May 26, 1942. E. C. PITMAN 2,283,946

PROCESS FOR MANUFACTURE OF SHOES

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Fig. 1

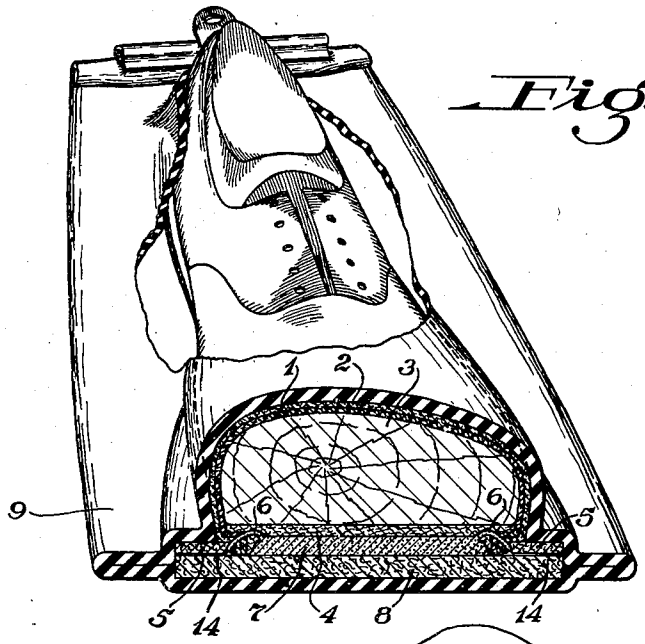
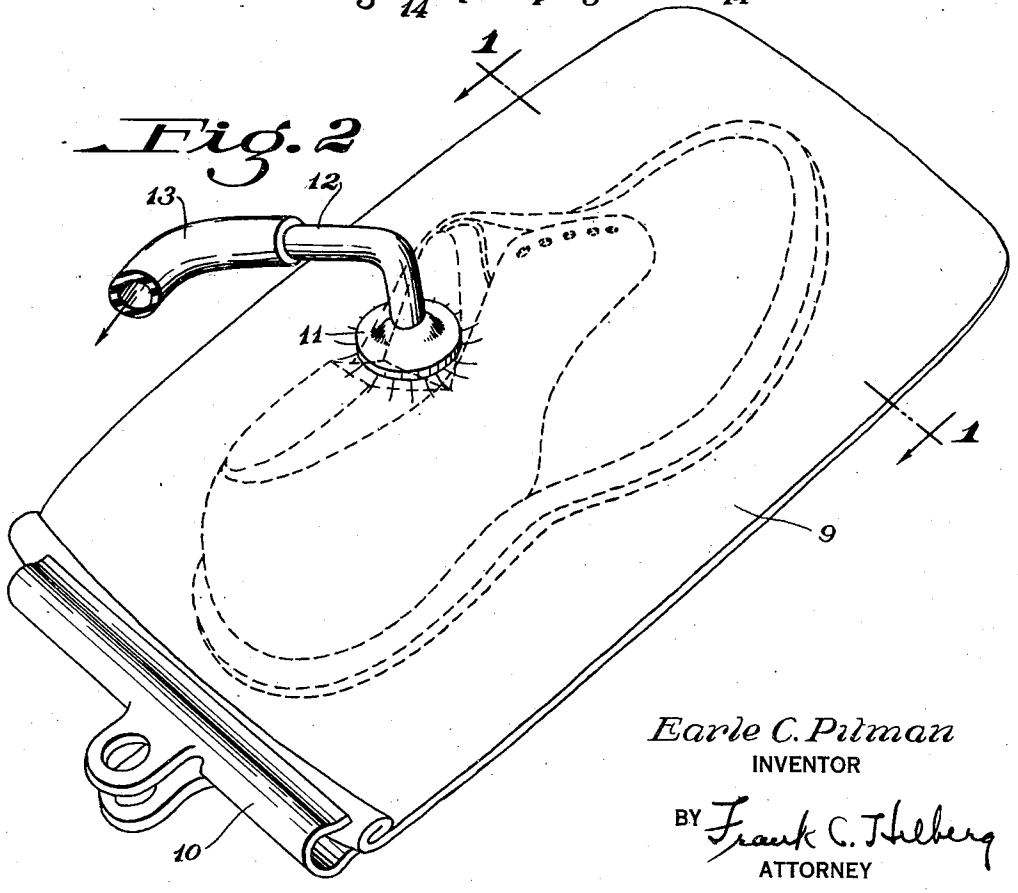


Fig. 2



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PROCESS FOR MANUFACTURE OF SHOES

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1 Claim. (Cl. 12—142)

This invention relates to the manufacture of shoes, particularly of cemented shoes, and more particularly to a method of holding the component parts of the shoe in position until the cementing medium has set.

The manufacture of cemented shoes has assumed major importance in the shoe industry, particularly in the manufacture of women's shoes of all types. It is particularly adapted to the high speed production of women's shoes, where the soles are thin and flexible enough to make relatively easy the holding of the sole and upper in position until the cement has set sufficiently. The equipment used, or developed thus far, has been generally unsatisfactory when stiff sole leather is used, such as the grade commonly required for the manufacture of men's shoes. It is a fundamental consideration that the stiffer the sole, the harder it is to attach the sole to the shoe upper. With the present sole-attaching mechanisms, it becomes necessary to use very strong adhesives and excessive pressures, or to keep the sole in position for excessive periods of time.

This invention has as an object the provision of an improved method of holding the sole to the upper until the cementing medium has set at least in part. A further object is the provision of a method for applying a low but uniform pressure over all parts of the sole and the lasted upper. A further object is the provision of a method of applying pressure whereby distortion of the sole or of the upper is prevented. A still further object is the provision of a method of applying a uniform pressure to cause the upper parts of the shoe to conform to the shape of the last. Other objects will appear hereinafter.

These objects are accomplished when the application of pressure to the component parts of the shoe is obtained by means of a vacuum induced in a highly flexible container in which the shoe assembly, including the last, has been placed while the portions to be cemented are in a condition such that the actual cementing operation can be completed.

In the drawing, Figure 1 is a section through the line I—I of Figure 2. Figure 2 is a plan view showing the arrangement of the parts. In both figures, the same reference members refer to similar parts.

Figure 1 represents a cross-sectional view of the forepart of a man's Goodyear welt shoe, with the exception of the application of the outsole by cementing rather than sewing. This type can be better described as a "Cemented Welt" construction. In addition, we show in Figure 1 the way in which the flexible container is shrunk tightly around the regular shoe assembly during the cementing operation. Figure 2 illustrates the positioning of the shoe assembly including the wood last within the flexible container, means for sealing the container and means for attaching to a vacuum pump.

In a shoe assembly of this type a cloth liner 1 and leather upper 2 are formed about a suitably shaped wooden last 3, which has attached to it in temporary fashion an insole 4, over the edges of which the lasting edge or allowance of the upper are drawn. The lasting allowance and a narrow strip of leather called the welt 5, 5 are stitched to a channeled lip of the insole at 6, 6. A plastic filler 7 is then spread to give a level surface prior to the application of the outsole 8. The outsole 8 is fastened to the upper assembly by a cement layer 14 which covers the underside of the welt 5, 5 and the outer edges of the outsole 8.

The cementing operation of the present application is accomplished by placing the shoe assembly described or its equivalent within the flexible container 9 and evacuating the container, whereby a uniform pressure of approximately 15 pounds per square inch is applied to the outside of the entire shoe assembly, causing a strict conformation of the component parts of the shoe assembly to the last. Also, the downward pressure of the flexible container on the welt, plus the upward pressure on the outsole, improves the efficiency of the cementing operation but at the same time prevents bending of the outsole upward. This is an important advantage which has heretofore been accomplished generally in the manufacture of cemented shoes by systems of complicated and expensive mechanical hold-down devices.

In Figure 2 the position of the shoe assembly in the flexible casing 9 is shown. The casing 9 is normally open at one end to provide for easy insertion of the shoe assembly. The strong metal spring clamp 10 is provided to seal the end of the casing, and as shown the effectiveness of this seal may be greatly increased by folding over the extreme end of the casing before applying the spring clip 10.

The casing 9 is also provided with an adapter assembly 11, so positioned as to come in contact with the upper part of the wooden last 3. The adapter assembly 11 provides a conventional metal to rubber connection and this is attached to an outlet pipe 12, to which is attached a rubber tube 13 which leads to a vacuum pump or eductor. Normally a single or two-way valve or other means is inserted in the vacuum line so that the line can be detached from the vacuum pump while still maintaining the vacuum or to assist in introducing air into the casing at the end of the cementing operation. The evacuation of casing 9, when accomplished, causes the casing to shrink around the shoe assembly of Fig-

ure 1, following all of the contours, and this shrinkage exerts a pressure equivalent to that of the normal atmospheric pressure over the entire shoe assembly.

The proper positioning of the shoe assembly in the flexible casing gives rise to problems which do not occur in the use of the conventional pressure jacks. Means for temporarily holding the forepart of the outsole in proper position as it is being inserted in the casing may comprise tacking, application of a tape coated with a pressure sensitive adhesive, clamping or other equivalent means, the principal criterion being that the temporary means should be quickly removable at the end of the cementing operation. A simple expedient is the tacking of the outsole at the heel and inserting the assembly heel first into the casing with the operator holding the forepart of the assembly until the positioning has been completed.

The vacuum is maintained in the casing as long as is necessary to permit the cement to set up to a point where the adhesive strength developed will permit the release in pressure without loosening of the outsole. The cement may be of the hard-setting type such as is represented by the nitrocellulose cements now widely used or by the gummy or extensible type of cement such as the natural or synthetic rubber cements.

The casing as described represents only one form, and it may vary in size, shape or thickness of wall over a wide range. It is advisable to make the casing large enough to handle the largest shoes in production, so that the casing can handle any or all of the shoe sizes produced. It may be used as described or may be attached to a metal frame or incorporated in semiautomatic or fully automatic mechanical handling equipment. Also, a number of the casings can be grouped together as single operators can handle many casings by sequence operations, or the casings can be attached to a conveyor system having any desired number of units attached.

The pressure induced by exhausting the highly flexible, air-tight container is normally of the order of 14 to 15 pounds per square inch. This compares with typical cementing pressures of 40 to 50 pounds per square inch now being used by the industry. I have found that the moderate pressure of 14 to 15 pounds is quite sufficient when it is applied uniformly over the entire shoe assembly and, in fact, is often more than sufficient for this purpose. It is not necessary to make use of an expensive vacuum pump as a vacuum equivalent to 29 inches of mercury or even less will satisfactorily hold the shoe assembly together provided that the wood last has been properly designed.

Example 1

A cemented welt shoe assembly was prepared as described above and a nitrocellulose cement having as its composition

	Parts by weight
Nitrocellulose (dry)	24.0
Dibutyl phthalate	6.0
Denatured ethyl alcohol	10.0
Acetone	30.0
Methyl ethyl ketone	30.0
	100.0

was applied to the underside of the welt and as a narrow band on the topside of the outsole, and allowed to dry without the parts being brought into contact. A flexible rubber container having side walls .05 inch thick was made ready by attaching to a vacuum pump. A generous coat of ethyl acetate was applied by brush to the dry cement on the welt and outsole. The parts were immediately brought together and the completed assembly placed in the rubber container, and the opening closed. The pump was started and a vacuum equivalent to 29 inches of mercury was induced in the container. The walls of the container drew tightly around the shoe assembly, forcing the outsole and welt together. The vacuum was maintained for 15 minutes. On removal of the completed shoe from the rubber container at the end of the 15 minutes cementing period, the outsole was found to be tightly fastened to the upper and the shoe bottom was found to be very flat and free from any noticeable upward bend at the welt. When the outsole was torn from the upper for inspection as to the efficiency of the cementing, it was found that the separation did not take place cleanly at the cement line; rather leather fibres were torn loose indicating a very satisfactory degree of adhesion.

In the manufacture of cemented welt shoes, where the soles are to be attached to the uppers by means of a cement, it has been the practice to apply the cement to the bottom surface of the welt and also to the marginal portion of the outsole which will eventually be opposite the portion of the welt to which the cement has been applied. In the case of the use of a nitrocellulose type cement, it is normally applied to the welt and outsole and allowed to dry. Immediately before the final cementing operation, a softening solvent or composition containing solvents is applied to the dry cement and the assembly formed as quickly as possible and placed under pressure. Normally the pressure is induced by the expansion of a heavy rubber bladder which is held in a metal frame of suitable character. Above the upper surface of the bladder is placed a heavy piece of leather. The bottom of the shoe assembly, that is, the sole, is placed upon the leather-covered bladder and the upper placed in the correct position on the sole. Hold-down clamps are then placed on the shoe assembly. This may be done, for instance, by a hold-down applied to the last near the heel, plus a padded hold-down on the toe. As soon as the hold-down clamps are in position, air or water is introduced into the rubber bladder to give the desired pressure. Many mechanical modifications of this principle have been described and several are in common usage in the industry.

A pressure assembly of this character has several serious disadvantages including a pronounced tendency to distort the upper part of the shoe because of the application of pressure, for example, on the toe. It also tends to cause the outer edges of the sole to be bent upwards and gives a rounded bottom to the shoe rather than the flat sole effect which is characteristic of sewed or nailed shoes and desired by many manufacturers. Also, because of the stiffness of the leather-topped bladder, small irregularities of the shoe assembly cause uneven pressures and the area actually bonded at best is probably considerably less than the total area provided for cement. It is because of these irregularities that high pressures of 40 to 50 pounds per square inch are applied to the bladder, and these high pressures in turn sometimes cause serious distortion of the entire shoe assembly.

I have found that by selecting a highly flexible,

airtight bag of a size slightly larger than the shoe assembly, but sufficiently large to allow quick and easy insertion of the shoe assembly and which can be sealed to maintain a vacuum of approximately 29 inches of mercury, I can obtain a degree of cementing greater than that heretofore possible. Also, I can insert the assembly and the exhausted casing in a pressure chamber to obtain pressures above atmospheric, or I can place the assembly and casing in a conventional pressure jack to obtain greater pressure on selected portions of the shoe assembly.

A suitable material for constructing such a bag is rubber. Neoprene or other tough rubber substitutes may also be used. The thickness of the rubber is controlled, first, by the pressures involved, namely, 15 pounds per square inch. Second, it must be sufficiently thick to give long life and high resistance to the rough handling which must necessarily occur in commercial production of shoes. Third, it must be thin enough to mold itself around the sole and upper of the shoe assembly. Very thin rubber cannot be used as there is some tendency to creep into the crevices of the shoe and cause an undesirable separation of the parts. Fourth, it must be sufficiently strong to permit the fastening of a mechanical or semi-mechanical closing device to the end of the bag through which the shoe assembly is introduced.

The procedure in carrying out a typical cementing operation with the vacuum container is substantially the same as with the mechanical pressure equipment except that a wider range of cements may be used and the drying speed of the cement is of lesser importance. Also, in the cementing of shoes with a nitrocellulose cement, the softening agent may be either highly volatile or even a relatively slow-drying material. The selection of the softening agent should be such that the operator will have plenty of time to properly position the shoe assembly in the casing before the adhesive sets up. In either case the evacuating of the bag serves to increase the evaporation of the volatile components from the cement layer and speeds up the cementing operation. Also, by use of the vacuum, concentrations of active volatile solvents from the cement layer are removed before they can condense and act upon the upper portions of the shoe, for example, the various coated leathers or fabrics.

My process is advantageously used with nitrocellulose cements as the adhesive. However, many other types of cements can be satisfactorily utilized such as rubber latex, rubber solutions and depolymerized rubber in organic solvents. Synthetic resin solutions of the non-reactive types such as the vinyl resins, styrene, acrylate and polyhydric alcohol-polybasic acid resins can also be used. Reactive resins of the urea-formaldehyde or phenol–formaldehyde type can be used. Water-dispersible adhesives based upon casein, glue, gelatin, starch, etc., particularly those which can be made waterproof by treatment with formaldehyde or other chemical agent, are readily handled.

The selection of the adhesive depends upon the use to which the final cemented product is to be put. In the cementing of shoes, such factors as toughness, water-resistance and speed of set-up must be considered. In most cases the cellulose nitrate adhesives now in use can be handled effectively in the vacuum casing unit.

The unit is particularly adapted to the cementing of soles to the uppers, but the ability of the casing to handle objects of irregular shape makes it readily adapted to other cementing operations in the manufacture of shoes, and in particular, certain stitching operations may be eliminated.

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 claim.

I claim:

The method of making cemented shoes which comprises assembling the parts of the shoe on a last with a cement between the parts to be united, placing the said assembled parts of the shoe within an air-tight flexible bag while the cement is in a tacky condition, inducing a vacuum within the bag to cause the said bag to hug the parts to be joined, and maintaining the vacuum until the cement has set sufficiently to prevent diplacement of the parts.

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