

No. 878,749.

PATENTED FEB. 11, 1908.

A. SCHULZE.

MANUFACTURE OF INDIA RUBBER BOOTS AND SHOES.

APPLICATION FILED OCT. 10, 1904. RENEWED NOV. 1, 1907.

2 SHEETS—SHEET 1.

Fig. 1.

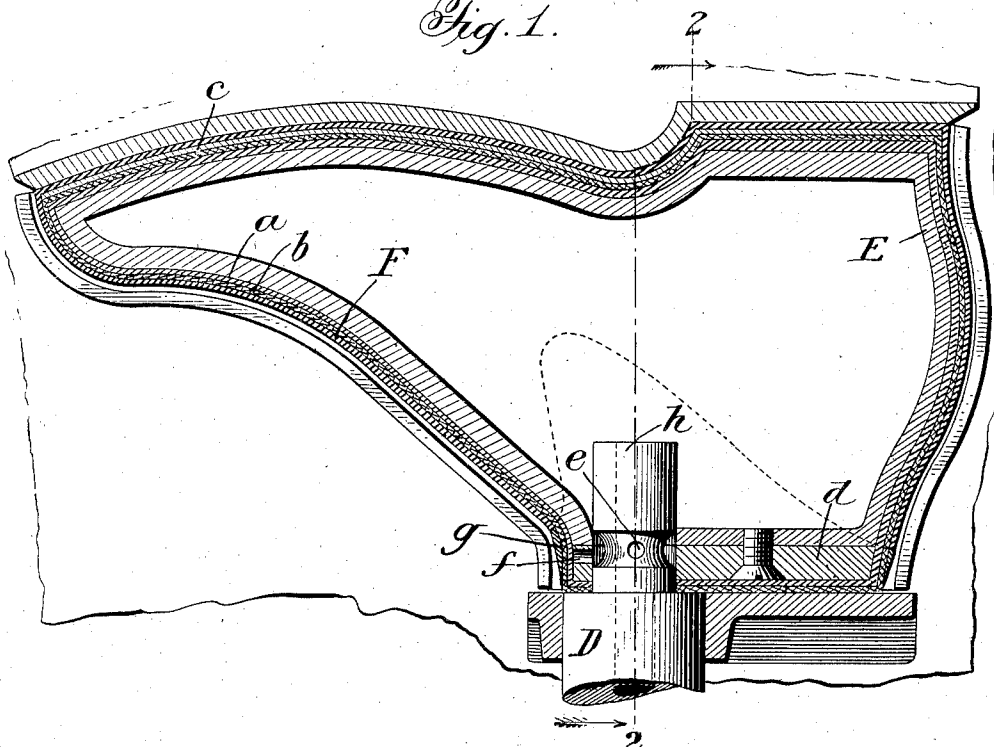
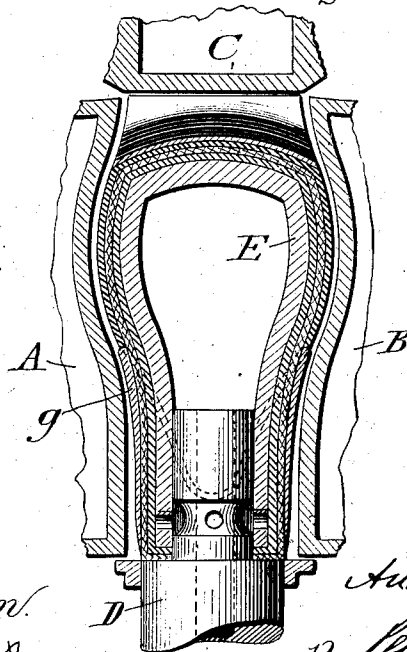


Fig. 2.



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2 SHEETS—SHEET 2.

Fig. 3.

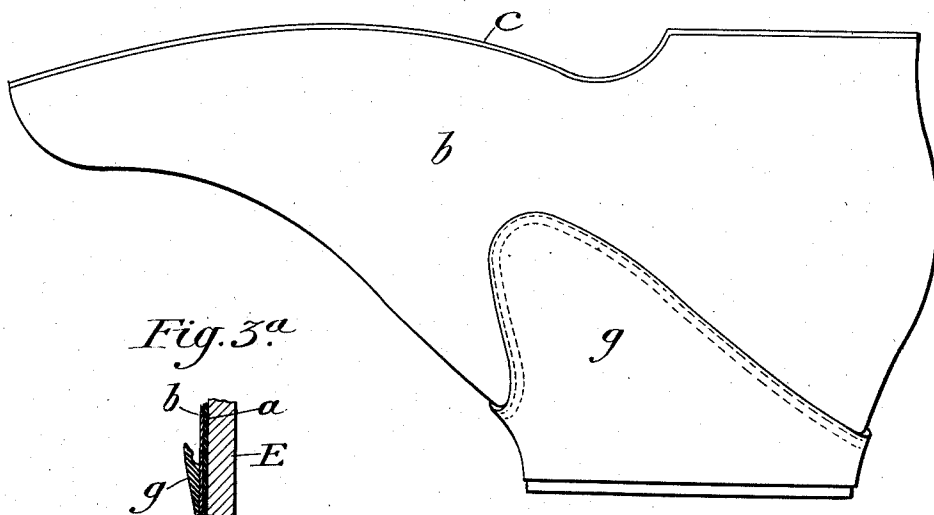


Fig. 3^a

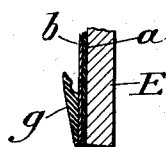
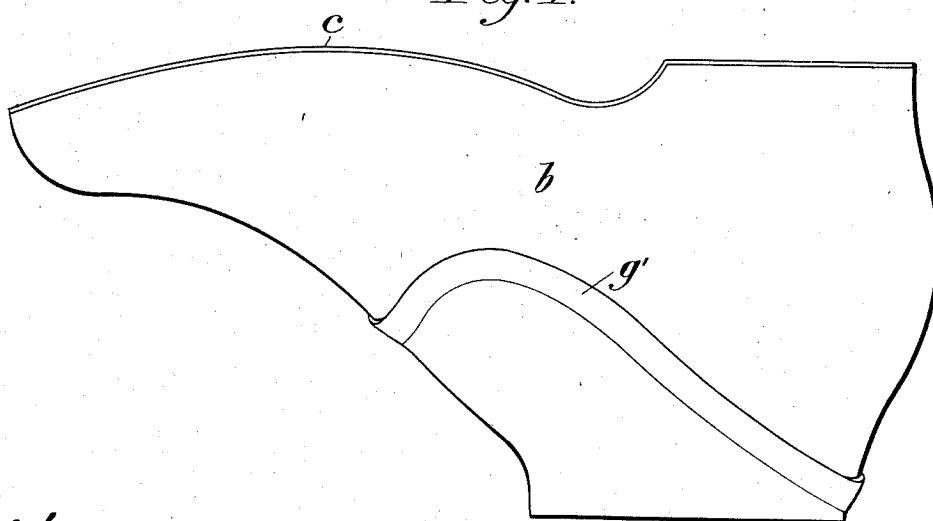


Fig. 4.



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UNITED STATES PATENT OFFICE.

ANDREW SCHULZE, OF WASHINGTON, DISTRICT OF COLUMBIA.

MANUFACTURE OF INDIA-RUBBER BOOTS AND SHOES.

No. 878,749.

Specification of Letters Patent.

Patented Feb. 11, 1908.

Application filed October 10, 1904. Serial No. 227,907. Renewed November 1, 1907. Serial No. 400,152.

To all whom it may concern:

Be it known that I, ANDREW SCHULZE, a citizen of the United States, residing in the city of Washington, District of Columbia, have invented certain new and useful Improvements in Manufacture of India-Rubber Boots and Shoes; and I do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same.

In an application for Letters Patent of the United States filed by me under date of August 26, 1903, Serial No. 170,846, I have described certain improvements in the manufacture of india rubber boots and shoes, involving the general feature of placing the inflated boot or shoe upon a last, then inclosing the last within a closable mold and expanding the boot or shoe against the heated walls of the mold, for the purpose of vulcanizing the boot or shoe.

My present invention relates to an improvement upon the invention shown in my former application referred to, and, in its main aspects, is applicable generally to the manufacture of india rubber boots and shoes, as will hereinafter more fully appear.

In the machine of my former application referred to, the compressed air utilized for expanding the unvulcanized boot or shoe against the heated sides of the mold is admitted into contact with the interior of the boot or shoe. In view of the fact that the air is under considerable compression, it is necessary, under these circumstances, that the mold shall close tight; otherwise, the compressed air would rupture the blank at any open or partially open joint. On the other hand, it is found, in practice, that when the mold is tightly closed, the vulcanized product frequently exhibits irregular indentations or depressions upon its exterior surface, which lessen the commercial value of the product, and sometimes render it altogether unsalable. These depressions or indentations are, in my opinion, due either to the entrapping of air in the mold as it closes upon the blank carried by the last, or to the generation of vapors or gases from the india rubber stock of the blank, or to both of these causes. The same difficulty must inevitably occur wherever the admission of air directly to the inner surface of the blank requires the employment of a tightly closing or substantially tightly closing mold; inasmuch as the

air, vapors or gases, finding no vent, hold portions of the blank away from the heated surfaces of the mold and reproduce themselves in the form of the depressions or recesses referred to.

In the practice of my present invention, I provide a last, as in my former application referred to, and upon this last I stretch or fit the unvulcanized boot or shoe to be vulcanized. The last which I employ, however, I first cover with a flexible covering applied closely to its surface and air tight, so that on the admission of compressed air between the main body portion of the last and the air tight covering, the covering will be inflated and will force the rubber boot or shoe against the inner heated surfaces of the mold. By this expedient, with the employment of a comparatively small amount of compressed air, I obtain an immediate inflation of the rubber boot or shoe and any air, vapor or gases that may be entrapped or that may be generated within the mold, are given ample opportunity to vent themselves through the mold joints, which are not required to be closed air tight, but which may be left open to the extent of several thousandths of an inch without injury to the final product. To lessen the tendency to the formation of important fins at the joints, I preferably make the flexible covering of two layers, the inner one being of india rubber, and the outer one of stockinet or other similar fabric having a limited degree of expansibility and which will therefore correspondingly limit the expansion of the inner rubber layer of the covering. By the employment of the aluminium shield described in my former application, I am enabled to entirely avoid the production of any fin whatever along the top surface of the boot or shoe.

In the accompanying drawing, Figure 1 represents a central longitudinal section of a last illustrating my invention and carrying an india rubber shoe blank, and indicates the relation of the last to the adjacent parts of the vulcanizing mold, portions of which are shown in section and other portions in elevation. Fig. 2 represents a section and partial elevation on the line 2—2 of Fig. 1. Figs. 3 and 4 represent exterior views of the covered last with edge-formers of differing configuration applied thereto. Fig. 3^a is a detail section through the edge former shown in Fig. 3.

Referring to the drawing, A and B indicate the side portions and C indicates the sole

portion of a mold, adapted to be heated by steam or its equivalent, so as to bring the interior mold surfaces to the desired vulcanizing heat, as shown in my former application referred to. These closable mold portions are adapted to receive the last upon which the rubber boot or shoe is to be placed, which last may be, if desired, made hollow as shown in Figs. 1 and 2, for the sake of lightness. It consists of the main body portion E, in combination with a flexible covering, applied to its outer surface, and consisting, preferably, of an inner layer *a* of expansible rubber and an outer layer *b* of stockinet or similar fabric having a limited degree of elasticity.

In my preferred construction, the flexible covering is so arranged as to envelop the entire last, and, in this event, it may, or may not be provided with an additional outer sole plate *c* of metal having the function of causing a sharper imprint upon the sole than could otherwise be conveniently obtained. It is feasible, however, to omit the covering upon the sole portion of the last and upon the wall *d* opposite the sole portion, provided the covering is sufficiently overlapped and held so as to inclose in an air tight manner the remainder of the last, when molds are employed of the kind wherein the metal sole portion of the last is brought into direct contact with the interior surface of the boot or shoe to be vulcanized. In general, however, it will be found expedient to cover the entire last with the two layer covering, and, if the plate *c* is employed, to rigidly connect said plate in place.

To the interior of the air tight covering, compressed air may be admitted through the tube D. The interior bore of this tube preferably terminates at a point opposite the radial openings *e*, although it may continue on into the hollow interior of the last, if so desired. I prefer, however, to have it terminate at a point opposite the radial openings of ports *e*, for the reason that by so doing, I greatly limit the amount of compressed air necessary to each vulcanization operation, as will be readily apparent, and produce a more direct and powerful effect. From the radial openings *e* the compressed air passes through ports *f* made in the walls of the last and thus gains access to the space between the flexible covering and the outer surface of the last. As a consequence, the flexible covering is immediately forced outward and with it the india rubber boot or shoe F, against the heated surfaces of the closed mold. Any air, vapor or gas present in the mold or generated therein is free to escape through the joints of the mold, which are purposely left sufficiently open for that purpose, although, as will be readily understood, this venting does not require that the joints be open for a width of more than from one to say four or

five one-thousandths of an inch, as the case may be.

In order to give a suitable finish to the mouth edge of the shoe, and particularly to obviate the tendency of the compressed air to unduly diminish the thickness of the material along the mouth edge, I find it desirable to provide the last with a suitably shaped dam or former preferably applied to the exterior of the flexible covering and of a general contour corresponding to the contour of the mouth of the shoe to be manufactured. For instance, if the shoe to be vulcanized is of the form known commercially as a storm shoe, *i. e.* a shoe having a front portion adapted to come up well over the lacings of the inner leather shoe, I give to the dam or former the general configuration shown in Figs. 1, 2 3 and 3^a of the drawings. Whereas, if a low quarter rubber shoe is to be made, I give to the dam or former a corresponding configuration for that particular make of shoe, as shown in Fig. 4.

The dam or former referred to is indicated by the letter *g* in Figs. 1, 2 and 3 and 3^a and by the letter *g'* in Fig. 4. It is preferably provided on its inner edge with a continuous groove, as indicated in Figs. 3 3^a and 4, so as to form a corresponding bead upon the mouth edge of the shoe, and, of course, whether the groove is present or not, to correspondingly thicken the shoe along the mouth edge, so as to reinforce it thereat, as is desired. The dam or former may be made of any suitable material. If made of metal or other like inflexible material, its exterior surface is so finished as to make contact with the sides of the mold when the mold closes upon the last, in which event, the compressed air will nevertheless find access into the space between the metal main body portion of the last and the flexible covering, because of the compressibility of the flexible covering. In order, however, to avoid the inconvenience and expense of carefully fitting a metal dam to the mold, I preferably employ, as indicated in Figs. 1 and 2, a dam or former of rubber having just sufficient expansibility to be forced out into contact with the sides of the mold by the action of the compressed air during the vulcanizing operation, but sufficiently incompressible to retain substantially its original edge thickness as against the air pressure. By this expedient, without fashioning the dam or former so as to make an accurate fit with the closing sides of the mold, I obtain the same result by employing the pressure of the incoming air to obtain the necessary closure. It will, of course, be evident that the same metal last having a flexible covering of the kind described may be employed for the vulcanization of shoes having different mouth openings, by merely removing one form or configuration of dam or former and substituting another therefor.

To this end, it will be convenient to attach the dam or former to the covering by means of cement, so that it can be removed when desired and another substituted in its place.

5 It is, of course, apparent that the dam or former can be, if desired, made in sections and applied to the closing sides of the mold or that it may be in part located upon the last and in part upon the mold; but, for most
10 purposes, it will be found more convenient to attach it directly to the last, as illustrated.

In operation, the workman, having built up the unvulcanized shoe upon the covered last, places the last upon the extension *h*
15 of the tube D, and causes the mold to close, for instance, by the means described in my former application hereinbefore referred to. With the closing of the mold, the compressed air is admitted through the tube D and enters between the flexible covering and the
20 metal main body portion of the last, thereby forcing the unvulcanized shoe out against the heated surface of the mold and thereby effecting its vulcanization. At the same
25 time, the thickened edge or bead around the mouth of the shoe is made by the dam or former, and any air that has been entrapped in the mold or any vapors or gases that may be generated from the india rubber stock escapes through the mold joints, which serve
30 as sufficient vents for that purpose.

Having thus described my invention, what I claim is:—

1. In apparatus for vulcanizing india rubber boots and shoes, a last, provided with a flexible covering, and means for introducing compressed air between the covering and the last.

2. In an apparatus for vulcanizing india rubber boots and shoes, a last provided with a flexible covering, a sole plate, and means for introducing compressed air between the covering and the last, substantially as described.

3. In apparatus for vulcanizing india rubber boots and shoes, a last, provided with a flexible covering, a mouth edge dam or former, and means for introducing compressed air between the covering and the last.

4. In apparatus for vulcanizing india rubber boots and shoes, a last, provided with a flexible covering, a mouth edge dam or former detachably secured to the flexible covering, and means for introducing compressed air between the covering and the last.

5. In apparatus for vulcanizing india rubber boots and shoes, a last, provided with a flexible covering consisting of an inner layer of rubber and an outer layer of fabric, and means for introducing compressed air between the covering and the last.

6. In apparatus for vulcanizing india rubber boots and shoes, a last, provided with a flexible covering, a mouth edge dam or former of expansible material, and means for introducing compressed air between the covering and the last.

7. In apparatus for vulcanizing india rubber boots and shoes, a last provided with a flexible covering, inlet openings passing through the last to the interior surface of the covering, and a supply tube for compressed air communicating directly with said inlet openings; substantially as described.

8. Apparatus for vulcanizing india rubber boots and shoes, comprising a last having a flexible covering, a closable mold for said last, and means for introducing compressed air between the covering and the last directly from the inlet pipe; substantially as described.

In testimony whereof I affix my signature, in presence of two witnesses.

ANDREW SCHULZE.

Witnesses:

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CHARLES LOWELL HOWARD.