other fabric, and with the polyvinyl coating of one of the looped over portions of one fabric contacting the polyvinyl coating of the inserted end of the other fabric, rows of stitching passing completely through said interfolded rows of fabrics and coatings, and a tape of polyvinyl material overlying the juncture of the folded end of the second fabric and the first fabric, said fabrics and coatings and polyvinyl material being compressed under heat whereby to cause the polyvinyl coatings and the tape to flow into the stitchings to seal the same.

5. A seam for uniting two fabrics each coated with polyvinyl resin, said fabrics being disposed with their polyvinyl coatings facing in the same direction, one of said fabrics having its end looped back upon itself with the polyvinyl surfaces of the looped portions facing each other, and the end of the other fabric overlapping the looped portion of the first fabric, stitching passing through said overlapping portions of said first and second fabric and their coatings, the polyvinyl resinous material coating said fabric being subjected to pressure and heat to cause the same to flow into the stitching and to cure in such position whereby to seal the stitching and render the same waterproof.

6. A composite article comprising at least two sheets of fabric material each coated on one face with a coating of polyvinyl resinous material and the coatings of said fabrics facing in the same direction, one of said sheets having its end folded back upon itself with the coatings of said folded back portion in contact and the other fabric having its end overlapping the doubled back end of the first mentioned sheet with the polyvinyl coating of said second mentioned sheet located on that face of the second sheet that is further away from said first mentioned sheet, and a tape of polyvinyl resin disposed between said first and second sheets with one end of said tape located beyond the folded end of said first mentioned fabric and the opposite end of said tape being located beyond the opposite end of said second mentioned fabric, said coatings and tape being subjected to pressure and heat whereby to cause the polyvinyl coatings and polyvinyl tape to flow to form a waterproof sealed union between the folded end of the first fabric and the second fabric, and

whereby the polyvinyl tape between the end of the overlapped folded portion of the first fabric and the end of the second fabric to flow outwardly and seal the joints therebetween

7. A composite article comprising at least two sheets of fabric each sheet being coated with a coating of polyvinyl resin with the coatings facing in the same direction, one of said fabric sheets having its end folded upon itself with the coating of said fabric fold disposed inwardly and facing the confronting portions of the confronting faces of the fold, the second fabric sheet likewise having its end folded over with the coating thereof located on the outside, the folded shorter end of one sheet lying within the folded end of the opposite sheet, and a strip of polyvinyl resinous material located between the short folded end of the first sheet and between the adjacent folded wall of the second sheet, said fabric material and polyvinyl coating tape being pressed under heat to cause the polyvinyl material to flow and seal the junction between the layers of fabric and to seal the junction between the folded end of the first fabric and the adjacent confronting face of the second fabric.

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WILLIAM E. SCHMIDT.

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