I. F. WILLIAMS.

Last for Rubber Working.

No. 166,443. Patented Aug. 3, 1875.

Fig. 1

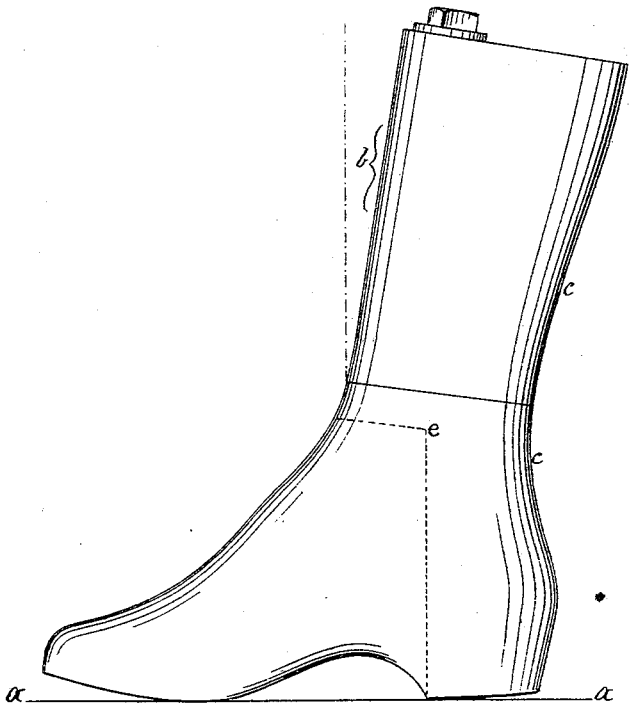


Fig. 2.

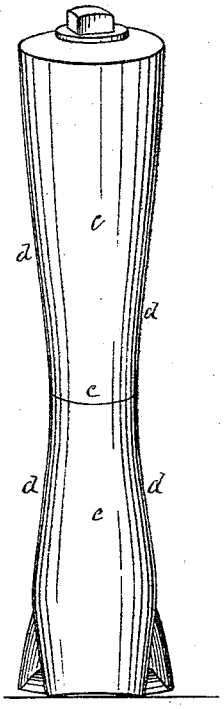


Fig. 3.

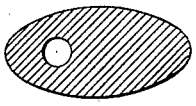
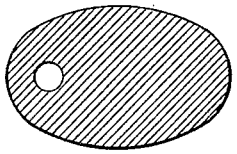


Fig. 4.



Witnesses.
Philip F. Garner
A. B. Cauldwell

Inventor.
Isaac F. Williams
By Wm. C. Wood
Attorney

UNITED STATES PATENT OFFICE.

ISAAC F. WILLIAMS, OF BRISTOL, RHODE ISLAND.

IMPROVEMENT IN LASTS FOR RUBBER-WORKING.

Specification forming part of Letters Patent No. **166,443**, dated August 3, 1875; application filed December 23, 1874.

To all whom it may concern:

Be it known that I, ISAAC F. WILLIAMS, of the town and county of Bristol, in the State of Rhode Island, have invented certain new and useful Improvements in Lasts, particularly intended for the manufacture of boots composed of cloth and vulcanized rubber.

My said improvements have for their object the production of a last having a foot and a leg, on which a vulcanized-rubber boot may be made having a close-fitting ankle and leg; and my invention consists in certain novel outlines or configurations of the front vertical leg-line above the instep; also, of the rear vertical line, extending from the heel past the ankle to the top of the leg; and, also, of the vertical side lines, extending from the foot past the ankle to the top of the leg; and I do hereby declare that the following specification, taken in connection with the drawings forming a part of the same, is a clear, true, and accurate description of a last embodying my invention.

Referring to the drawings, Figure 1 represents one of my improved lasts in side elevation. Fig. 2 represents the same in rear elevation. Fig. 3 represents the last in horizontal section at the ankle. Fig. 4 represents, in horizontal section, the leg of the last near its upper end.

As shown in the drawings, the last is composed of a leg and a foot section, the dividing line being adjacent to the ankle. Instead of this nearly-horizontal dividing line between the two sections, the line may be an irregular one, as indicated in dotted lines, as at *e*, in Fig. 1.

It is not essential in their use that the last be made in two pieces, although preferable that they be so made, and secured together by a central screw-rod, as they are stronger, and less liable to crack and split during the vulcanizing process.

In the manufacture of boots composed of cloth and rubber as heretofore practiced an arbitrary form for the boot has been always derived from the last on which such goods were vulcanized. The outlines attainable heretofore in these goods have been only those which could be employed or embodied in the last without interfering with its withdrawal from the finished boot. In other words, the lasts have heretofore been constructed on the general principles of pattern-making in the art of casting metals, and were only operative when the subject of "draft" had been fully considered and amply provided for. In most cases, by reason of the textile fabrics employed in connection with the gum, the boots are non-elastic, especially at the ankle, by reason of the overlapping of the fabrics adjacent to that point in effecting unity of foot with the leg. For this reason a close-fitting ankle has been heretofore practically unattainable, because the foot-last could not be withdrawn through a small opening.

The production of a new line of goods, of which I believe myself to be the inventor, the characteristics of which are a practically seamless water-tight foot and a leg composed of textile fabric and gum, constructed with overlapping leg-sections, has demonstrated the practicability of constructing boots closely fitting at the ankle and leg by means of my novel lasts.

Referring to the drawings, in Fig. 1 two of the novel features of my last are shown. First, in the front leg line, as at *b*. In leather boot-trees and in leg-lasts, as heretofore employed in the manufacture of rubber goods, the front leg-line is so drawn from the instep upward that, when the heel is applied to the boot, the front leg-line of the boot will incline forward more or less. In some instances the front leg-line has been vertical, or in a right line to the longitudinal tread-line *a* of the last. In my novel last this front leg-line *b* is inclined backward from a vertical line, preferably approximating, more or less, closely to eighty-one degrees from the tread-line *a*. This front leg-line, if based upon the outline of the average human leg, would be inclined slightly forward, and in making over-boots it would seem to be requisite to incline it still further forward, in order that provision might thereby be made for the leg of the inner gaiter or boot usually worn by ladies, for instance.

In practice, however, with the overlapping leg-sections, it is found that if the front leg-section of the rubber boot be drawn unduly to the rear for a fit to the front leg-line, that a wrinkle is induced extending from the in-

step toward the heel; but, on the other hand, if the leg of the wearer carries the front leg-section of the boot forward, no such wrinkle occurs. Therein lies the value of the receding front leg-line *b*.

The second novel feature, shown in Fig. 1, consists in the rear leg-line *c*.

In leather boot-trees and leg-lasts, as heretofore employed in the manufacture of rubber goods, the rear leg-line has either been nearly at right angles to the tread-line, inclining outward gradually to the top, or it has been nearly vertical to the ankle, and then curved slightly to the rear, thence upward in a nearly straight line to the top of the leg. Therefore, a boot vulcanized on such a last as has heretofore been used has a rear leg-line which does not and cannot conform, to any substantial degree, to the rear outline of the human leg, ankle, and heel. It is to attain this object that this second novel feature of my last is intended.

This rear line *c* is a novel outline in a boot-last, in that it curves inward from the large part of the heel to the ankle, thence curves outward to a point above the ankle, and thence continues to the top of the leg in a line approximately corresponding to the rear calf-line of a symmetrical human leg; but, at the same time, it is preferable that the upper portion of the outline be carried somewhat to the front of the average rear vertical calf-line, instead of excessively to the rear of said average calf-line, for the same reasons as those set forth in connection with the front leg-line—that is, if the rear leg-section is of necessity drawn forward to fit the vertical rear line of the leg, a fold or wrinkle occurs at or near the ankle; but if, on the other hand, the rear section be carried to the rear to attain the fit, no such wrinkle occurs.

In Fig. 2 I show vertical concave side lines at *d*.

Heretofore, in such boot-trees and leg-lasts as have for a long time been employed in the manufacture of rubber goods, the vertical side lines, from the widest part of the foot below the ankle, have been practically straight in a vertical line to the ankle, thence to the top of the leg by a straight but outwardly-inclined line, or, in some cases, by an outward curve upward from the ankle for a short distance, thence to the top of the leg in a vertical straight line, in order that, as before stated, a practical draft of the leg-last may be effected. Therefore, by the use of such trees or lasts, a boot with a close-fitting ankle could not be produced.

By reason of these concave side lines a boot with a close-fitting ankle is attainable.

The last here shown has substantially correct proportions for a No. 2 rubber last, and from these proportions a last maker can readily determine the requisite proportions for lasts of other sizes. The lateral sectional outline at the ankle and at the top of the leg are also shown, which, when taken in connection with the side and rear views of the last, afford sufficient data from which lasts may be readily made.

It is, of course, impossible for me to prescribe any particular angles or curves to be followed in the construction of my last; but in the drawings I have shown proportions of width of the leg at various points from front to rear, and thickness of same from side to side, which have been proven to practically meet essential requirements.

It will be of no benefit to change the lines by carrying them farther to the rear, as in the front leg-line, or farther to the front in the rear leg-line, or farther inward in the concave side lines.

On the other hand, while no benefit will accrue by advancing somewhat the front leg-line, or carrying the rear leg line farther to the rear, nor lessening the depth of the concavity of the side lines, yet they might be varied in the ways stated, and effect approximately valuable results.

Believing it to be new, in a last having a foot and a leg, to have the front leg-line recede from a line which is a right line to the tread line, and that it is also new in such a last to have a concave rear line between the heel and leg, and also new for such a last to have, in connection with the concave rear line, the vertical concave side lines, I claim broadly those features, if embodied in such a last to an extent which will give to the last the practical value herein described.

Having thus described my invention, I claim as new, and desire to secure by Letters Patent—

1. In a last having a foot and a leg, the receding front leg outline, substantially as described.

2. In a last having a foot and a leg, the concave outline at the rear of the leg, ankle, and heel, substantially as described.

3. In a last having a foot and a leg, the concave outline at the rear of the leg, ankle, and heel, and the concave side lines, with the greatest depth adjacent to the ankle, substantially as described.

4. A last having a leg and a foot, with an outline at the front of the leg, which recedes to the rear from the instep upward, a concave outline at the rear of leg, adjacent to the ankle, and concave side lines, substantially as described.

ISAAC F. WILLIAMS.

Witnesses:
ANDREW R. TROTTER,
J. HENRY GLADDING.