2 Sheets—Sheet 1.

G. W. COPELAND, E. WOODWARD & M BROCK.

Lasting-Machine for Boots and Shoes.

No. 197,607. **Patented Nov. 27, 1877.**

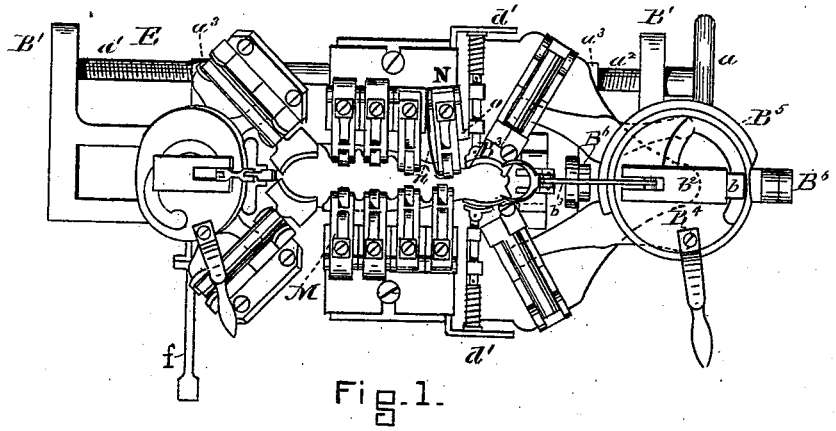

Fig. 1.

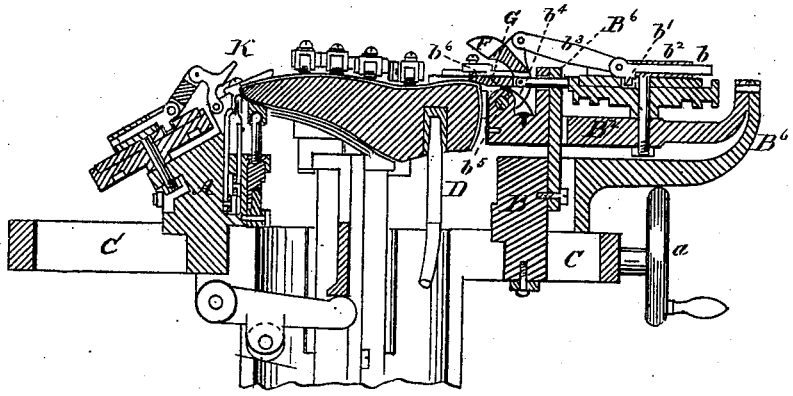

Fig. 2.

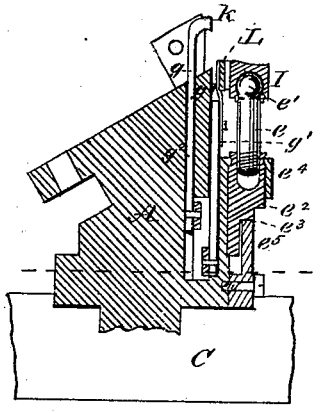

Fig. 4.

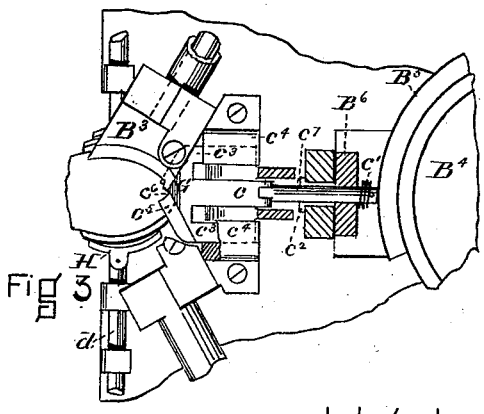

Fig. 3

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2 Sheets—Sheet 2.

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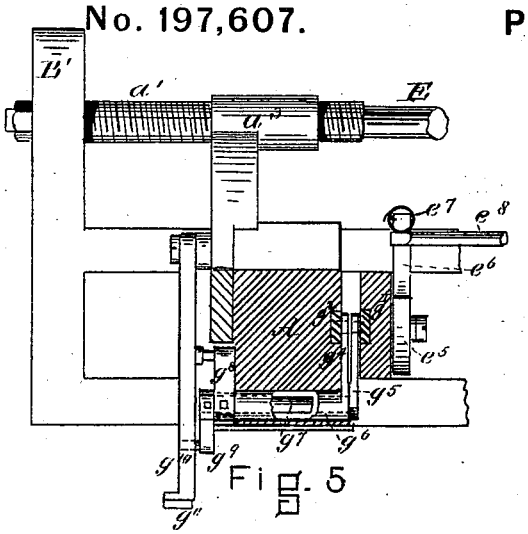

Fig. 5

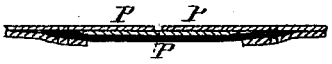

Fig. 9.

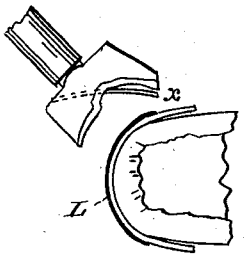

Fig. 6

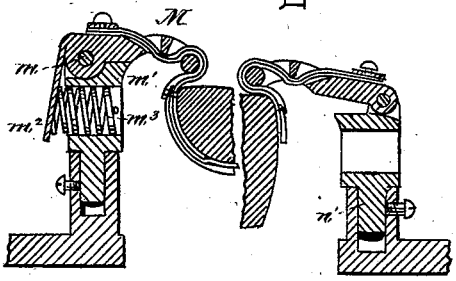

Fig. 7 Fig. 8.

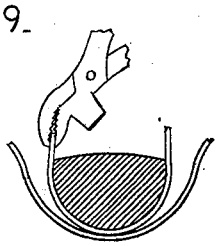

Fig. 10.

Fig. 11.

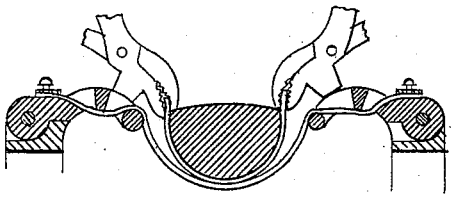

Fig. 12.

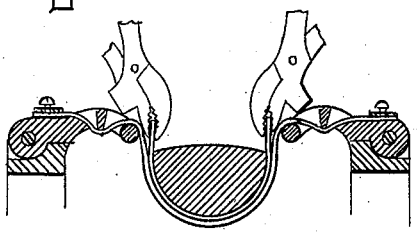

Fig. 13

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UNITED STATES PATENT OFFICE.

GEORGE W. COPELAND, OF MALDEN, AND ERASTUS WOODWARD AND MATTHIAS BROCK, OF BOSTON, MASSACHUSETTS, ASSIGNORS TO THE COPELAND LASTING MACHINE COMPANY.

IMPROVEMENT IN LASTING-MACHINES FOR BOOTS AND SHOES.

Specification forming part of Letters Patent No. **197,607**, dated November 27, 1877; application filed November 8, 1877.

To all whom it may concern:

Be it known that we, GEORGE W. COPELAND, of Malden, in the county of Middlesex, ERASTUS WOODWARD, of Boston, in the county of Suffolk, and MATTHIAS BROCK, of said Boston, all in the Commonwealth of Massachusetts, have invented certain new and useful Improvements in Machines for Lasting Boots and Shoes; said improvements being modifications and developments of the devices embodied in the Patent numbered 191,937, granted us June 12, 1877, and as the mechanism for lifting and closing the cross-heads carrying the girth-supporting fingers was fully shown and described therein, we have dispensed with that portion of the machine in the views illustrating our improvements.

The particular features to which our invention relates consist, first, in means for automatically adjusting the heel-lasting mechanism by the slope of the bottom of the last, whereby the heel-folding plates, when actuated, close upon the bottom of the last, substantially parallel with the plane thereof, as hereinafter explained; second, in an improved reciprocating heel-clamp or down-hold, whose upper outer edge may be provided with a recess on each side to act as a support and guide in preventing the heel-folding plates from being tipped or sprung as they close upon the last in the act of turning over the upper counter and lining upon the insole; third, in an elastic heel-pad automatically operated by the closing of the cross-heads to clamp the upper to the heel of the last while the girth is operating and before the heel-folding plates are actuated; fourth, in an abutment at the toe, and an automatically-adjusting friction toe stretching and smoothing pad, and mechanism for alternately actuating them; fifth, in a spring attached to the under surface of the toe-lasting plates to bear upon the ends of the toe stretching and smoothing pad to clamp the same against the last, operated simultaneously therewith, compressing, smoothing, and shaping that portion of the upper to the surface of the last which lies between the portion fitted by the girth and that part operated upon by the toe-lasting mechanism, and which is a very narrow section, somewhat liable to become puffed away from the last as the lasting proceeds, if not held against the sides of the last by a suitable retaining or clamping device; sixth, in the improved girth-supporting fingers provided with longitudinal adjustability; seventh, in the improved girth-supporting fingers, having automatic vertical adjustability; eighth, in means for protecting the elastic portion of the girth from the destroying action of oil, which is more or less absorbed from the upper in lasting by the material contacting with it; ninth, in the improved process employed, which hereinafter will be fully explained; tenth, in the hereinafter-described means of providing the toe-support with universal adjustability laterally, longitudinally, and vertically, and means for lowering the same after the lasting is completed by the fall of the cross-heads.

In the drawings, Figure 1 represents a plan of our improved machine; Fig. 2, a vertical central section of the same. Fig. 3 shows an enlarged plan of the heel-lasting mechanism. Fig. 4 is an enlarged vertical section, showing the toe-support, abutment, and stretching and smoothing pad, and the method of their operation. Fig. 5 is an enlarged horizontal section, further illustrating the method of operating the toe-support, abutment, and toe stretching and smoothing pad. Fig. 6 shows the spring-clamp attached to a toe-plate. Fig. 7 is an enlarged cross-section, showing the means by which an automatic vertical adjustment of the girth-supporting fingers is obtained. Fig. 8 shows, in cross-section, a somewhat different mode of vertically oscillating the end of the girth-supporting fingers. Fig. 9 is a cross-section of the improved girth; and Figs. 10, 11, 12, and 13 illustrate the varying stages and modifications of our process.

The carriages A B, respectively carrying the toe and heel mechanism, are provided with the same movement upon the tables C, in relation to each other and in relation to the spindle D, that is given the like parts in the machine previously patented to us, and for the purpose fully set forth in the specification of said patent; but the operative mechanism is slightly different, and consists of a shaft, E,

having a handle, a, and bearings in the arms B^1, that project laterally from the tables B and the right and left screws a^1 a^2, each of which operates through an arm, a^3, in moving the carriages. The thread of the former or right screw is enough quicker than that of the left screw to preserve the proper ratio of movement between the two carriages. If necessary, a like device can be arranged on the opposite side of the machine, and, by suitable gearing, be connected with the one described, and this construction may be necessary to prevent springing the shaft in machines for doing heavy work.

The carriage B is further provided with the brackets B^1, which support the oscillating plate B^2, upon which is arranged the heel-lasting mechanism, and which is provided, in addition to the cam and other mechanism for operating the heel-lasting plates B^3, as described in our said patent, with the face-cam B^4 arranged immediately over the cam operating the heel-lasting plates and the edge-cam B^5.

The cam B^4 serves to lift the heel-centering foot F from the surface of the insole through the means of the reciprocating slide b, which is provided with the cam-pin b^1, suitably bearing in the box b^2 on top the cam, and the connecting-rod b^3, which is pivoted at one end to the bar and at the other to the heel-centering foot F. This foot F is provided with a curved arm, b^4, which opens at the bottom to surround or partly surround the arm c, and is pivoted at b^5 to the projection b^6.

The edge-cam B^5, in conjunction with the spring c^1, reciprocates the heel-clamp or down-hold G by means of the rod c^7. This rod plays in a bearing provided by the cylinder c^2, which also acts as the pivot on which the oscillating plate B^2 swings, and by which it is fastened to the bracket B^1, and is pivoted to the rod c^7, as shown. The down-hold G, in addition to the arm c, is provided with the arm c^3, which, with the projection c^4 and the projection b^6, serve as a housing to guide the down-hold in its reciprocation.

A spring, c^5, bears upon the under surface of the down-hold, and serves to support the same on a plane slightly above the plane of the under surface of the heel-lasting fingers.

The projecting end of the down-hold is pointed, as shown, and is provided on its outer upper edge with the sloping recess c^5, somewhat beveled, and upon which the edge of the heel-lasting plates next adjoining the down-hold rest as they converge.

It will be seen that when the last is adjusted on the spindle the down-hold is withdrawn, and the heel-lasting plates are wide open, but that the centering-foot is bearing upon the insole at the heel, and has so adjusted the oscillating plate B^2 that when the heel-lasting plates advance they move in a path directly parallel with the surface of the insole; that then the down-hold advances and securely clamps the last at the heel; that this movement is immediately followed by the closing of the heel-lasting plates and the lifting of the centering-foot; that, as the heel-lasting plates converge, they are guided and partly supported in the recess on the side of the down-hold; and that the down-hold is forced downward against the action of the spring C^6 by the converging action of the heel-lasting plates.

The spring-rod d, whose office in compressing the elastic or flexible heel-pad H is fully explained in the patent before referred to, is actuated by the wings d^1 projecting from the cross-heads.

The toe-block I is supported on the rod e, and, by means of the universal joint e^1, provided with a lateral and longitudinal adjustability. The lower end of the rod screws into the movable block e^2, which is provided with the recess e^3 on its under surface, and is guided by suitable boxing e^4 in the carriage A. The under surface of the recess e^3 rests upon the cam e^5 having the arm e^6, the end of which is laid hold of by the spring e^7. A rod, e^8, projects from one of the cross-heads and contacts with the upper surface of the arm e^6.

It will be observed that, by the joint operation of the cross-heads and the mechanism described, the toe-block is slightly raised and lowered simultaneously with the rising and falling of the cross-head.

The toe-clamp or down-hold K is operated by a cam substantially in the manner described in the patent referred to. The abutment k and the toe stretching and smoothing pad L are alternately actuated, immediately before the toe-lasting plates converge, by the treadle f, so that the abutment against which the toe of the last contacts while the girth is performing its function is withdrawn to permit the operation of the toe stretching and smoothing pad.

The abutment and the toe stretching and smoothing pad are, respectively, supported on the vertically-sliding bars g g^1 which move in the slides g^2 g^3 in the carriage carrying the toe-lasting mechanism, and are actuated by the cranks g^4 g^5, the former of which is operated by the sleeve g^6, which surrounds and furnishes a bearing for the shaft g^7, which lays hold of the crank g^5. The sleeve and the shaft are partially revolved in opposite directions by the cranks g^8 g^9, one of which, the crank g^8, is operated by the lever g^{10} from a point toward its fulcrum, and the other, g^9, by the same lever g^{10} at a point near its power end. This lever is connected with the treadle by the rod g^{11}, and the treadle acts in opposition to a spring.

The girth-supporting fingers m, which close over the ball of the last, are pivoted at m to a support, m^1, and are each provided with the downwardly-projecting arm m^2, and the spring m^3 is arranged to act against the end of said arm in depressing the end of the finger supporting the girth. This construction provides an automatic vertical adjustment to the ends of the girth-supporting fingers, by which they

accommodate themselves to any inequalities on the last-surface or any unusual tension on the girth in closing upon the same without racking the insole or breaking.

The springs m^3 must be sufficiently powerful not to be compressed until the strain on the end of the girth-supporting fingers is almost sufficient to break the fingers, as it is necessary that the girth-supporting fingers nearest the toe should be stiff enough, when shut upon the insole, to hold the last in the right position in relation to the toe-lasting plate while the toe down-hold is being withdrawn, and before the action of the toe-lasting plates. The girth-supporting fingers at or near the shank may simply be pivoted, as shown in Fig. 8.

We further provide the fingers with a longitudinal adjustment at their girth-bearing ends, so that the same number of fingers, when separated, may answer with the same girth in lasting at least three sizes without change. This longitudinal adjustment may be effected by means of the spring *n* arranged to bear against the end of the finger *n* pivoted at *n'*, as shown in Fig. 1, to force it away from the end of the next finger, thereby lengthening the line on which the girth acts.

This construction may answer under certain conditions; but, in practice, we prefer that not only the ends but the entire finger be longitudinally adjustable on the cross-heads, and we are now constructing a machine in which the fingers, to a certain extent, shut into each other against spring-pressure by the closing of the toe and heel carriages upon the last, and which open automatically upon said carriage, separating after the lasting is completed.

The arm *o*, projecting downward from the finger *n*, acts as an abutment in preventing the girth-supporting fingers, when thus spread, from interfering with the action of the heel-lasting mechanism, by contacting with the edge of the oscillating plate B^2.

The upper surface of the girth is protected by the leather or other aprons P, one on each side of the girth, and fastened to the top thereof only, and another laid loosely under the flaps of the side aprons. This girth acts somewhat differently from the unprotected elastic girth, as all the strain on the upper must come from the center of the girth by the rise of the leather apron.

The operation of the machine is as follows: The last, with the upper properly adjusted thereon, is hung on the spindle, with the heel-centering foot F resting upon the top of the insole, to adjust the heel-lasting mechanism, as hereinbefore set forth, and the carriage A, with the toe-lasting mechanism, is moved toward the spindle until the toe rests upon the toe-block, and contacts with the abutment *k*. The toe down-hold is then shut upon the insole of the toe. The last is now properly adjusted in the machine. The next step in the operation is to draw and stretch that part of the upper operated upon by the girth, or more particularly that portion of the upper lying between the instep and the toe, preferably simultaneously on each side, tightly to the last, by the aid of lasting-pinchers. This manipulation removes all wrinkles or tendency to wrinkle from the upper before the girth acts, and partially shapes it on the last. The girth is then lifted against the upper, and firmly clamps it to the last, at or near the median line from instep to toe, from which line a portion of the upper is drawn by the pinchers, (which are preferably so held by the operator as to be supported on the ends of the girth-bearing fingers, as shown in Figs. 12 and 13, so that as they rise they lift the pinchers, and, consequently, the edge of the upper,) operating on each side of the last parallel or substantially parallel with the sides of the last under a moderate strain, while the girth continues to advance from the said median line with, perhaps, a stretching force somewhat greater than that exerted by the pinchers on the upper, and a smoothing and clamping action—that is, that portion of the girth that is being brought against the sides of the last with an upward movement in relation to the same acts as a stretching, straining, and smoothing power, while the lower portions act additionally as a clamping force in holding and compressing the upper, already fitted, by the previous stretching, straining, and smoothing action, on the last, and as the edges of the upper are somewhat stretched by the action of the lifting-pinchers from the advancing line of the girth, it follows that, as the stretch is taken out of the upper by the pinchers, the upper is prevented from drawing back by the clamping action of the girth.

When the girth has advanced along the sides of the last sufficiently far to clamp that portion of the upper that is better fitted to the last by the described combined action of girth and pinchers than by the girth alone, the strain from the edge of the upper developed by the lifting-pinchers is discontinued, and the girth continues its action, unaided, of lifting the upper on the last and laying the folds on the surface of the insole by the closing of the fingers. The cross-heads, in closing, compress and clamp the elastic heel-pad in position. The heel-lasting mechanism is then operated, and the down-hold is advanced by the action of the cam on the insole, to be immediately followed by the lifting of the centering-foot, the converging of the heel-lasting plates, and the descent of the heel down-hold.

The toe is then lasted by withdrawing the abutment and lifting the toe stretching and smoothing pad into a position flush with the bottom of the insole, the toe down-hold carried back, and the upper folded upon the insole by the advance of the toe-lasting plates.

In working out our process we do not confine ourselves to the particular girth described, but may use any of the girths or contrivances

mentioned in the various Copeland patents for lifting, stretching, straining, smoothing, and clamping an upper on a last from the median line of the last, from instep to toe, or surfaces immediately adjacent thereto.

As the various mechanical devices shown and described herein are principally modifications of like principles already patented to us or to said Copeland, or are clearly evident from the description of their construction, their particular advantages need not be enumerated.

We claim—

1. In a lasting-machine, the combination of a heel-centering foot or plate, adapted to automatically adjust the heel-lasting mechanism to the slope of the surface of the insole, with mechanism for folding the upper over upon the surface of said insole, substantially as and for the purpose described.

2. In a lasting-machine, the combination of a reciprocating down-hold, G, with a heel-lasting mechanism, substantially as described.

3. In a lasting-machine, an automatic adjusting heel down-hold, as described.

4. In a lasting-machine, the combination of a heel down-hold with devices for folding the upper upon the insole at the heel when the same acts as a guide and support in directing and assisting the action of the folding mechanism, as set forth.

5. In a lasting-machine, the combination of a centering-foot and a heel down-hold alternately actuated, substantially as described, for the purpose set forth.

6. In a lasting-machine, the combination of a centering device and down-hold successively actuated with mechanism for folding the upper upon the insole at the heel, substantially as and for the purpose set forth.

7. In a lasting-machine, a centering-foot adapted to automatically adjust the folding-plates on a plane with the bottom of the last, substantially as shown and set forth.

8. In a lasting-machine, the combination of the adjustable carriage B, provided with means for supporting an oscillating plate, and said oscillating plate, substantially as described.

9. In a lasting-machine, the combination of the centering-foot F, pivoted at d^6, with the rod d^3 and cam B^4, substantially as described.

10. In a lasting-machine, the combination of the heel down-hold G, connecting-rod c^7, and actuating-cam B^5.

11. In a lasting-machine, the combination of the heel down-hold, recessed on the upper outer edge, as shown, with the spring c^6, substantially as and for the purpose described.

12. A down-hold provided with a horizontal movement parallel or substantially parallel with the plane of the insole, followed by a descending movement upon the same, in combination with folding-plates, for the purpose set forth.

13. The combination of the cross-heads, provided with wings d^1, with the spring-fingers d, all adapted to operate, substantially as shown and described.

14. In a machine for lasting boots and shoes, a toe-rest provided with automatic lateral, longitudinal, and vertical adjustment, in combination with toe-lasting mechanism, substantially as described.

15. In a lasting-machine, a toe-rest provided with and supported on a universal joint, in combination with mechanism for automatic vertical adjustment, for the purpose set forth.

16. A toe-rest supported on a universal joint, and adapted to be raised by the lift of the cross-heads, for the purpose set forth.

17. The combination of an abutment and a toe stretching and smoothing pad alternately actuated, substantially as described, for the purpose set forth.

18. The toe-lasting and folding plate, provided with spring-clamps x, adapted to close upon the ends of the toe stretching and smoothing pad simultaneously with the closing of the folding-plates, as described.

19. The combination of the abutment and toe stretching and smoothing pad with the actuating mechanism described.

20. A girth-supporting finger provided with automatic vertical adjustment at its end, as described.

21. A girth-supporting finger provided with automatic vertical adjustment at its end, for the purpose of relieving it from strain, as and for the purpose described.

22. The combination of a girth-supporting finger, provided with means for vertically oscillating its end, with a spring of sufficient power to relieve a severe strain on the ends of the finger, as described.

23. The combination of a girth or straps for stretching, shaping, and clamping an upper to a last with girth-supporting fingers, provided with longitudinal adjustability, whereby the length of the girth may be increased or diminished to the length of the last.

24. The combination of the girth-supporting finger N with the spring n, whereby an automatic longitudinal adjustment is effected.

25. The combination of a girth-supporting finger, having automatic longitudinal adjustment, with means for regulating the extent of said adjustment by the closing of the toe and heel-carriage or either, as set forth.

26. In a machine for lasting the uppers of boots and shoes, the combination of an automatic toe-lasting mechanism and the improved oscillating heel-lasting mechanism described.

27. In a machine for lasting the uppers of boots and shoes, the combination of an automatic toe-lasting mechanism, the side girth-lasting mechanism provided with an automatic longitudinal adjustment, and heel-lasting devices, as described.

28. In a lasting-machine, an oscillating

heel-lasting mechanism adapted to be automatically adjusted by the slope of the insole, for the purpose set forth.

29. The girth described, consisting of an elastic central section protected upon its upper surface, in manner substantially as described, for the purpose set forth.

30. In a boot and shoe lasting machine, the combination of the shaft E, provided with the right and left screws a^1 a^2 and hand-wheel a, with the arm a^3, projecting from the carriages A B, substantially as described.

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