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METHODS OF ASSEMBLY OF FOOTWEAR UPPERS

Filed Nov. 15, 1963 3 Sheets-Sheet 1

FIG. 1.

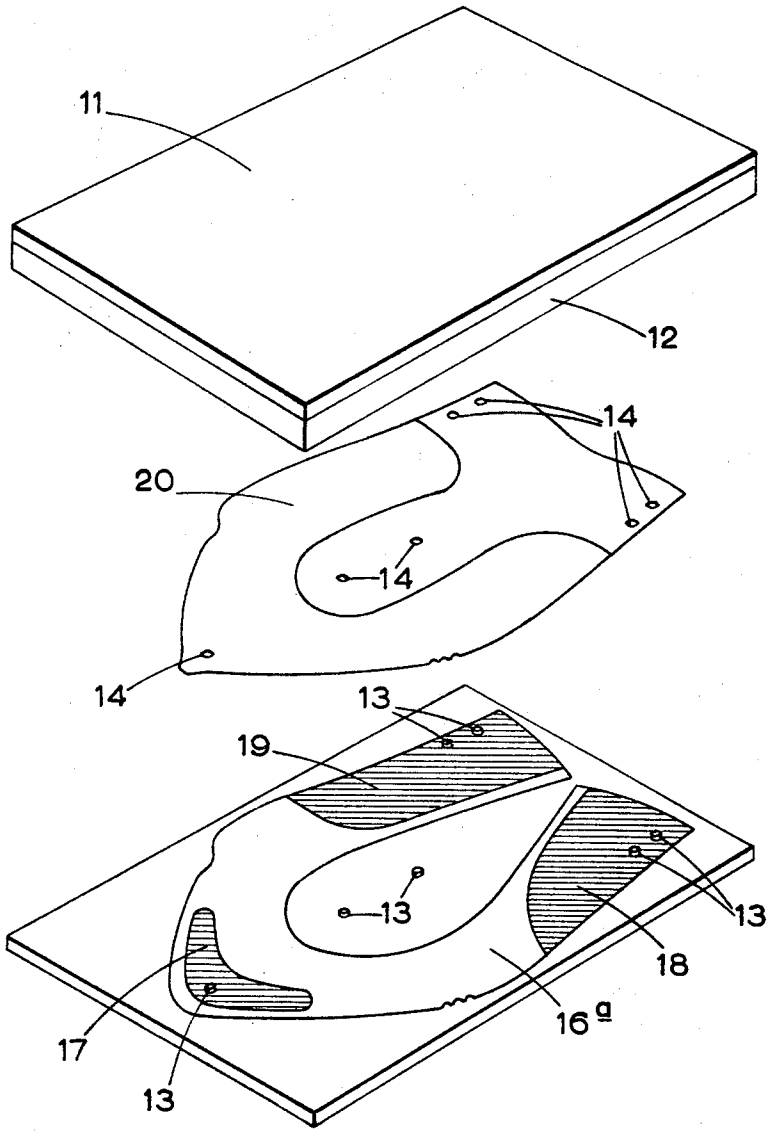
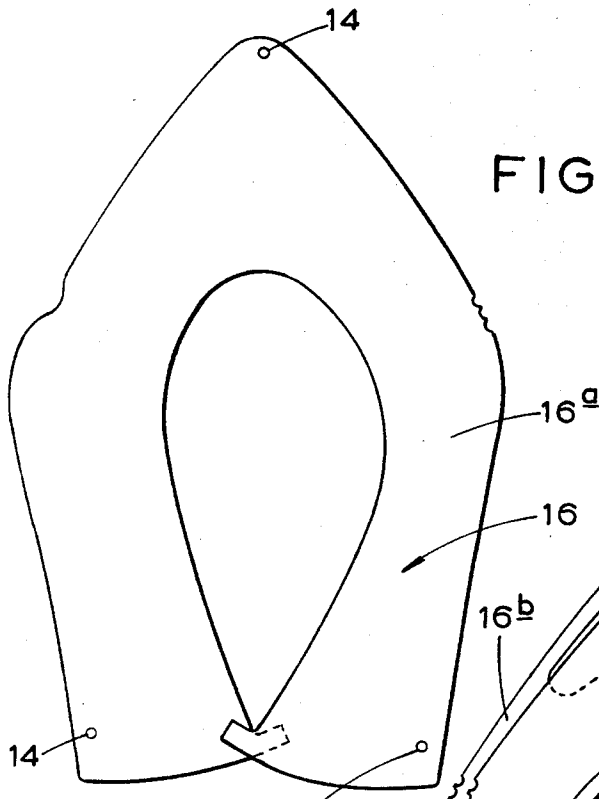


FIG. 2.



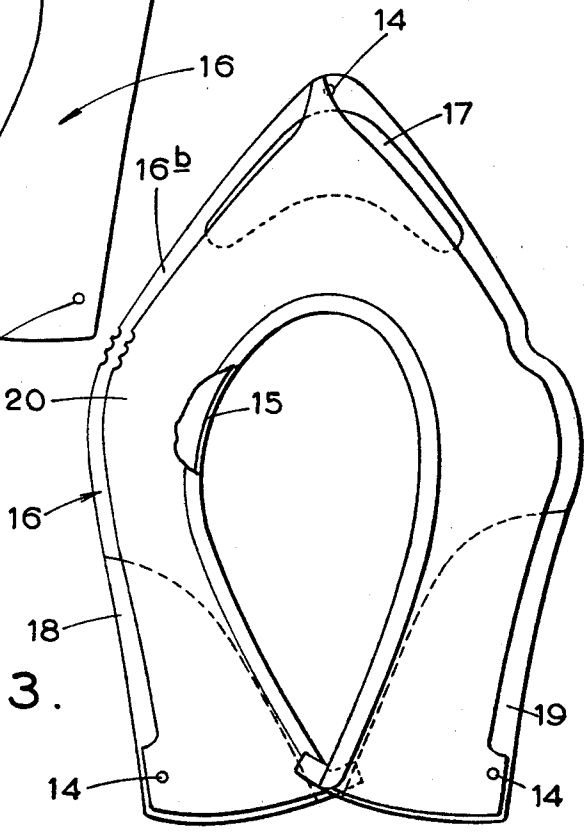


FIG. 3.

FIG. 4.

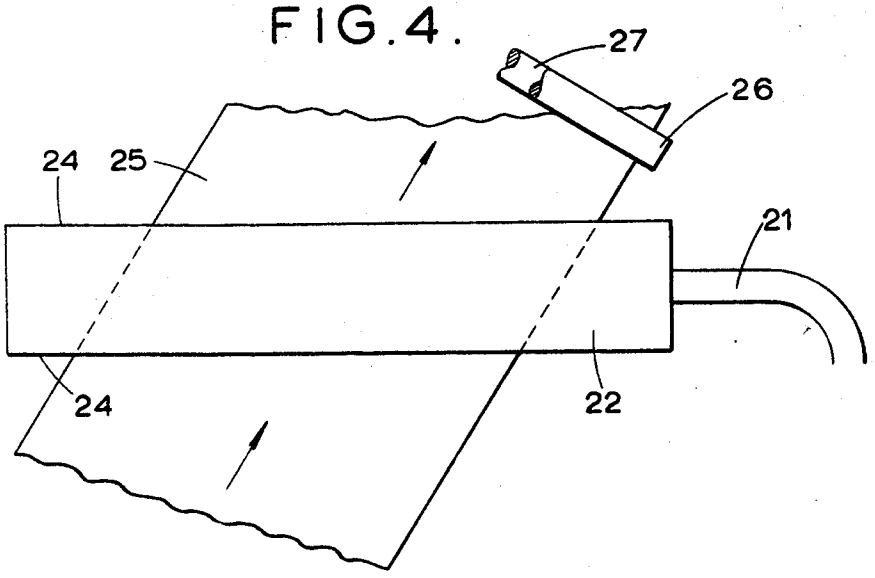
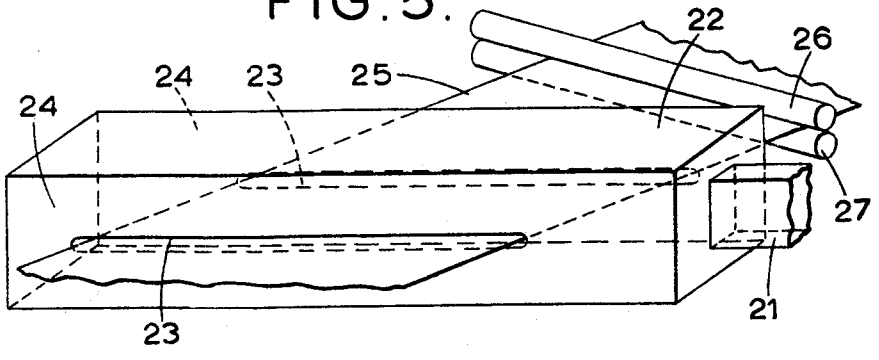


FIG. 5.



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METHODS OF ASSEMBLY OF FOOTWEAR UPPERS

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18 Claims. (Cl. 12—146)

This invention relates to methods of assembly of the components of shoe uppers.

In the normal method of constructing a shoe upper the lining, which may be of fabric or leather, is attached to the outside material by the use of adhesive cement, or by using a fabric coated with a film which can be softened by heat, the lining being ironed on to the outside material and such ironing constituting a first operation. A toe puff is also cemented to the upper by another operation. The top edge of the upper is then bound by a fabric binding, or the outer material is turned over at the top edge, and the edge of the binding or the turned over edge is then covered by a piece of material either stuck or stitched to the assembly, constituting a third operation.

It is an object of the invention to provide a method of assembly which reduces the number of operations and is more expeditious than heretofore.

A further object is the elimination of skill, work, and equipment from the process of upper assembly. Whenever a fair degree of skill is used there are always rejects, caused by failure of the human element. By eliminating human skill from the upper assembly, we also eliminate the rejects normally produced, and make supervision easier. The overall result is a great saving in cost, time, space and equipment, with an improved end product.

Another object of the invention is the provision of apparatus whereby unskilled labour may be employed in a method hitherto requiring a high degree of skill.

Similarly, common side seams, as well as the joining of differently coloured leather in some designs, have always involved machine stitching, which was time consuming and which required skill and equipment. Now such joints can be produced without skill, without any special equipment, and without any additional time element, beyond that involved in the initial assembly, assisted by the locating pins of the invention, so there is a great economy in production.

Furthermore, the seams so produced are neater than those made by stitching, are impervious to water, and are stronger, as there are no needle perforations and no thread which weakens with use.

According to the invention, a method of bonding simultaneously an assembly of the components of a shoe upper comprises uniting the components under pressure by the activation of an adhesive by electromagnetic oscillations. Such oscillations may be high frequency oscillations, providing dielectric heating, effected by placing the assembly in a high frequency field so that heat is generated within the assembly through dielectric losses. Alternatively, activation of the adhesive may be accomplished by microwave heating, by the use of electromagnetic oscillations having a frequency in the range of approximately 3000 to 30,000 megacycles per second. The better utilization of energy at these frequencies allows for the use of smaller generators to produce comparable effects, so that there is a considerable saving in initial cost over high-frequency heating.

At least the major part of the pressure may be applied as a separate step immediately after the step of activating the adhesive. The pressure may be effected between cooled elements.

The use of assembling jigs is very common in certain industries, but in the shoe industry, it is revolutionary. The use of such devices has never been regarded as practical in this industry, owing to the irregular shapes of the components and to their relatively flimsy nature. The parts of the assembly may, however, according to the present invention, be assembled and secured together temporarily in a jig, then passed by conveying means to a heating enclosure, and thence to elements for the application of pressure. The conveying means may comprise an andless belt of glass fibre fabric impregnated with PTFE.

The parts of the assembly may be secured together temporarily by spaced spots of a pressure sensitive adhesive, or by localized spot bonding by heat and pressure.

The heating enclosure may comprise a box served by a waveguide, whereby electromagnetic oscillations in the range of approximately 3000 to 30,000 megacycles per second are conducted into the box to form a standing wave, opposite sides of the box being apertured to permit the conveying means to pass therethrough.

In the method according to the invention there may be employed a separated stiffener, in which event the assembly may be united between the flat platens of a press. Alternatively, the method of bonding may employ a one-piece stiffener of the usual shape, as will be described hereinafter.

In either event, components of the assembly may conveniently be formed before union with holes to register with pins to locate them during the application of the pressure.

Surface decoration such as stitch marking, design embossing, or perforating, of the outer surface of the outside material may be effected during the bonding.

The platens may be formed as curved beds, and the forepart and sides of the assembly may be shaped during the bonding. The outside material may be made up of two or more pieces of dissimilar substances, for example leather and nylon, possibly of contrasting colours. Such substances may be united during the bonding.

The invention will be described with reference to the accompanying drawings, in which:

FIGURE 1 is a diagrammatic perspective view of a flat bed press, indicating the parts of an assembly,

FIGURE 2 is a view of the outer surface of an assembly after bonding,

FIGURE 3 is a view of the inner surface of the assembly,

FIGURE 4 is a diagrammatic fragmentary plan of a microwave heating installation, and

FIGURE 5 is a diagrammatic perspective view of the enclosure thereof.

Referring to FIGURES 1 to 3 of the drawings, in one embodiment of the invention, employing a separated stiffener enabling the assembly to be united in the flat, a press has a flat lower platen **10**, of the usual construction, and a flat upper platen **11** faced with a relatively thick pad **12** of rubber or other suitable material to form a blanket. The platens **10, 11** constitute the high frequency electrodes. The lower platen **10** is provided with a number of spring-loaded locating pins **13** which are normally urged upwardly to project above the operative surface of the platen **10** but are enabled under pressure to retreat to a position level with the assembly. The pins **13** are suitably arranged, both as regards number and location, to enable the parts of the assembly to be held against unwanted displacement, and for this purpose such parts of the assembly as require such location are preformed with holes such as **14** arranged to receive the locating pins **13** and so retain the parts on the lower platen **10**.

The top edge **15** of the outer material **16** is bound or turned in (see FIGURE 3) and said outer material **16** is

then located on the lower platen **10**, with its outer surface **16***a* lowermost, and a toe puff **17** and the halves **18**, **19** of a separated stiffener are located on the outer material **16**, each of said components being retained by one or two locating pins and a suitable adhesive being provided over either or both of any two mating surfaces. The lining **20** is then laid over the assembly so far formed, suitable adhesive again being present. The upper platen **11** is then brought down on to the components and pressure is applied. A suitable pressure is of the order of 80 lbs. per square inch. The assembly is then subjected to the effect of a high frequency field, the power and time cycle being appropriate to suit the materials being used, and the components of the assembly are thus bonded together by activation of the adhesive so that the faces which lie against one another and are coated with the adhesive are caused to adhere.

It will be appreciated that during the application of the H.F. energy, heat is generated mainly in those components of the assembly which have high dielectric losses. Thus the adhesive will attain a high temperature, and so will components made of, for example, PVC, but leather will not become very hot, and so will not suffer any damage.

The heat to which the leather or other material is subjected during the process has a beneficial effect on the lasting or shaping properties, the finished shoe keeping its shape better and presenting a more attractive appearance due to this, as well as to the neatness of all visible seams or joints.

Plasticised polyvinyl acetate, with or without the addition of modifying agents, is suitable as an adhesive for this process. Other adhesives may be based on acrylic esters, with or without additional cross-linking resins, such as melamine formaldehyde condensation products, polyurethanes, again with or without cross-linking additives, other thermoplastic materials, such as polyvinylidene chloride, or elastomers, such as polychloroprene.

The outer material may be made of dissimilar or contrasting substances, such as nylon and leather.

In another embodiment of the invention, where a one-piece moulded stiffener is to be employed, and a curved bed is used, steps will have to be taken to prevent the lining from bonding to the upper material, whilst these are in the press, either by omitting the thermo-softening cement from the area which will form a "pocket" for the stiffener, or by separating the two components over the area in question with, for example, a sheet of paper, which may be treated so as to prevent the cement from adhering thereto.

When a curved bed is used, this will normally be placed on the bottom platen of the press, and will form the bottom H.F. electrode. It will, therefore, be made of a conductive material, or will incorporate a suitably positioned conductive layer. An extra thick resilient pad will be used as the top pressure element. This pad, which may be made of cellular rubber or rubber-like material, will have incorporated within its thickness, and relatively near to its bottom surface, a deformable electrically conductive layer, which may be formed of a thin wire mesh, and which will form the top H.F. electrode.

The bonded assembly will normally be removed from the H.F. press whilst still hot. The adhesive will, therefore, be soft, and the assembly will be somewhat vulnerable until it cools down and the adhesive hardens. This can be avoided by modifying the process so that the H.F. energy is applied to the assembly without, or with only a slight pressure, the final pressing, or consolidating stage, being carried out immediately afterwards between cooled platens or curved elements, the assembly leaving this stage as a strongly bonded unit, capable of withstanding any mechanical strain that the next manufacturing stage may impose upon it.

Referring to FIGURES 4 and 5, a different technique can be employed, using the microwave heating system, in which energy in the form of electromagnetic oscillations

having a frequency in the range of approvimately 3000–30,000 megacycles per second is conducted through suitably designed wave guides **21** into an oblong enclosure **22**, so proportioned that a standing wave is produced within it, along its length. The enclosure **22** is an oblong rectangular metal box, positioned horizontally, with the wave guide **21** connected to it at one end, and formed with two horizontal slits **23**, one in each of its vertical sides **24**, so that the assembly can easily be passed through it by an endless band **25**, which may be made of a glass fibre fabric, impregnated with UTFE. At this stage the assembly will preferably have been removed from its assembling jig, the various components being secured together in a temporary manner, for example by small spots of a pressure sensitive adhesive, or by spot welding. Immediately after passing through the enclosure, the assembly will be consolidated by pressure, as hereinbefore described.

The heating will be most intense in the areas around the nodal points of the standing wave. This effect can be neutralised by passing the endless band **25** with the assembly through the enclosure **22** not at right angles to its longitudinal axis, but at an angle of about 30°–45°, as shown in FIGURE 4, when a uniform heating will be obtained.

This method of heating is more efficient than that produced by the use of lower frequencies, which means that higher production speeds, with lower installation costs, are possible.

Although a press will usually be employed for the purpose of consolidating the heated assembly, it is possible to do this by means of two pressure rollers **26**, **27**, at least one of which has a resilient covering.

We claim:

1. A method for producing a substantially flat shoe upper assembly which includes the necessary components connected together and is thereby substantially complete and ready for lasting, comprising the steps of: applying to at least some mating faces of substantially flat shoe upper components an adhesive having a dielectric loss at least as high as that of any of said components, locating said components in a flat condition in a jig means and maintaining them in correct relative position against unwanted displacement, activating the adhesive by electro-magnetic oscillations, and applying pressure to said components, thereby bonding said components together and providing a substantially flat shoe upper assembly which, save for the formation of further seams to impart three dimensional shape to the upper, is substantially complete and ready for lasting.

2. A method as claimed in claim **1**, wherein the activation of the adhesive is accomplished by high frequency heating.

3. A method as claimed in claim **1**, including the step of securing the parts of the assembly together temporarily by spaced spots of a pressure sensitive adhesive.

4. A method as claimed in claim **1**, including the step of securing the parts of the assembly together temporarily by spot welding.

5. A method of bonding as claimed in claim **1**, including placing a separate stiffener in the assembly and uniting the assembly between flat platens.

6. A method of bonding as claimed in claim **1**, including placing a one-piece stiffener in the assembly, and uniting the assembly between platens on a former.

7. A method of bonding as claimed in claim **1** including locating the components of the assembly before uniting them by registering holes in the components with pins in the jig before applying the pressure,

8. A method of bonding as claimed in claim **1** including decorating the outer surface of the outside material.

9. A method of bonding as claimed in claim **1**, wherein the platens are formed as curved beds, and including shape the forepart and sides of the assembly during the bonding.

10. A method of bonding as claimed in claim 1, wherein the outside material is made up of two or more pieces of dissimilar substances and including uniting said substances during the bonding.

11. A method as claimed in claim 1 wherein the step of applying pressure comprises applying light initial pressure to said components prior to the completion of the activating step to cause the components to adhere, and subsequently applying final pressure after the activating step to consolidate the assembly.

12. A method as claimed in claim 11 wherein the final pressure is applied by cooled elements.

13. A method as claimed in claim 1, wherein the activation of the adhesive is accomplished by microwave heating.

14. A method as claimed in claim 13 including the step of passing the parts of the assembly to a heating enclosure via a conveyor means after having located the assembly in the jig, and then applying pressure to the assembly.

15. A method as claimed in claim 14, wherein the conveying means comprises an endless belt of glass fibre fabric impregnated with PTFE.

16. A method as claimed in claim 14, wherein the heating enclosure comprises a box served by a waveguide, whereby electromagnetic oscillations in the range of approximately 3000 to 30,000 megacycles per second are

conducted into the box to form a standing wave, opposite sides of the box being apertured to permit the conveying means to pass therethrough.

17. A method as claimed in claim 16, wherein the passing step includes passing the assembly through the box at an angle of about 30° to 45° to the longitudinal axis thereof.

18. A method as claimed in claim 16, wherein the pressure is applied by two pressure rollers, at least one of which has a resilient covering.

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