Sept. 3, 1946. J. J. BROPHY 2,406,738

APPARATUS FOR USE IN STIFFENING UPPERS OF SHOES

Original Filed Nov. 22, 1944 2 Sheets-Sheet 1

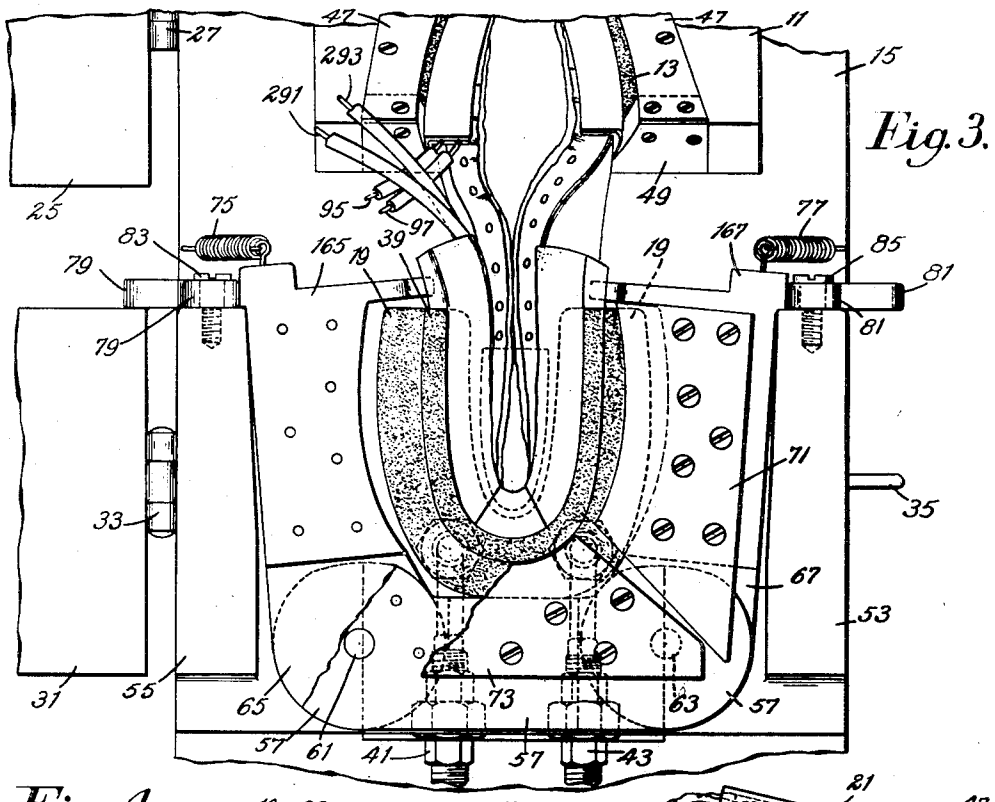


Fig. 3.

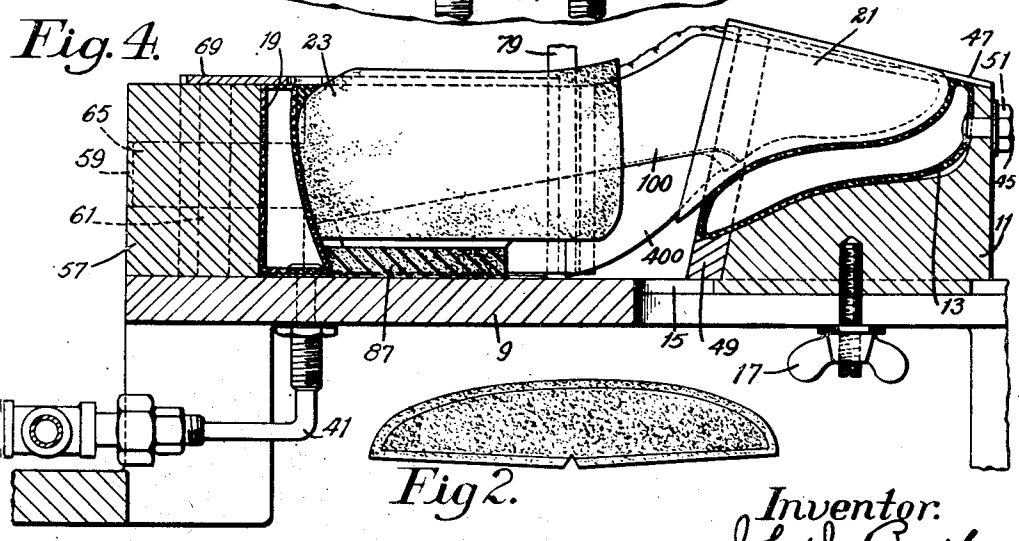


Fig. 4.

Fig 2.



Fig 1.

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Fig 5.

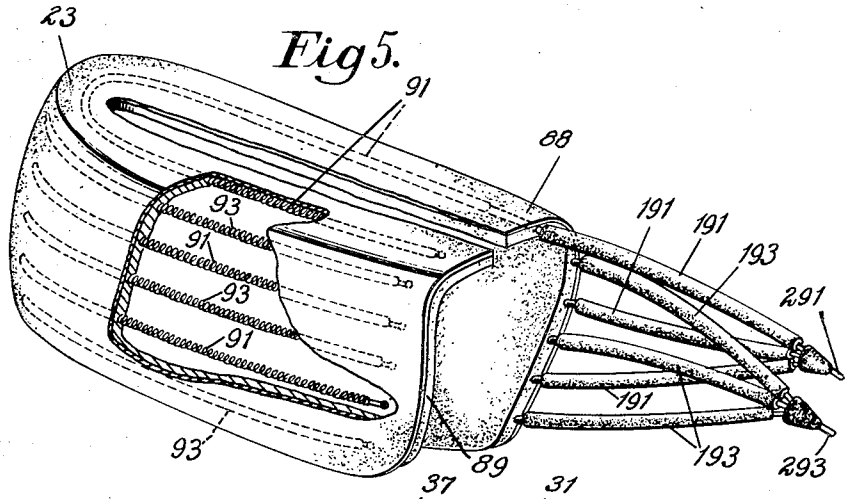


Fig. 6.

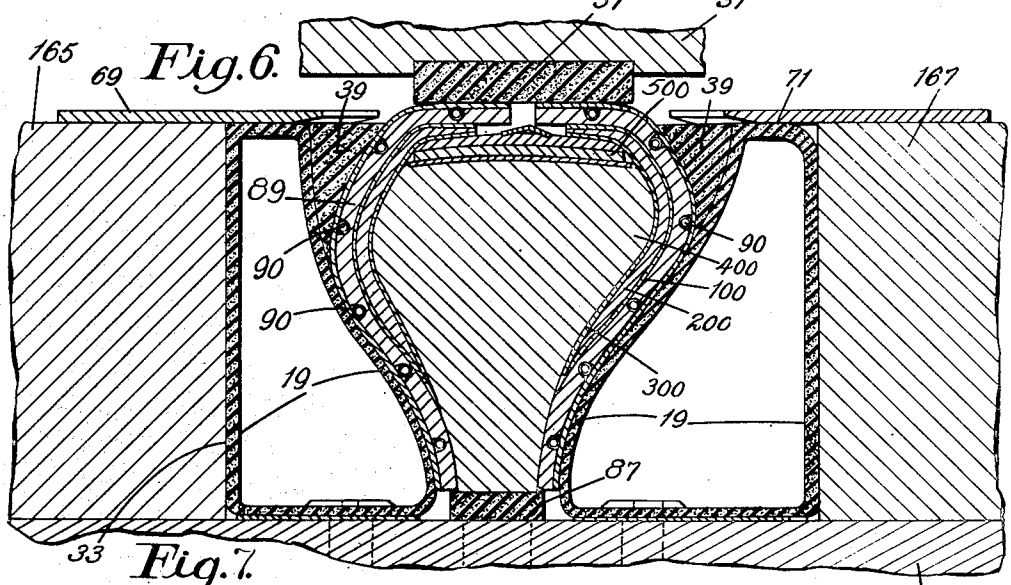
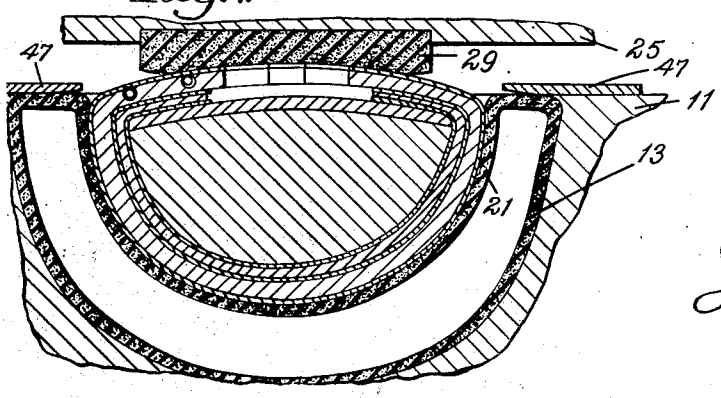


Fig. 7.



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UNITED STATES PATENT OFFICE

2,406,738

APPARATUS FOR USE IN STIFFENING UPPERS OF SHOES

John J. Brophy, Salem, Mass., assignor to United Shoe Machinery Corporation, Flemington, N. J., a corporation of New Jersey

Original application November 22, 1944, Serial No. 564,605. Divided and this application August 10, 1945, Serial No. 610,110

7 Claims. (Cl. 12—51)

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This invention relates to stiffening selected portions of the uppers of shoes and is herein set forth in connection with stiffening the toe portions and the rear portions of uppers.

It is common to provide a toe stiffener blank, usually one having a fabric base impregnated with a stiffening substance, which can be softened and rendered limp by treatment with a solvent or with heat; to incorporate the softened blank in an assembled upper; and then to conform the upper with the softened blank to a last, the blank becoming hard and resilient upon evaporation of the solvent or upon dissipation of the heat.

There are certain disadvantages involved in the use of stiffener blanks of the general type outlined above. They can be most conveniently incorporated in the assembled uppers, and are usually so incorporated, just prior to the pulling-over operation, a special solvent-applying or heat-applying apparatus being provided for rendering them temporarily limp. They become hard and resilient as soon as the solvent has evaporated or the heat dissipated; but it is difficult to maintain them limp, and hence in condition for being conformed to the last, for just the right time, and then to have them become hard soon afterward so that the last may be removed from the upper. These and other disadvantages present very considerable difficulties to the use of such blanks as counter stiffeners so that, although toe stiffeners of the general type under discussion are widely used, no shoe manufacturer, so far as I am aware, uses them as counter stiffeners.

The patent to Schwartz No. 1,215,875 of February 13, 1917 discloses a method intended to avoid the disadvantages involved in the use of stiffener blanks which are given a preliminary treatment to render them soft and limp before they are conformed to the last. This patent discloses a method which comprises the use of a stiffener blank carrying shellac in powdered or broken form, whereby the blank is limp when cold and dry. Such a stiffener blank is incorporated in the assembled upper of a shoe and conformed to the last. After the shoe is lasted, the part of the upper which contains the stiffener blank is subjected to radiant heat to fuse the shellac whereby the particles of shellac are

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caused to run together so that, when the shellac hardens, a stiffened portion of the upper results. Shellac is not a satisfactory material for use in stiffening portions of the uppers of shoes; and subjecting the selected portion of the upper to radiant heat for approximately an hour at a temperature between 210° and 250° F., as is necessary in the patented process, is extremely injurious to all but a very few kinds of leather. Consequently no one, so far as I am aware, has ever made use of the Schwartz process, said patent never having advanced at all the art of shoemaking.

According to the present invention there is incorporated in a selected portion of the upper, in cold, dry, non-fused form, a resinous material which can be caused to coalesce when subjected to the heating effect of a high-frequency field. The resinous material, while cold and dry, is conformed with the upper of a shoe to a last and subsequently is subjected to the heating effects of a high-frequency field. This material produces a tough, strong stiffener. By making use of a high-frequency field the heat is applied directly to the stiffening material. The heat need be applied for only a very short interval; there is no danger of injuring the upper of the shoe such as is present when radiant heat is used, and a resinous material having a comparatively high melting point can be employed.

Preferably the electrodes of the high-frequency apparatus are flexible members mounted in a flexible presser which is pressed against the selected portion of the upper. In this manner not only is a stray field from the electrodes made use of to heat the stiffening material but the stiffener blank is caused, by the action of the presser, to conform very accurately to the contour of the last beneath it, and the upper, stiffener and lining are firmly bonded together.

The invention comprises a method, an apparatus for use in carrying out a step of the method, and an article which is used in the method.

Referring to the accompanying drawings,

Fig. 1 is a plan of a toe stiffener blank according to the present invention;

Fig. 2 is a similar view of a counter stiffener blank;

Fig. 3 is a plan of an apparatus for subjecting the front and rear portions of the upper of a lasted shoe to the heating effect of a high-fre-

quency field, a shoe being shown in place, certain parts of the apparatus having been removed or broken away;

Fig. 4 is a vertical longitudinal section of the apparatus and lasted shoe shown in Fig. 3, the plate **69** which has been removed in Fig. 3, being shown;

Fig. 5 is a perspective of the rear electrode holder with the electrodes;

Fig. 6 is a vertical cross-section through the rear part of the apparatus and the shoe which are shown in Fig. 3; and

Fig. 7 is a vertical cross-section through the forward part of the apparatus and shoe.

The stiffener blanks (Figs. 1 and 2) are preferably made by impregnating a sheet or porous base, such as cotton flannel, felt or paper, with a solution of a plastic stiffening material consisting essentially of a synthetic resinous material, such, for example, as ethyl cellulose, in a solvent, such, for example, as acetone; treating the impregnated base with a non-solvent liquid, such, for example, as water, which is miscible with the solvent but is not a solvent for the resinous material, so as to precipitate the resinous material in the base; and then drying the sheet.

The procedure outlined above for impregnating a porous sheet by precipitating in its interstices a resinous material may be carried out in any suitable manner, for example, as disclosed in United States Letters Patents No. 1,256,240, dated February 12, 1918, and No. 1,353,599, dated September 21, 1920, both granted upon applications of Stanley P. Lovell. The dry sheet carrying the resinous material in precipitated form, if stiffer than desired, may be rendered limp or flexible by any suitable treatment. For example, the sheet may be carried between moving belts which make sharp reverse turns over small rolls so as to bend the sheet sharply first in one direction and then in another; or the sheet may be run through a mangle and thus rendered limp and flexible by reducing the precipitated resinous material more or less to discrete particles. After the above treatment the stiffener blanks may be cut out of the sheet.

It may be desired to omit the precipitating step, in which case the solvent may be caused to evaporate, and the dry sheet containing the resinous material treated to render said sheet limp. It will be understood that the base, instead of being a separate member, may be some part of the assembled upper of a shoe, for example, the doubler, which has, for example, been cut out of an impregnated sheet. Also, if desired, the porous base may be omitted, and limp, easily conformable stiffener blanks produced by spraying a suitable solution of a synthetic resinous material in a suitable manner upon a smooth surface, peeling off the comparatively thick, porous sheet which results when the solvent has evaporated, and cutting out blanks from such a sheet. In any case, there will be incorporated in the upper of a shoe a synthetic resinous material which while cold and dry may be conformed with the upper to a last and may be later caused to coalesce by subjecting it to the heating effect of a high-frequency field.

Limp stiffener blanks, for example, a toe stiffener blank (Fig. 1) and a counter stiffener blank (Fig. 2), may be incorporated in the upper of a shoe at any suitable stage in the manufacture of the shoe. Conveniently the blanks may be incorporated in and become part of the upper during the assembling of the parts of the upper in

the stitching room. The upper may then go through the regular shoe manufacturing operations, including being mounted upon and conformed to a last; and, at any time after the lasting has been completed, the toe and heel ends of the upper, with the conformed, limp stiffener therein, may be subjected to the heating effect of a high-frequency field.

The resinous stiffening material, as has been stated, is preferably incorporated in selected portions of the upper by incorporating two separate stiffener blanks such as are shown in Figs. 1 and 2. In Fig. 6 a lasted upper is indicated at **100**, a stiffener at **200**, a lining at **300**, and a last at **400**. After the stiffeners have been incorporated in the upper and the upper has been lasted, the next step is to subject the selected portions of the upper to the heating effect of a high-frequency field. A convenient method of accomplishing this will now be described in connection with a suitable apparatus.

Referring first to Figs. 3 and 4, the apparatus comprises a base **9** upon which are mounted a front section and a rear section. The front section comprises a block **11** which is hollowed out to receive a flexible rubber bag **13** shaped to receive the toe portion of a lasted shoe, said block being adjustable toward and from the rear section in a guideway **15** formed in the base **9** and held in adjusted position by a clamping screw **17**, the purpose of this adjustment being to provide for shoes of different lengths. The rear section also has a flexible bag **19** which is shaped to extend around the rear and sides of the shoe, and the wings or sides of which can be moved from open to closed position. Two electrode holders **21**, **23**, the details of construction of which will be described later, are placed respectively upon the toe portion and the rear portion of the upper on the lasted shoe, and then the lasted shoe, with the electrode holders in place upon it, is placed as shown in Figs. 3 and 4 with the electrode holder **21** resting against the bag **13** and the electrode holder **23** resting against the bag **19**, the block **11** having been adjusted horizontally and locked in position by the clamping screw **17**. A cover **25**, which is hinged to the front section at **27**, is swung over and down into horizontal position and fastened in this position by a hasp (not shown) on the cover, the slot in the hasp receiving a staple (not shown) driven into the block **11**, a pin (not shown) being passed through the staple to hold the hasp in place. The cover **25** (Fig. 7) has set into it near its middle a block of resilient material **29** which presses down the electrode holder on the toe portion of the shoe. A similar cover **31** (Fig. 3), hinged to a stationary part of the rear section at **33**, is swung over and its hasp (not shown) held by a staple **35** which is driven into a stationary part of the rear section. This cover **31** (Fig. 6) has set into it near its middle a block of resilient material **37** which presses the electrode holder **23** and the rear portion of the lasted shoe against the flexible bag **19**. Next, the sides or wings of the rear bag **19** are forced inwardly in a manner presently to be described so as to press the sides or wings of the rear electrode against the upper and the upper against the sides of the rear portion of the last.

In the manufacture of shoes it is usual to tack an insole to a last, the heel end of the insole being somewhat narrower than the widest part of the rear end of the last so that there is a re-entrant angle which extends around the heel

end of the last and insole, said angle (Fig. 6) being bounded on one side by the edge of the insole 500 and on the other by the somewhat curved surface at the bottom of the heel end of the last. It is desirable that the finished stiffener should bridge this angle; and in order that the stiffener, while soft, shall not be forced into this angle, the inner wall of the bag at this locality is given sufficient rigidity. In the illustrated construction there is vulcanized or otherwise attached to the adjacent portion of the inner wall of the bag 19 a strip of resilient material 39, wedge-shaped in cross-section, so that no objectionable crease or depression appears in the outer of the finished shoe.

With the shoe and the electrodes thus firmly held, a fluid under pressure, for example, compressed air, is forced through two pipes 41 and 43 into the rear bag 19 and through the pipe 45 into the front bag 13 to distend the bags. Thereafter the electrodes are energized from the terminals of an oscillator of a high-frequency machine whereby the resinous stiffening material is caused to coalesce and, finally, becomes hard, film-like, and resilient. The purpose of the pressure is twofold. First, it presses the electrodes, which are flexible, firmly into contact with the shoe, thereby rendering them much more effective. Second, it presses the outer, the stiffening material, and the lining of the shoe into firm contact with each other so that the three members are firmly bonded together in the finished shoe.

The general construction and mode of operation having been given above, a detailed description of the parts of the apparatus will now be given. The block 11 of the front section is hollowed out, as has been explained, to receive the resilient bag 13. In order to aid in holding the bag properly in place, a suitably shaped thin plate 47, the inner edge of which extends over the top of the bag, is fastened by screws to the block; and a comparatively thick, substantially upright, but slightly inclined plate 49 is fastened to the block 11, said plate 49 having cut in it a curved bevel-edged opening to fit closely around the inner (left-hand as viewed in Fig. 4) end of the bag 13. The pipe 45, through which compressed air is forced into the bag, has its inner end upset over one wall of the bag and is held firmly in place by a nut 51 which is threaded upon the pipe.

The rear section is different from the front section principally because means are provided for causing the sides or wings of the bag 19 to press the electrode holder against the sides of the rear portion of the shoe. This rear section comprises two stationary, upright side walls 53, 55 and a stationary, upright rear wall 57, all three walls being rigid with the base 9. The rear wall has rounded ends which are adjacent to but somewhat spaced from the side walls 53, 55. These rounded ends have horizontal slots about midway of their height, one such slot being shown at 59 in Fig. 4; and extending vertically through the rounded ends and the slots are vertical pivot pins, one of which is shown at 61 and the tops of both of which are shown at 61 and 63 in Fig. 3. Extending horizontally into the slots and pivoted on the pins are flat tongues 65, 67 formed respectively on the rear ends of arms 165, 167 which receive between them the sides of the bag 19, as shown in Fig. 6, in which figure the arms have been swung in about their respective pivots 61, 63 to cause the sides of the bag to press

the electrode holder 23 firmly against the upper of the shoe and the upper firmly against the last. Fastened respectively to the tops of the arms 165, 167 are two thin plates 69, 71; and fastened to the top of the rear wall 57 is a third thin plate 73, the inner edges of these plates extending over the top of the bag 19. The arms 165, 167 are normally held in open or spread-apart position, as shown in Fig. 3, by two tension springs 75, 77, one end of each spring being fastened to an arm and the other end to the base 9. In order to move the arms to closed position against the force of the springs 75, 77, there are provided two cam members 79, 81 pivoted respectively about the stems of screws 83, 85 which are threaded respectively into the side walls 55, 53. The cam members have comparatively long, straight handles which, as viewed in Figs. 3 and 4, are upright, the springs 75, 77 holding the arms 165, 167 open. When it is desired to swing the arms toward each other to exert pressure, the handles are swung down and outwardly about the pivot screws 83, 85. This causes the cam members, which are integral with the handles, to force the arms inwardly. Upon the upper face of the base 9 is a block 87 of resilient material to receive the cone of the last 400.

The electrodes are flexible. They are substantially alike except for their shapes, and consequently only the rear electrode will be described in detail. The holder 23 for the rear electrodes has the general shape shown in Fig. 5, being provided with curved side walls which resemble in shape those of a molded counter stiffener, and with an inturned, substantially flat flange at the top. The inner wall of the holder thus corresponds roughly to the shape of the rear portion of the last. The illustrated holder is made of two layers of flexible material, such as leather, a thin layer 88 and a thicker layer 89, the thicker layer having in it a series of holes 90 to receive spirals of wire which constitute the electrodes of the high-frequency machine. Conveniently, if desired, the layers of the electrode holder may be made of finely woven elastic glass, and the electrodes fastened in place between the glass layers. These electrodes are arranged in sets of two series of three each. To the three members of one set have been applied the reference numerals 91, and to the three members of the other set the reference numerals 93. The three electrodes 91 are connected to three conductors 191 which in turn are connected to a single conductor 291, said last-named conductor leading from one terminal of a high-frequency oscillator. The three electrodes 93 of the other set are connected to three conductors 193 which in turn are connected to a single conductor 293, said last-named conductor leading from the other terminal of the high-frequency oscillator. It will be noted that the three electrodes 91 are alternated with the three electrodes 93, and that direct fields lie between these electrodes. It is not, however, such direct fields which are relied upon to heat the stiffening material in the shoe. There is present a series of stray fields extending outwardly and inwardly from the planes between the electrodes, these stray fields being parts of the electrostatic fields which are external to the space between the electrodes, and it is this series of stray fields which is principally relied upon. The forward electrode holder is of substantially the same construction as that of the rear electrode holder which has just been described, but differs from the rear holder in that

it is shaped roughly to correspond to the shape of the toe portion of a lasted shoe. The conductors for the two sets of electrodes of the front holder 21 are indicated in Fig. 3 at 95 and 97.

The following are examples of solutions which may be used to impregnate a porous base.

Example I

	Parts by weight
Ethocel 100 C. P. Standard	16.25
Rosin (cherry wood)	5.25
Acetamide	6.75
Acetone	75
Methanol	15

"Ethocel 100 C. P. Standard" is ethyl cellulose put out by the Dow Chemical Co. of Midlands, Michigan. The rosin is used principally to add to the tackiness of the compound. Acetamide is a compound which has a lower melting point than the "Ethocel" and is more susceptible to the heating effect of a high-frequency field than is the "Ethocel." Its principal function is to cause the "Ethocel" to melt at a lower temperature than it otherwise would.

Example II

	Parts by weight
Ethocel #250 C. P. Standard	15
Petrex acid	6
Acetone	100
Methanol	28

In this formula "Petrex acid" is used in place of acetamide and rosin. This acid is a high molecular weight, synthetic, polybasic acid of terpene origin put out by the Hercules Powder Co. of Wilmington, Delaware.

Example III

	Parts by weight
Ethocel #150 C. P. Standard	16
Polypale ester No. 2	12
Acetone	140
Methanol	28

In this formula "Polypale ester No. 2" is used in place of acetamide and rosin. This ester is the diethylene glycol ester of polymerized rosin and is also put out by the Hercules Powder Co.

Example IV

	Parts by weight
Ethocel 250 C. P. Standard	10
Rosin (cherry wood)	10
Acetone	120
Methanol	24

Rosin, besides adding to the tackiness of the compound also is more susceptible to the heating effect of a high-frequency field than is the "Ethocel." It will be noted that no acetamide, "Petrex acid" or "polypale ester" is present in the formula, the large proportion of rosin in this case acting to increase sufficiently the susceptibility of the "Ethocel" to the heating effect of the high-frequency field. The above formula produces a stiffener which, when hot, is somewhat more sticky than that produced by Example I and one which will soften at a somewhat lower temperature, but not below that to which the stiffened portion of a finished shoe is liable to be exposed.

Example V

	Parts by weight
Polyvinyl acetate R. H. #410	45
Acetamide	15
Acetone	90

Polyvinyl acetate R. H. #410 is a polymerized vinyl acetate put out by the E. I. du Pont de Nemours & Co., Inc., of Wilmington, Delaware.

Example VI

	Parts by weight
Normal propyl methocrylate	35
Acetamide	12
Acetone	80

Example VII

	Parts by weight
Normal butyl methacrylate	35
Acetamide	12
Acetone	80

Example VIII

	Parts by weight
Ethocel 100 C. P. Standard	16
Rosin (cherry wood)	12
Hycar	6
Acetone	90
Methanol	20

Example IX

	Parts by weight
Ethocel 50 C. P. Standard	24
Rosin (cherry wood)	12
Hycar	6
Acetone	90
Methanol	20

Hycar, a synthetic rubber, is a butadiene-acrylonitrile copolymer containing in the neighborhood of 25% by weight of acrylonitrile and 75% by weight of butadiene put out by the Hycar Chemical Company of Akron, Ohio. Like acetamide it has a lower softening point than has the ethyl cellulose. The synthetic rubber renders the stiffener blank more pliable when cold so that the lasting operation is facilitated, and enhances the resilient quality of the finished stiffener in the shoe.

Example X

	Parts by weight
Paraplex X100	40
Durez resin #12687	70
Benzoyl peroxide	1
Altax	1
Titanox R. A. 10M0	50
Acetone	134
Methanol	24

Paraplex X100 put out by the Resinous Products & Chemical Co. of Philadelphia, Pa., is an alkyd type thermosetting resin having a softening range of from 100° F. to 105° F. Durez resin #12687 is a thermosetting phenol-formaldehyde resin, put out by Durez Plastics & Chemicals, Inc., of North Tonawanda, New York, which has a softening range of 40°–60° C. and a melting range of 70°–75° C. Benzoyl peroxide is an accelerator for the curing of the thermosetting resinous material. Altax, benzothiazyl disulfide, put out by the R. T. Vanderbilt Co., of New York, N. Y., is a rubber accelerator but here probably acts to retard somewhat the curing operation. Titanox R. A. 10M0 is a titanium oxide put out by the Titanium Pigment Corporation of New York, N. Y. It serves here principally as a filler.

This application is a division of application Serial No. 564,605, filed November 22, 1944, and is directed to the apparatus.

Having described my invention, what I claim as new and desire to secure by Letters Patent of the United States is:

1. Apparatus for use in stiffening the front and

rear portions of the upper of a lasted shoe, there being incorporated in the two portions non-fused resinous stiffening material capable of being caused to coalesce by heat, said apparatus comprising two supports including yielding members against which the two portions of the shoe rest, means for exerting pressure through the flexible members upon the two portions of the upper to press them against the last, and means for subjecting the pressed portions to the heating effect of a high-frequency field.

2. Apparatus for use in stiffening the front and rear portions of the upper of a lasted shoe, there being incorporated in the two portions non-fused resinous stiffening material capable of being caused to coalesce by heat, said apparatus comprising two supports including yielding members against which the two portions of the shoe rest, means whereby one support may be adjusted toward and from the other to provide for shoes of different lengths, means for exerting pressure through the flexible members upon the two portions of the upper to press them against the last, and means for subjecting the pressed portions to the heating effect of a high-frequency field.

3. Apparatus for use in stiffening a selected portion of the upper of a lasted shoe having incorporated therein a non-fused stiffening material capable of being coalesced by heat, said apparatus comprising a flexible electrode holder having two sets of electrodes in its wall, the electrodes of one set being alternated with the electrodes of the other set, said holder being shaped to fit over the selected portion of the shoe, means for pressing the flexible electrode holder against the shoe, and means for connecting the sets of electrodes respectively to the terminals of a high-frequency oscillator.

4. Apparatus for use in stiffening a selected portion of the upper of a lasted shoe, said selected portion having incorporated therein a non-fused stiffening material capable of being caused to coalesce by heat, said apparatus comprising a flexible electrode holder shaped to fit about the selected portion, an inflatable bag shaped to fit about the holder, means for supporting the bag in such manner that, when inflated, it will press the electrode holder against the selected portion of the upper and the selected portion against the last, means for inflating the bag, and means for connecting the electrodes to the terminals of a high-frequency oscillator.

5. Apparatus for use in stiffening a selected portion of the upper of a lasted shoe, said selected portion having incorporated therein a non-fused stiffening material capable of being caused to coalesce by heat, said apparatus comprising a flexible electrode holder shaped to fit about the selected portion, an inflatable bag shaped to fit about the holder, means for supporting the bag in such manner that, when inflated, it will press the electrode holder against the selected portion of the upper and the selected portion against the last, said bag-supporting means including members of rigid material movable toward and from each other, means for inflating the bag, and means for connecting the electrodes to the terminals of a high-frequency oscillator.

6. Apparatus for use in stiffening a selected portion of the upper of a lasted shoe having incorporated therein a non-fused stiffening material capable of being caused to coalesce by heat, said apparatus comprising a flexible electrode holder having two sets of electrodes in its wall, the electrodes of one set being alternated with the electrodes of the other set, said holder being shaped to fit over the selected portion of the shoe and to extend over the bottom thereof, a flexible bag embracing the holder, means for holding the outer wall of the bag from movement away from the shoe, means for inflating the bag to press the electrode holder against the bottom and side portions of the upper, and means for connecting the two sets of electrodes respectively to the terminals of a high-frequency oscillator.

7. Apparatus for use in stiffening a selected portion of the upper of a lasted shoe, said portion having incorporated therein a non-fused stiffening material capable of being caused to coalesce by heat, said apparatus comprising a flexible member, means for causing said member to press the selected portion against the last, said flexible member having a part of sufficient rigidity located to bridge the re-entrant angle bounded on one side by the edge of the rear part of the insole and on the other by the curved surface at the lower portion of the rear part of the last, and means for subjecting the selected portion while under pressure to the heating effect of a high-frequency field.

JOHN J. BROPHY.