(No Model.) 3 Sheets—Sheet 1.

H. J. DOUGHTY.

MANUFACTURE OF BOOTS OR SHOES.

No. 576,811. Patented Feb. 9, 1897.

Fig. 1.

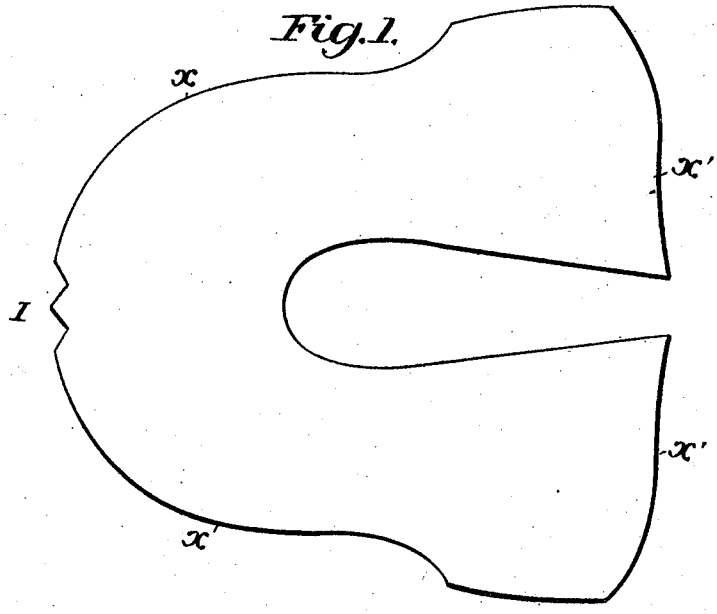


Fig. 2.

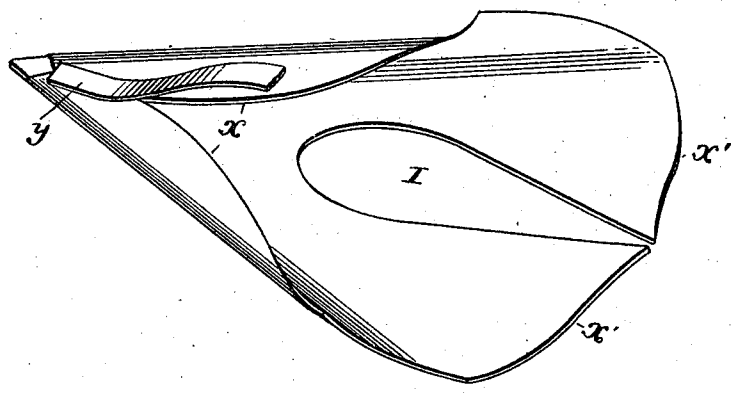
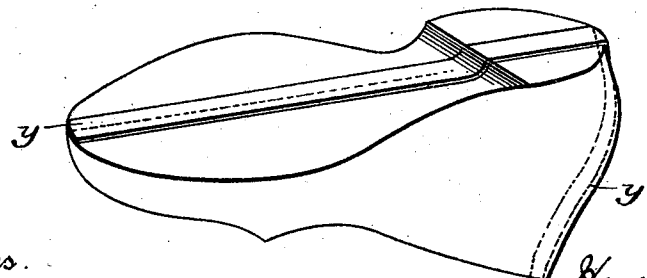


Fig. 3.



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(No Model.) 3 Sheets—Sheet 2.

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MANUFACTURE OF BOOTS OR SHOES.

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Fig. 4.

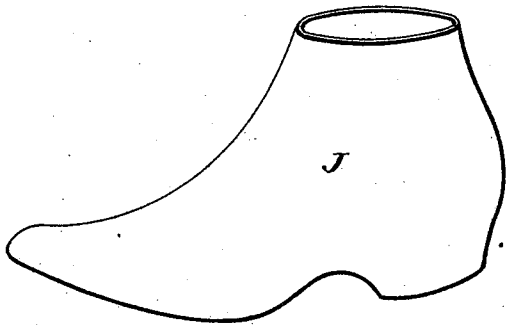


Fig. 5

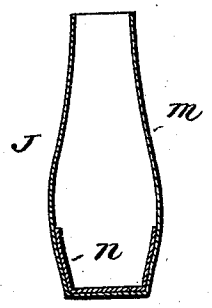
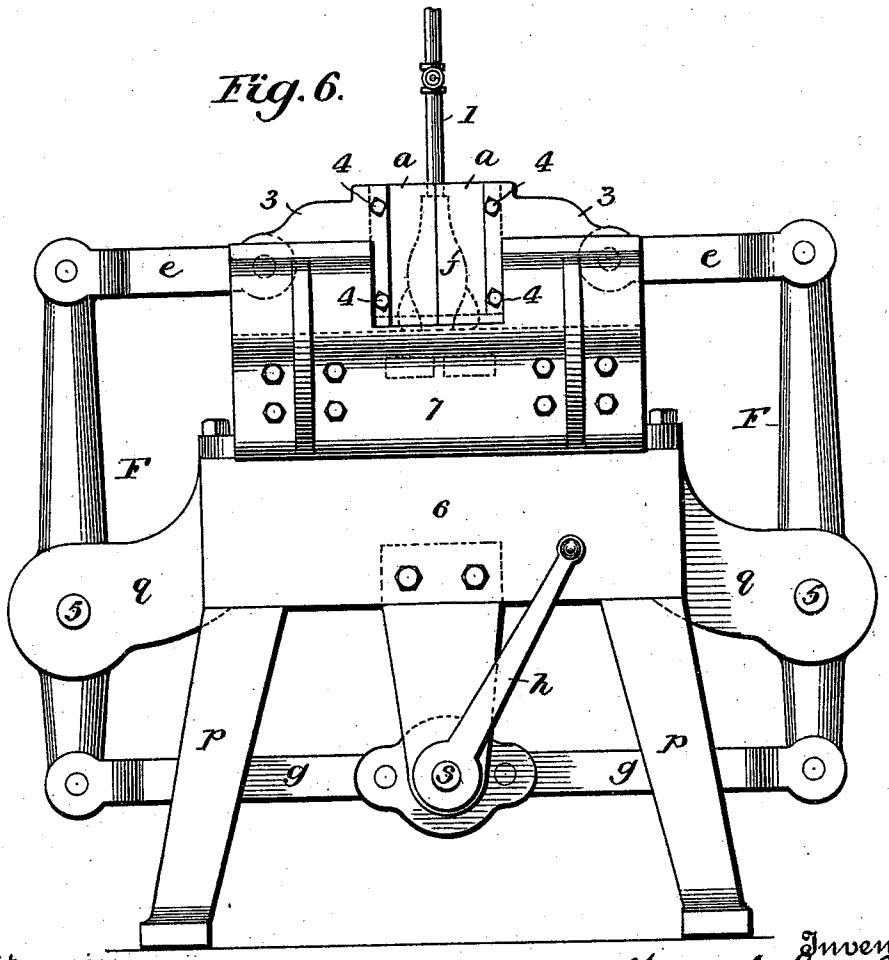


Fig. 6.



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(No Model.) 3 Sheets—Sheet 3.

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MANUFACTURE OF BOOTS OR SHOES.

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Fig. 7.

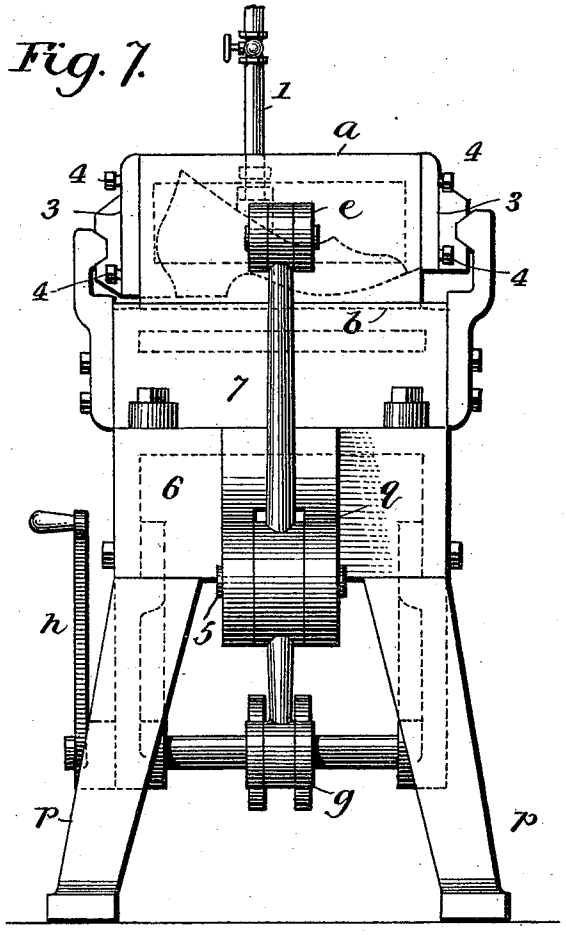
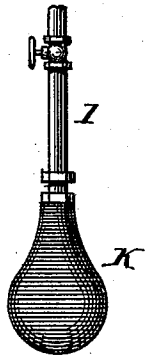


Fig. 8.



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UNITED STATES PATENT OFFICE.

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MANUFACTURE OF BOOTS OR SHOES.

SPECIFICATION forming part of Letters Patent No. 576,811, dated February 9, 1897.

Application filed April 23, 1896. Serial No. 588,776. (No model.)

To all whom it may concern:

Be it known that I, HENRY J. DOUGHTY, a citizen of the United States, residing at Providence, in the county of Providence and State of Rhode Island, have invented certain new and useful Improvements in the Manufacture of Boots, Shoes, &c., of which the following is a specification.

My invention relates to the manufacture of shoes, boots, &c., from vulcanizable material; and it consists of the method and means hereinafter fully set forth, and illustrated in the accompanying drawings, in which—

Figure 1 illustrates one form in which the stock may be cut to produce a blank for forming the article. Fig. 2 is a perspective view illustrating the folding of the blank. Fig. 3 is a perspective view showing the article as produced by folding the blank prior to insertion into the finishing-mold. Fig. 4 is a perspective view of the flexible last. Fig. 5 is a sectional view of the flexible last. Fig. 6 is a side view of the finishing-mold; Fig. 7, an end view of the finishing-mold, and Fig. 8 is a view showing the flexible bag for expanding the last in the finishing-mold.

In carrying out my improved method of manufacture I first cut from the stock, consisting of fabric of any suitable character, a blank I of such a shape that when the outer edges x x' are brought together the blank will closely approximate the form of the finished article. These edges may be brought together by hand or otherwise, beginning at the toe of the shoe, as illustrated in Fig. 2, and laying upon the meeting edges a cementing-strip y, which, when the article is in shape, will run from the toe along the sole and heel and upward at the back of the heel, as indicated in Fig. 3. Of course the fabric surface of the stock will be upon the inside of the shell thus formed. After the shell is brought to the condition shown in Fig. 3 a sole-piece is applied to extend over the sole and heel. As the article is thus formed it will present an unfinished appearance with open joints, and in order to impart the proper finish and vulcanize the article without the necessity of making use of molds for vulcanizing I first finish the article in a mold by means of internal pressure, then place the article upon a suitable flexible last or support and then vulcanize by "open heat," that is, in an oven without the use of a vulcanizing-mold.

To operate upon the article in the position shown in Fig. 3 to impart the proper finish, I make use of a mold in separable parts having a molding-chamber conforming to the external shape and finish of the article. Such mold may be constructed in many different ways; but, as shown in Figs. 6 and 7, there are two side sections a a and a bottom section b, and these sections are heated in any suitable manner, as by means of hot air, steam, electricity, &c., to an extent sufficient to render the composition upon the stock plastic without vulcanizing the same. As shown, the sections have chambers for the admission of hot air or steam.

The section b is preferably fixed, and the sections a a may be carried away from each other to permit the article to be introduced, after which they are brought together.

In order that the article may be forced into tight contact with the faces of the molding-chamber, I make use of a flexible last J, consisting of a flexible shell m, of suitable material, as, for instance, a fabric coated with vulcanized-rubber composition, with internal stiffening material n extending along the bottom and upward for a short distance along the sides. By this means the last is rendered sufficiently stiff to support the article while in the vulcanizing-chamber. At the same time it is sufficiently yielding to enable the article to be finished in the mold, as hereinafter described. After the last has been placed in the article and the latter in the mold a flexible or elastic bag K, as, for instance, a bag or rubber, corresponding generally with the internal shape of the last, is introduced into the last, and air or other fluid under pressure is passed through a pipe l into the bag, thereby distending the same, expanding and forcing outward the flexible last, and compressing the material of the shoe forcibly against the faces of the mold and thereby imparting to the composition on the face of the material a contour and finish of the molding-faces, closing all seams and joints and properly finishing the face of

the article. As the composition is in a plastic condition the finishing effect is produced in a moment, so that the articles may be finished in succession, with great rapidity, using but a single molding device. The articles thus finished, with the flexible lasts inside, (the bag K being removed after each operation of the mold,) are then transferred to the vulcanizing ovens or chambers where they are vulcanized. The flexible last maintains them in proper shape, so that the use of vulcanizing-molds and the expense attending the same is avoided. After the vulcanization is complete the last is removed from each article.

A shoe thus made has all the advantages of a hand-made shoe, having the inside fabric for lining and the finished exterior, which may be varnished prior to vulcanization, as in the case of hand-made shoes, while it also has all the beauty, shape, and finish of a molded shoe, which results are effected by first forming the stock with a fabric of one size, then cutting and folding the blank to the shape of the finished article with the fabric inside, then molding the article with the composition in a plastic condition by internal pressure forcing the composition face against the face of a mold, the article being supported by a flexible last capable of expanding under internal pressure and maintaining the article in shape upon said last during vulcanization.

The finishing apparatus having a mold in separable sections may be constructed in different ways. As shown in Figs. 6 and 7, each section *a* of the mold is secured by bolts 4 in a sliding carriage 3, sliding between guides in a frame 7, which also supports the section *b* and which is secured to a platform 6, having legs *p*. The carriages 3 are connected to levers F by links *e*, and these levers are pivoted at 5 to brackets *q* and are connected by links *g* to crank-arms upon a rock-shaft *s*, which may be rocked by a lever *h* to vibrate the levers F and open or close the mold.

Without limiting myself to the construction of apparatus herein shown, I claim as my invention—

1. The within-described improvement in the art of manufacturing rubber shoes, the same consisting in first cutting a blank from stock having a fabric on one face, then forming the blank into a shape approximating that of a finished article with the fabric inside, then imparting the desired finish to the outer face of the article by expanding the article by air-pressure within a finishing-mold while the composition face is maintained in a plastic condition and then vulcanizing the article upon a suitable last, substantially as set forth.

2. In the manufacture of rubber shoes supporting the article to be finished and vulcanized upon a flexible last within a finishing-mold, while expanding the last by internal air-pressure, substantially as set forth.

3. In the manufacture of rubber shoes first applying the article to be finished and vulcanized to a flexible last then expanding the last and article thereon within the finishing-mold and then vulcanizing the article upon the last, substantially as set forth.

4. The combination in a finishing apparatus for the manufacture of rubber shoes, of a mold in separable sections, means for heating the sections, an expansible last, and means for expanding the last within the mold, substantially as described.

In testimony whereof I have signed my name to this specification in the presence of two subscribing witnesses.

HENRY J. DOUGHTY.

Witnesses:
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