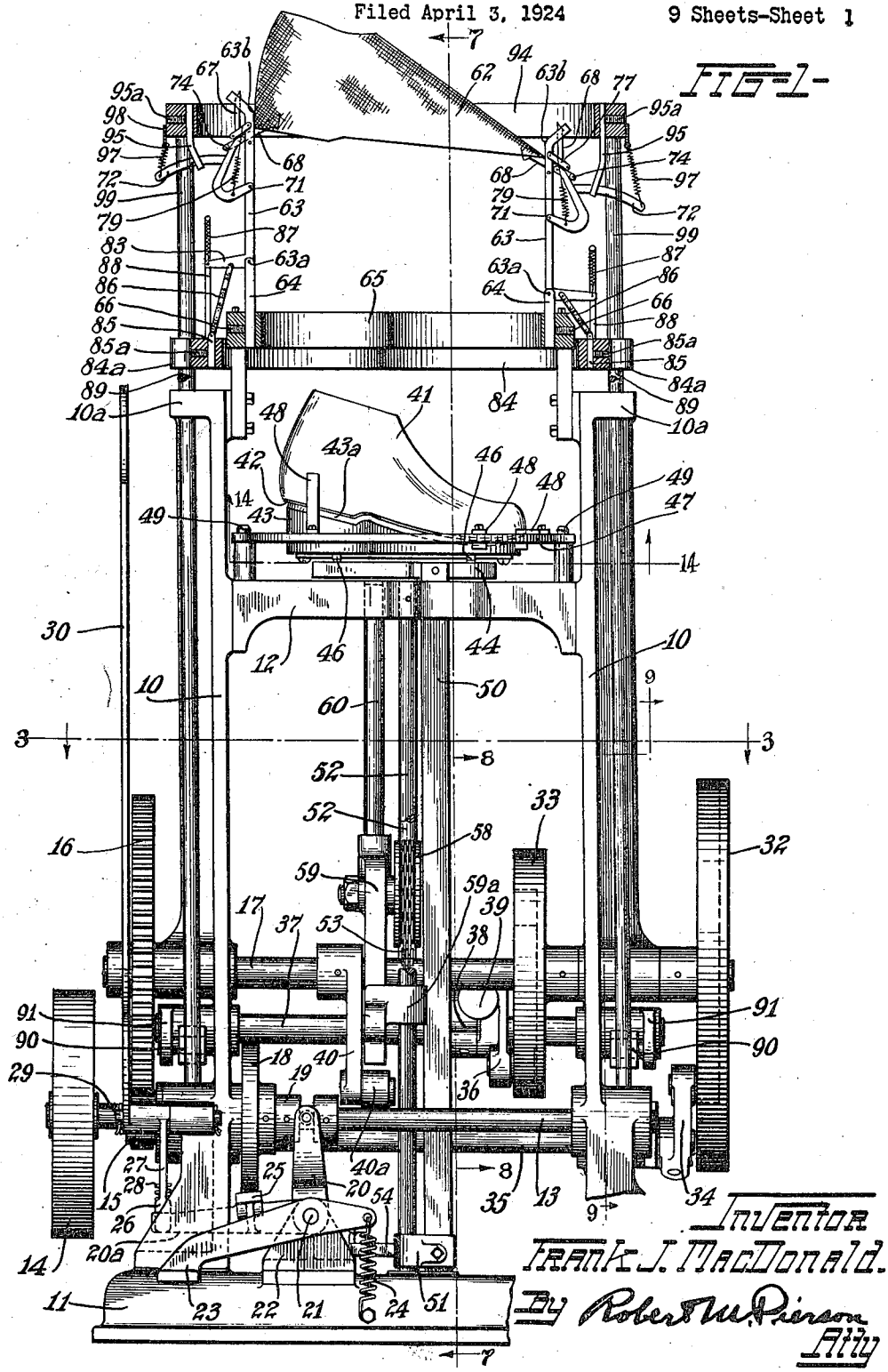
March 20, 1928. 1,663,458

F. J. MacDONALD

LASTING MACHINE

Filed April 3, 1924 9 Sheets-Sheet 1

FIG. 1.



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March 20, 1928. 1,663,458

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LASTING MACHINE

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FIG-2-

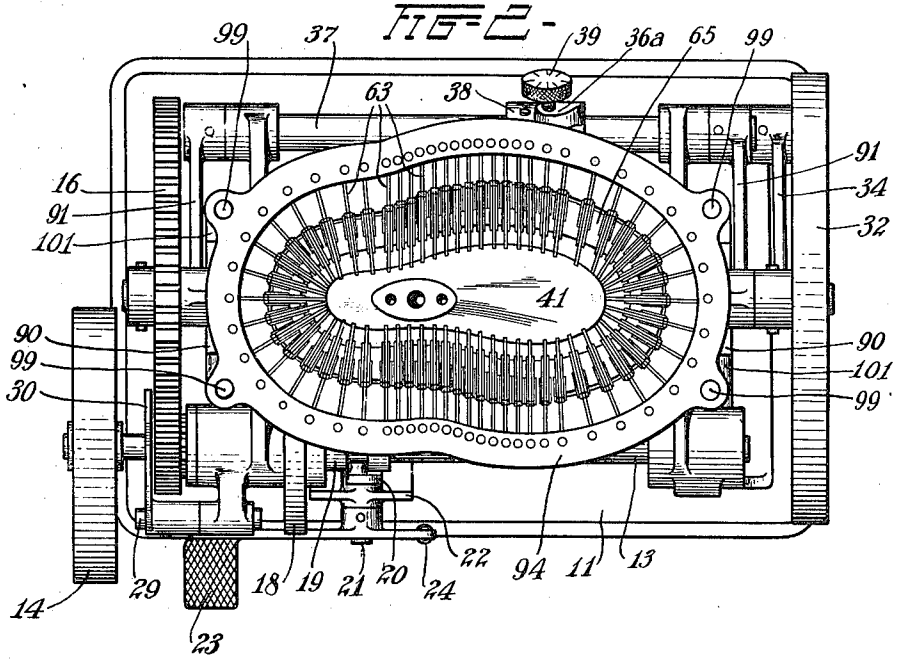
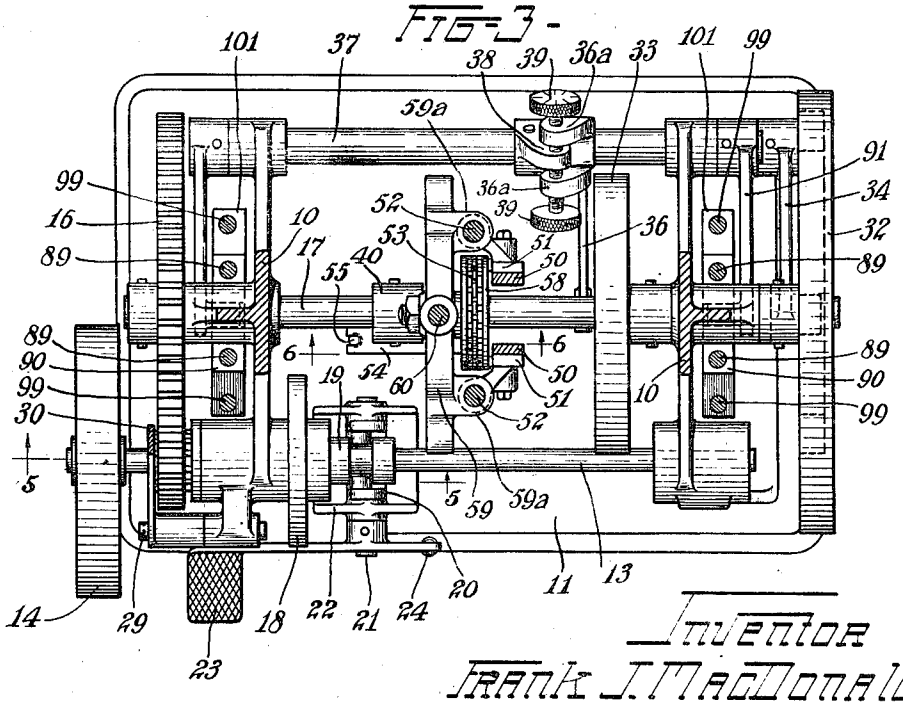


FIG-3-



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LASTING MACHINE

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FIG-4.

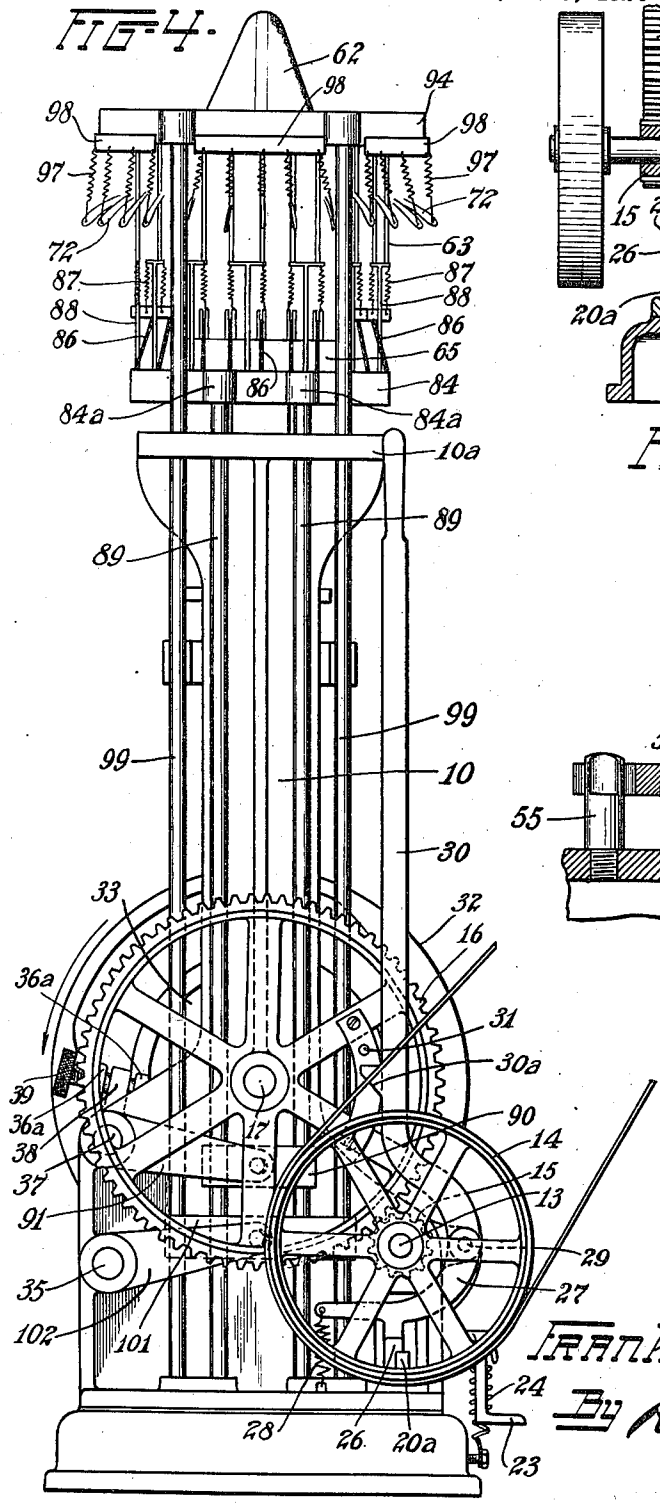


FIG-5.

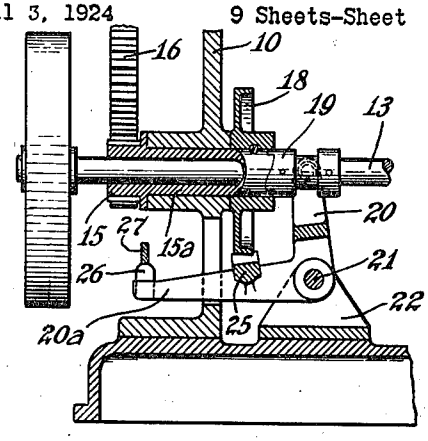
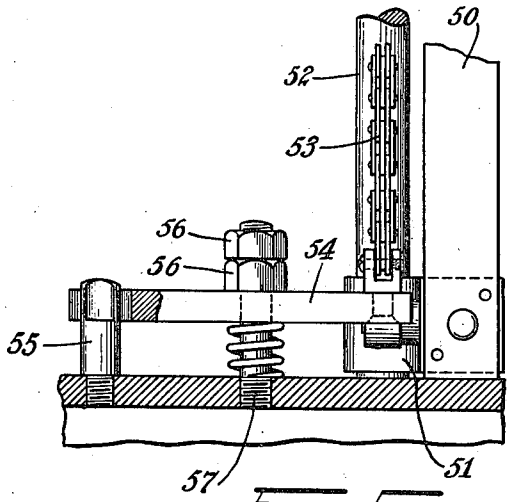


FIG-6.



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LASTING MACHINE

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FIG. 7.

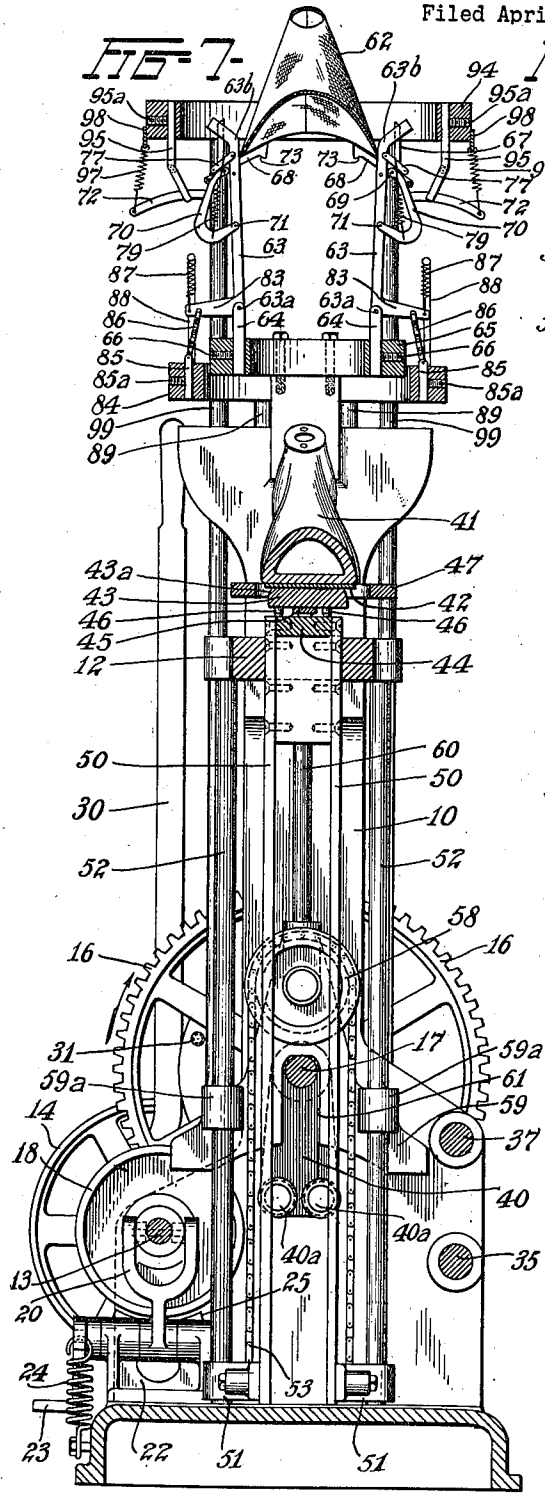


FIG. 8.

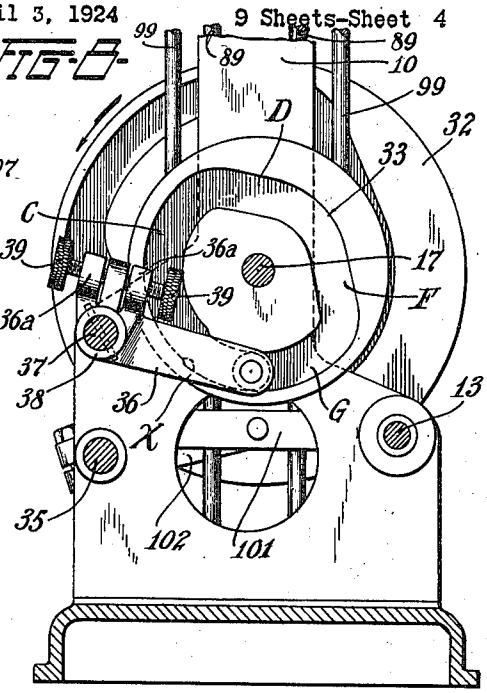
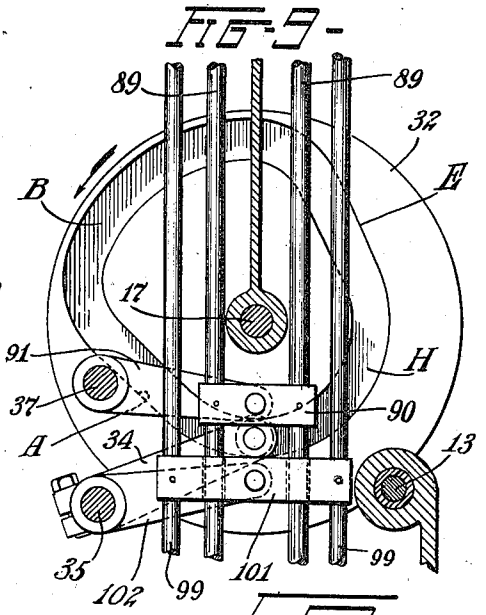


FIG. 9.



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LASTING MACHINE

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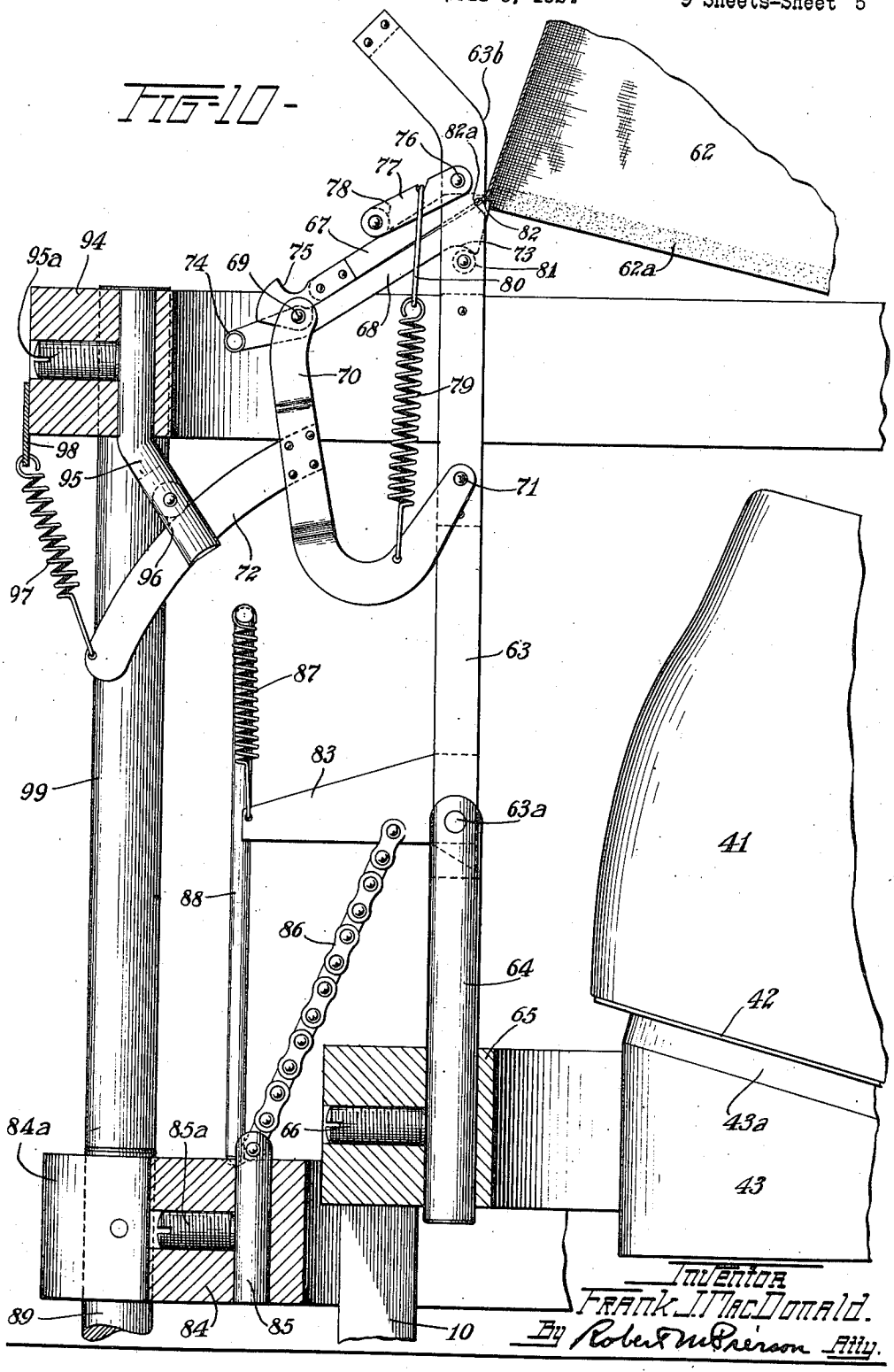
FIG-10-



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LASTING MACHINE

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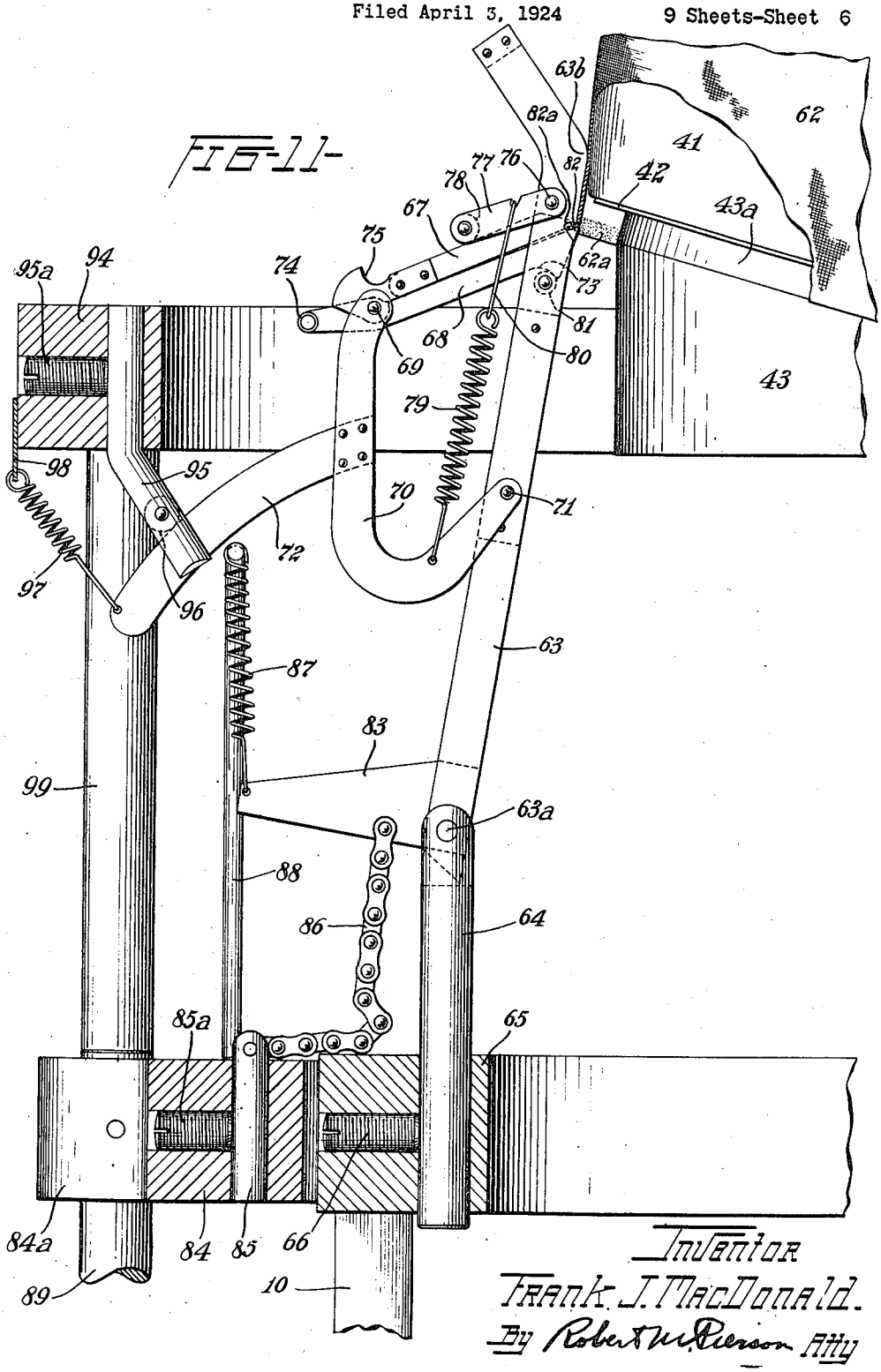
FIG-11-



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LASTING MACHINE

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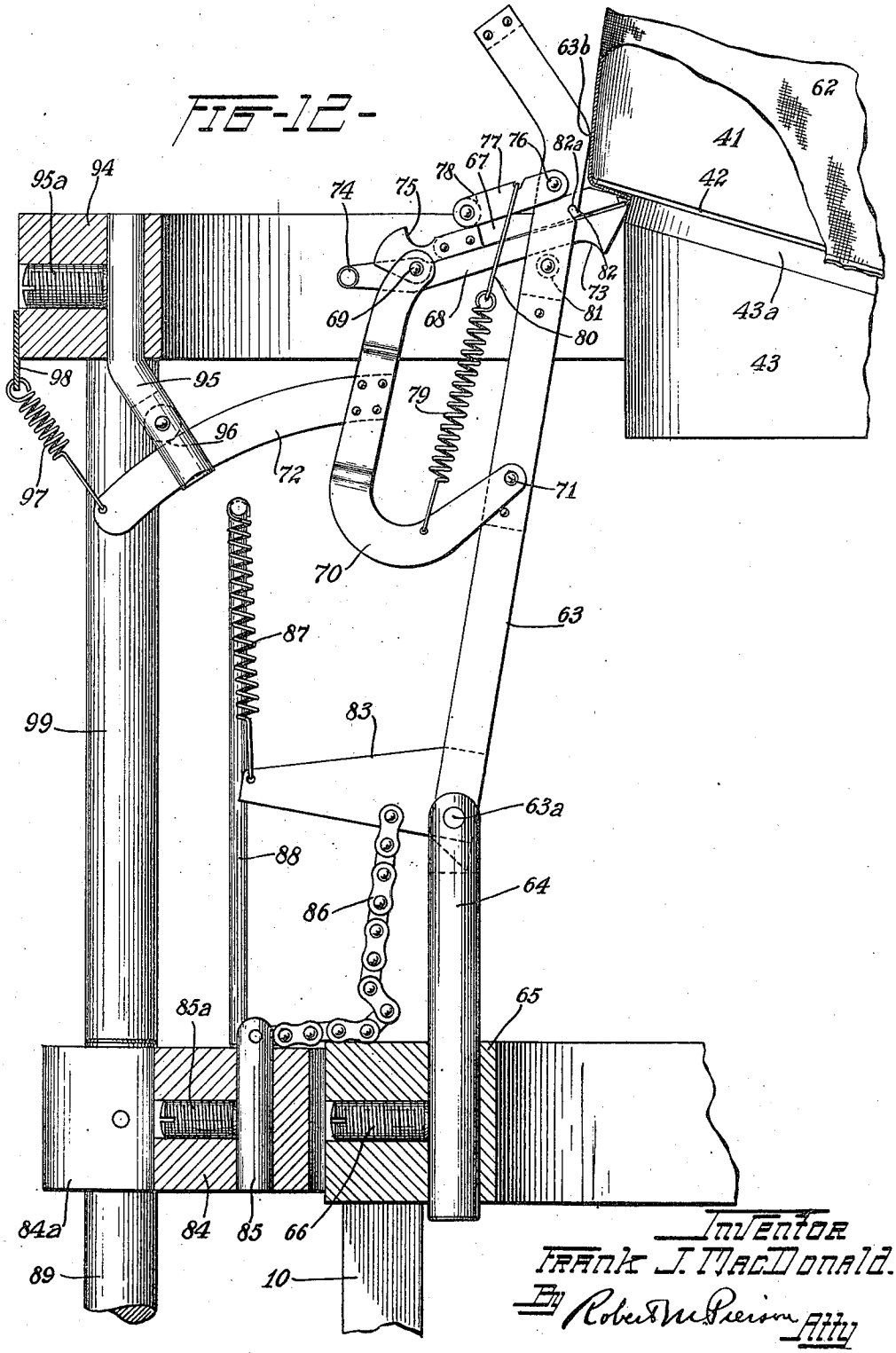
FIG-12-



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LASTING MACHINE

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FIG-13

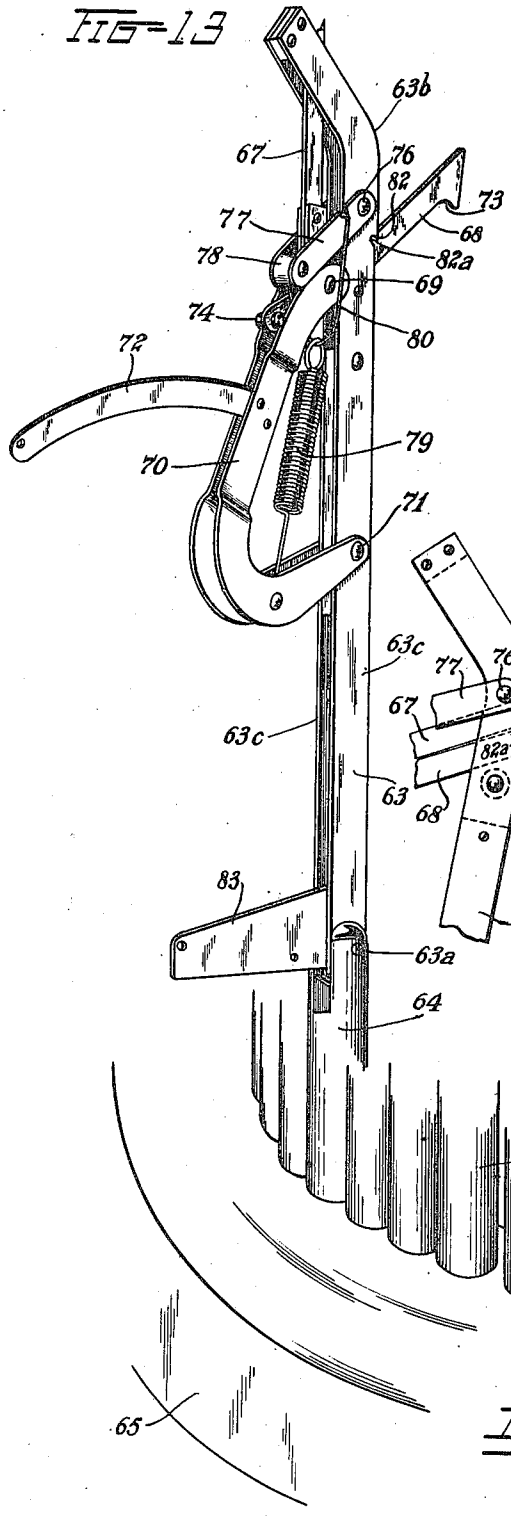


FIG-14

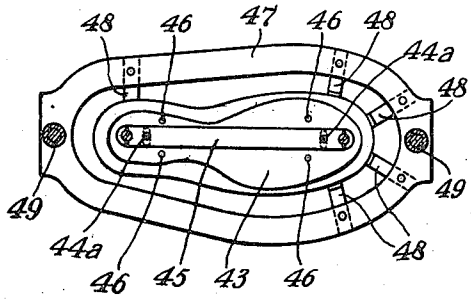
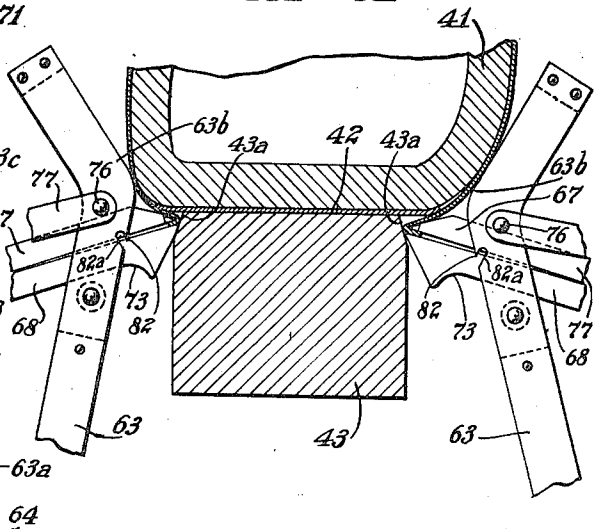


FIG-15



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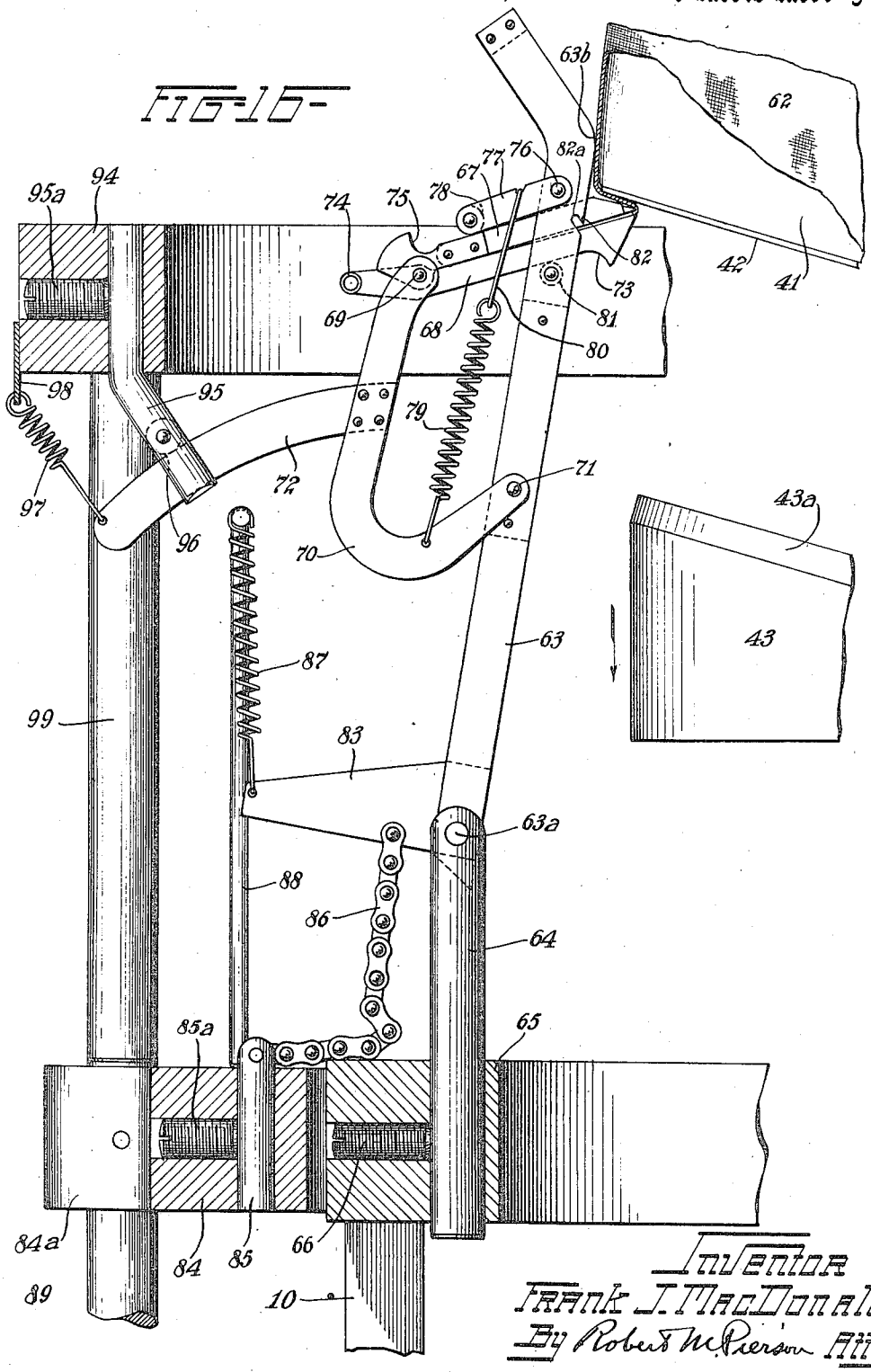
LASTING MACHINE

Filed April 3, 1924 9 Sheets-Sheet 9

FIG-16-



Inventor
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Patented Mar. 20, 1928. 1,663,458

UNITED STATES PATENT OFFICE.

FRANK J. MacDONALD, OF AKRON, OHIO, ASSIGNOR TO THE B. F. GOODRICH COMPANY, OF NEW YORK, N. Y., A CORPORATION OF NEW YORK.

LASTING MACHINE.

Application filed April 3, 1924. Serial No. 703,905.

This invention relates to the art of making footwear and more particularly to the lasting of shoes, in the broad sense of applying shoe parts to or assembling them upon lasts, and is of especial value in the building of footwear comprising rubber or rubberized parts, although not wholly limited thereto. The present application is in part a continuation of my application Serial No. 661,191, filed September 6, 1923, and the present invention, in some of its features, is an improvement upon those described and claimed in my applications Serial No. 582,884, filed August 19, 1922, and Serial No. 630,796, filed April 9, 1923.

Numerous machines heretofore have been devised for stretching preformed or partially formed leather uppers on their lasts and applying the margin of the upper to the bottom face of an insole associated with the last, but in all such machines, so far as I am aware, the upper has required to be introduced by hand to the last or to be shifted or positioned upon the last after it is brought into contact therewith, in order to obtain the proper relation of parts in the finished shoe. This has required skill or care and the expenditure of time, and so far as I am aware no such machine heretofore devised has been adapted to bring a last and an annular or conoidal upper together in determinate relation, from isolated positions, and automatically to perform the complete lasting operation, in the broad sense, without intermediate manual control or manipulation.

It heretofore has been proposed to form a leather shoe by clamping a flat, water-soaked, imperforate leather blank between annular clamping members engaging its margins and to give it the form of an upper by stretching it over a last while the blank or the last is constrained to move in a determinate path with relation to the other, but the leather blank has required to be continuous over the shank of the last during the stretching operation, necessitating the later cutting out of a portion to form the ankle opening, with substantial waste. Intermediate manual control or manipulation has been required, and the apparatus proposed is not adapted to fold under the sole margin of the upper.

In my applications Ser. Nos. 582,884 and 630,796 above mentioned I have described apparatus and procedure whereby a flat, U-shaped upper of unvulcanized sheet rubber and a last may be brought together in determinate relation from isolated positions and the upper completely applied to the last without visual gaging or manual positioning of the stock upon the last, but the inventions of those applications have been directed more especially to the manipulation of stock adapted to adhere to the last or a lining thereon at all points of contact, which is in some respects a different problem from the manipulation of a lining or an upper adapted readily to slide and shift its position upon the last, and the operations there described have involved a considerable degree of care in the initial positioning and securing of the stock upon the members which subsequently manipulate it.

The general object of my present invention is to provide improved procedure and apparatus for making footwear and for similar operations. More specific objects are to provide means for automatically positioning the edge of a piece of sheet stock such as a shoe part, and to provide means for determinately manipulating a piece of stock having its edge so positioned, as in holding a shoe upper or the like for the reception of a form member such as a last, and shaping the stock thereon. Further objects are to provide for the automatic assembling of a last with an annular or conoidal upper, from isolated positions, so that the two readily may be mounted, initially, upon their respective assembling means without requiring excessive care, and to provide for the application of the sole margin of the upper to an insole associated with the last, as a part of an automatic cycle of operations. A further object is to provide for the automatic release of the work, and the supporting thereof in a position for convenient removal, upon the completion of such cycle of operations. Another object is to provide, and more particularly in a lasting machine, a nipper unit adapted automatically so to position the edge of a piece of sheet material between its own jaws as to grip its margin to a determinate depth from said edge. Another object is to provide means for applying the sole margin of an upper to the bottom face of a last or an insole thereon with a width of over-lap accurately determined by the applying means. Further objects and advantages will become manifest

in the following description of the preferred embodiment of my invention.

Of the accompanying drawings:

Fig. 1 is a front elevation, partly in section, of a machine embodying and adapted to carry out my invention in its preferred form, the work being mounted therein and most of the nipper units being omitted for clearness of illustration.

Fig. 2 is a plan view of the machine and a shoe last therein.

Fig. 3 is a horizontal section on line 3—3 of Fig. 1.

Fig. 4 is a side elevation of the machine as viewed from the left of Fig. 1.

Fig. 5 is a section on line 5—5 of Fig. 3.

Fig. 6 is a section, on a larger scale, on line 6—6 of Fig. 3.

Fig. 7 is a section on line 7—7 of Fig. 1.

Fig. 8 is a section on line 8—8 of Fig. 1.

Fig. 9 is a section on line 9—9 of Fig. 1.

Fig. 10 is a fragmentary, vertical section of the machine, on a large scale, showing one of the nipper units and adjacent parts in elevation, at an early stage of operation.

Fig. 11 is a similar view of the same at a succeeding stage of operation.

Fig. 12 is a similar view of the same at a still later stage of operation.

Fig. 13 is a perspective, detail view of one of the nipper units.

Fig. 14 is a reverse plan view of the last-supporting and positioning members taken on the line 14—14 of Fig. 1.

Fig. 15 is a fragmentary, vertical section through the work and adjacent parts at the instep portion of the last.

Fig. 16 is a fragmentary, vertical section of the apparatus, showing one of the nipper units in elevation, and representing a modified construction and mode of operation of the machine.

General description.

The preferred embodiment of my invention shown in Figs. 1 to 15 comprises a set of closely-spaced, up-standing nipper units completely surrounding and defining the lasting position and adapted freely to receive, from above, a conoidal shoe lining, or similar upper shoe part, and automatically to position the sole margin of the lining between their jaws in a manner such that each pair of jaws will grip the margin of the lining to a determinate depth from its edge and hold it in exact position for the reception of a last, which is raised from below, through the space surrounded by a stationary, annular support upon which the nipper units are mounted, and forced into the lining so held. The nipper units are pivoted on their annular support for tilting movement toward the last, against which they are adapted to bear, under the force of springs by which they are backed, to position them for a margin-applying projective movement of their jaws under the last, and to prevent recession of the stretched lining during such movement of the jaws.

A lower, annular, vertically movable frame, having connection to the several nipper units, is provided for controlling their tilting movement from and toward the last, and a higher, annular, vertically movable frame, with suitable actuating means for the several nipper units, is provided for controlling the opening and closing and the projective and retractive movements of the jaws.

Automatic means are provided for raising the last and for so raising and lowering the vertically movable frames in timed relation to the movement of the last as to effect the complete cycle of lasting operations, and for stopping the machine at the end of each such cycle.

While I prefer to provide separate machines adapted respectively for right and left shoes, rather than to make the adjustments of one machine which would be necessary for operation upon both right and left shoes, the machine shown in the accompanying drawings, for a left shoe, will be sufficiently illustrative,

As my invention is not wholly limited to the application of a shoe lining or to the presence of an insole on the last, the word "upper" will be used throughout the specification and claims as including a lining or similar upper shoe part, and the word "last" will be used as including an insole or an upper shoe part such as a lining associated with the last, as well as a bare last.

Actuating mechanism.

Referring to the drawings, 10, 10, are vertical frames mounted upon a suitable base 11, and 12 is a cross-brace connecting said frames 10 near their upper ends. Journaled in the respective frames 10 near the base of the machine is a driving shaft 13 provided with a belt pulley 14, and with a loosely-journaled pinion 15 meshed with a gear 16 secured to a countershaft 17, also journaled in the frame members 10. The pinion 15 is formed with a quill 15^a which extends through a boss on one of the frames 10 (Fig. 5) and has a brake-drum 18 secured to its projecting end portion. The end face of the quill 15^a is formed with clutch teeth adapted to be engaged by complemental clutch teeth formed on a clutch member 19, secured to the shaft 13, and engaged by the forked ends of a shipper lever 20 which is secured to a short rock-shaft 21 mounted in a suitable bracket 22 on the base of the machine. The rock-shaft 21 is provided with a treadle 23 for operating the clutch, said treadle having an extension to which is secured a pull-spring 24 for holding the clutch

normally disengaged. The shaft 13, being loosely journaled, is adapted to be shifted axially whenever the clutch is operated.

The shipper lever 20 is formed with a laterally extending arm 20ª, the intermediate portion of which is formed with an arcuate brake-shoe 25, adapted to bear against the brake drum 18 when the clutch is disengaged. For holding the clutch 19 in its engaged position after the treadle 23 has been depressed, a notched dog 26 is formed on an arcuate lever 27, said lever having a pull-spring 28 connected to its free end for urging said dog normally against the free end of the arm 20ª, the dog being thus adapted automatically to engage and hold said arm after the latter has been depressed. The lever 27 is pivoted on a stub shaft 29 mounted in a bracket formed on one of the frames 10, and the hub of said lever is formed with an upwardly-extending handle 30 whereby the dog 26 may be manually released from the arm 20ª to shift the clutch and stop the machine at any stage of its operation. The handle 30 is formed with a projection having a cam face 30ª, said projection extending into the orbit of a pin 31 projecting laterally from the gear 16, said pin being adapted to engage said cam face 30ª, and throw the handle 30, automatically to disengage the dog 26 from the arm 20ª to stop the machine after each revolution of said gear 16, which corresponds to a complete cycle of operation of the several work-manipulating mechanisms to be described.

Secured to the shaft 17 at its end opposite the gear 16 is a face cam 32, for raising and lowering the jaw-actuating annular frame, and at an adjacent intermediate point on said shaft is a similar but somewhat smaller face cam 33, for raising and lowering the nipper-unit-tilting frame. The cam 32 is adapted to actuate a cam arm 34 secured to a rock-shaft 35, the latter being journaled in the respective frames 10. In a similar manner the cam 33 is adapted to actuate a cam arm 36 journaled on a rock-shaft 37, the latter also being journaled in the frames 10. The hub of the cam arm 36 is formed with a pair of spaced-apart ears 36ª, 36ª, which straddle a radial lug formed on a collar 38 secured to the rock-shaft 37. Adjustment screws 39, 39 are threaded through the respective ears 36ª and between them hold the lug of the collar 38 securely in the desired position, and make possible the angular adjustment of the shaft 37 without corresponding adjustment of the cam 33. The screws 39 are formed with large knurled heads which may be provided with suitable markings to indicate the relative position of the rock-shaft 37, the purpose of this adjustment being to shift the vertically-movable, nipper-unit-tilting frame with reference to its actuating mechanism, in order to vary the initial positions of the nipper units to accommodate lasts of different sizes.

Mounted on the countershaft 17 near its middle is a crank 40 having a pair of roller crank-pins 40ª, 40ª, located side by side and extending laterally from its free end, said crank being adapted to actuate the mechanism for elevating the shoe last and presenting it to the lining-applying units.

Last support and elevating mechanism.

For supporting a last such as 41, and an insole 42, I provide a seat 43, the upper or seating face of which conforms to the shape of the bottom of the last, and the annular side face of which is beveled at its upper margin to provide a guiding surface 43ª for the nipper jaws as the latter apply the upper's margin to the sole face of the last as hereinafter described. The seat 43 is mounted upon a table 44 and held against lateral movement thereon by dowel pins 44ª, 44ª, which project upwardly from said table and engage suitable apertures in a laterally adjustable plate 45, secured to the bottom of said seat, as is most clearly shown in Fig. 14. Set-screws 46, 46 are threaded through the bottom of the seat 43 to provide leveling standards for the same, and are adapted for small vertical adjustments to compensate for variations of the lining material due to variations of temperature and humidity. For accurately positioning the last on the seat 43 an oval jig 47, having inwardly-extending fingers 48, 48, to be abutted by the last, is supported at its respective ends upon shouldered dowel pins 49, 49, mounted on the top of the cross-brace 12 at each end thereof. To accommodate lasts of different sizes, the seat and jig are changed.

The table 44 is stationed, between operations, just above the cross-brace 12, being mounted on the upper ends of a pair of parallel slide bars 50, 50, which extend through a slideway in said cross-brace. Secured to the lower end portions of the respective slide bars 50 are apertured guide blocks 51, 51, embracing respective vertical, fixed guide-rods 52, 52, the latter being secured at their upper ends to the cross-brace 12 and having their lower ends inset in the base 11. A chain 53 has one end secured to one of the guide blocks 51 and its other end anchored to an adjustment plate 54 (Fig. 6) which has a slotted end engaging flat surfaces on opposite sides of a fulcrum pin 55, and is adapted to be adjusted by means of nuts 56, 56, threaded onto the end of a stud 57 which projects through the plate substantially at its middle, for setting the anchored end of the chain in the desired position to determine the upper limit of movement of the last.

The chain 53 passes over a pulley 58 journaled on a cross-head 59, said cross-head

being formed with apertured guide brackets 59ª, 59ª, embracing the respective guide rods 52, and having a guide rod 60 secured in its upper portion, the upper end of said rod 60 being slidably mounted in an aperture in the cross-brace 12. The bottom edge face of the cross-head 59 is arcuate, on a radius equal to the effective length of the crank 40, and has a vertical slot 61 extending radially from said face, said slot permitting the cross-head to straddle the counter-shaft 17 to carry its arcuate bottom face substantially below the same, the closed upper end of said slot normally resting upon said counter-shaft. The cross-head is adapted to be engaged by the roller crank-pins 40ª on the crank 40 as the latter is rotated, to lift said cross-head, and with it the slide bars 50 and table 44, in order to raise the shoe last 41 and insole 42 into position to be operated upon by the lining-manipulating devices, the last dwelling in its uppermost position, for the margin-applying operation, while the roller crank-pins traverse the arcuate bottom face of the cross-head 59. The provision of two crank-pins 40ª enables them collectively to bridge the slot 61. The mechanism for raising the last 41 gives the slide bars 50 an upward stroke which is twice as great as the distance through which the cross-head 59 moves, permitting a simple and compact arrangement of the parts.

Lining supporting and manipulating devices.

For receiving and manipulating a shoe-upper or lining 62, having its heel portions stuck together to give it a conoidal, self-sustaining shape, a plurality of upright jaw-carriers or fingers 63, 63, are pivotally mounted at 63ª in respective supporting pins 64, 64, said pins being mounted in a stationary, annular frame 65 which is supported by its end portions on top of the respective frame members 10. The shape of the frame 65 conforms generally to the peripheral contour of a shoe sole, and the fingers 63 are mounted therein at various heights to conform to the longitudinal contour of said sole. The supporting pins 64 are vertically adjustable, being held by set-screws 66, to conform them to such contour.

Each finger 63 is outwardly bent at its upper end, forming a rounded shoulder 63ᵇ adapted to rest against the last, to position the nipper unit and to prevent recession of the lining during the margin-applying operation. The fingers at the instep of the last are formed with their rounded shoulders at a less distance above their nipper jaws than those at other parts of the last, as shown in Fig. 15, so that they may tilt well inward under the overhanging instep portion of the last and thus engage the work at substantially the same distance from the sole as the other fingers do.

As shown most clearly in Fig. 13, each finger includes a pair of side frame 63ᶜ, 63ᶜ, held apart by suitable spacing members to allow working space for a pair of stock-gripping or nipper jaws, the upper and lower members of which are designated 67 and 68 respectively. The aforesaid jaws are pivoted at 69 in the upper end of a curved lever 70, which is pivoted at 71 on the finger 63, and has an arcuate, rearwardly-extending arm 72. The lower jaw 68 is formed on the under side of its front end portion with a descending cam surface 73, and its rear end is extended beyond its pivot and provided with a transverse stop-pin 74, adapted to coact with the outer edge of the lever 70 when the parts are in their work-receiving position, as shown in Figs. 1, 7 and 13. The nose of the upper jaw 67 is sharply pointed and its rear end is bifurcated and straddles the rear extension of the jaw 68, said bifurcated portion being formed with an ascending cam surface 75. Pivoted at 76 to the finger 63 over the nipper jaws is a double-plate dog 77 having a roller 78 journaled at its outer end, said roller being yieldingly held against the upper jaw 67 by a pull-spring 79 connected at one end to the lever 70, and at the other to a U-shaped wire link 80 hooked into a pair of notches on the dog 77. Journaled between the side-frames 63ᶜ, below the lower jaw 68, is a roller 81 upon which said lower jaw normally rests and which coacts with the cam surface 73 of said jaw to produce its nipping movement. The respective side frames 63ᶜ are obliquely recessed at 82ª on their front edge to form a spur 82 located slightly above the normal meeting plane of the jaws 67, 68, and adapted to coact with said jaws, through the cam action of the roller 81 on the cam face 73 of the lower jaw, to provide a firm anchorage of the upper's margin for the operation of stretching it onto the last. The lower end of the finger 63, adjacent its pivot, is formed with an outwardly-extending arm 83, adapted to be acted upon to swing the entire finger forward or backward.

Surrounding the annular frame 65 is an outer annular frame 84 in which are adjustably fixed, by means of set-screws 85ª, a series of vertical anchor pins 85, 85, to the respective upper ends of which are secured short lengths of chain 86, the other ends of the chains being secured to the respective arms 83 of the fingers 63, at a point relatively close to the finger's pivot 63ª as to the fingers near the heel and toe of the last (Fig. 1), and at a point farther from said pivot as to the fingers at the instep of the last (Fig. 7). To the outer end of each arm 83 is attached the lower end of a pull-

spring 87 adapted to urge said arm upward and the finger 63 forward, said spring having its upper end hooked over one end of the cross-piece of a T-shaped rod 88, said rod being mounted between two such arms 83, and supporting the springs for both of them. The rod 88 has a conical base portion and seats in a counter-sink in the frame 84, being thus adapted for pivotal movement to compensate for the movement of the arm 83. Thus the spring 87 is adapted to urge the finger 63 inwardly toward the work, and the chain 86 to effect its outward movement against the force of said spring.

The ends of the frame 84 are formed with respective pairs of apertured ears 84^a in which are secured the upper ends of respective pairs of lift-rods 89, guided in apertured flanges 10^a, 10^a, formed on the upper ends of the respective frames 10, at opposite ends of the machine. The lift-rods 89 of each pair are connected near their lower ends by a yoke 90, and the two yokes are loosely pivoted to studs on the free ends of a pair of rocker-arms 91 mounted on the rock-shaft 37. Thus the frame 84 is adapted to be raised or lowered by said rock-shaft 37 as the latter is rocked by the cam 33 acting through the cam arm 36, and by means of the adjustment screws 39 above described (Fig. 8) said frame is adapted to be shifted with relation to its actuating mechanism to vary the upper-receiving positions of the nipper units for uppers of different sizes.

The chains 86, which control the upper-receiving position of the respective nipper units, being connected to the fingers 63 at points relatively close to the latter's pivots, as to the nipper units at the heel and toe portions of the last, and at points farther from the pivots of the fingers as to the nipper units which are at or nearer to the instep portion of the last, as will be seen by comparison of Figs. 1 and 7, the upper-receiving positions of the nipper units will be less varied at the instep than at the heel and toe in the adjustment just described, this being in accordance with the fact that lasts of different sizes vary less in width at the instep than they do in outline of the heel and toe.

An upper annular frame 94 carries a plurality of vertically-adjustable, depending rods 95, 95, fixed therein by set-screws 95^a, said rods having forked lower ends bent obliquely inward, and each being provided with a roller 96 journaled near the closed end of its slot. The slots in the respective rods 95 are adapted to receive and guide the actuating arms 72 of the respective levers 70, and said arms 72 are held yieldingly engaged with the rollers 96 by pull-springs 97, 97 secured to their free ends, the other ends of the springs being hooked into apertured plates 98, 98, depending from the outer periphery of the frame 94. Thus vertical movement of the frame 94 will be transmitted to the arms 72 so as to swing the levers 70, thereby manipulating the jaws 67, 68, pivoted to their free ends.

The curvature of each of the arms 72 is such as to be substantially concentric with the pivot 63^a of the finger 63 when said arm is in depressed position as shown in Fig. 10, so that the roller 96 will hold the nipper jaws closed while permitting the nipper unit to be tilted from the position of Fig. 10 to that of Fig. 11.

The frame 94 is mounted on the upper ends of two pairs of lift-rods 99, guided in apertures in the flanges 10^a. The rods 99 of each pair are connected near their lower ends by a yoke 101 formed with apertures through which the lift-rods 89 freely pass, and the two yokes 101 are loosely pivoted to studs on the ends of a pair of rocker-arms 102 mounted on the rock-shaft 35. Thus the frame 94 is adapted to be raised or lowered by the rock-shaft 35 as its angular position is varied by the cam 32 acting through the cam-arm 34.

Operation.

In the operation of the machine, the parts being in their starting positions as shown in Figs. 1 and 7, an insole 42 and shoe last 41 are placed upon the seat 43 by one operator while another operator mounts a rubberized fabric shoe lining 62, cemented on the inner face along its lower edge as shown at 62^a (Figs. 10 and 11), upon the lower nipper jaws 68 carried by the fingers 63. The first operator then steps on the lever 23 to engage the clutch 19, which is then locked in this condition by the dog 26 while the machine automatically goes through a complete cycle of operations, the operators being next required only to remove the finished work.

The driving shaft 13 being continuously rotated, the engagement of the clutch starts the rotation of the countershaft 17, which rotates the crank 40 to bring its rollers 40^a into engagement with the cross-head 59, and raise the latter and the shoe last 41.

Countershaft 17 also rotates the cams 32 and 33, the action of which may be noted in Figs. 8 and 9, said cams rotating counter-clockwise as there viewed. In the first movement of the work-manipulating elements the oblique part A of the groove in cam 32 moves the frame 94 downward, thereby actuating the arms 72 of the levers 70 to draw their jaws 67, 68, in a direction away from the work (see Fig. 10), the position of the fingers 63 being maintained by the chains 86 and springs 87. This causes said jaws lightly to close upon the margin of the shoe lining and frictionally grip the same, the jaw 67 being yieldingly held closed by the dog 77. The margin of the lining is thus drawn against the front edges

of the respective fingers 63, causing the jaws to slide on the fabric until, toward the end of the outward movement of said jaws, the cam surface 73 of the lower jaw engages the roller 81, and rides upward thereon, causing said jaws to carry the margin of the lining 62 upward against the spur 82, where it is firmly held and anchored as shown in Fig. 11. The duration of said anchorage is indicated by the arcuate dwell B of the groove in cam 32. In this action the spur 82 acts as a third nipper jaw.

During the descent of the frame 94, just before the jaws close upon the lining, a slight offset in the groove of the cam 33, shown at X in Fig. 8, slightly raises the frame 84, permitting the fingers to tilt slightly toward the last so that the edge of the lining at all points may be drawn against the fingers, the initial positions of the fingers being such that they define a slightly larger figure than that represented by the sole margin of the lining, so that the latter may be readily mounted in extended condition, upon the lower nipper jaws.

While the jaws 67, 68 are closing upon the margin of the lining, the action of crank 40 upon the cross-head 59, transmitted through the pulley 58, chain 53 and bars 50 to the last-support 43, elevates the last toward the lasting position.

The fingers 63 as positioned in Fig. 10, by the arcuate portion C of the groove in cam 33, stand so as to hold the lower margin of the lining 62 a substantial distance from the last at its greatest dimensions, so that the last will first contact with the lining near the shank and force its way into the lining, contacting with the latter progressively from the shank toward the sole.

As soon as the cross-head 59 has reached the limit of its upward stroke and the last is forced into the lining, the oblique part D of the groove in cam 33 raises the frame 84 as shown in Fig. 11, permitting the springs 87 to swing the fingers 63 inwardly so that their shoulders 63^b carry the body of the lining against the last and press it thereagainst to prevent its recession while its margin is swung onto the bottom face of the insole as will presently be described, the contact of said fingers with the work also serving to position them for the margin-applying operation. Next, the oblique part E of the groove in cam 32 raises the frame 94, thus releasing the pressure on the actuating arms 72 and permitting the springs 79 and 97 to swing the levers 70 inwardly and thereby push their jaws 67, 68 forward to carry the lining margin inward under the last and insole. As will be apparent from a comparison of Figs. 1, 8 and 9, all showing the several parts in starting position, the dwell of the last-holder in its uppermost position, while the roller crank pins 40^a traverse the lower face of the cross-head 59, the curve of which is then concentric with the shaft 17, occurs while the oblique part E of the groove in the cam 32 permits the jaws 67, 68 to be pushed forward as just described, so that said jaws, held lightly closed by the spring-backed dog 77 and roller 81 contact the guiding face 43^a of the last seat 43 and are thereby guided upward, in sliding contact with said face, to carry the upper's margin against the insole while the latter is still supported by the last seat, the pointed end of the upper jaw 67 penetrating the outer face of the upper to prevent slippage. The upper's margin is thus stuck to the insole at a determinate distance from the edge of the latter, without requiring the tacky, cemented margin to slide upon the insole, although the retraction of the stock subsequently may cause it to draw backward past the edge of the insole in case the margin is transversely slack, slippage past said edge being permitted by the absence of cement from that portion of the upper's margin. During the application of the upper's margin to the last, the latter is preferably held down by hand, to prevent the jaws which first bear against the last from lifting it before the other jaws have been brought to bear firmly upon it.

The further movement of the jaws 67, after they bear against the insole, causes them to lift the last assembly. Depending upon the relative proportions of the last support and adjacent parts, such lifting of the last may be either the result of a cam action of the lower nipper jaw 68 upon the upper edge of the last support, or it may be, throughout or only at a later stage, in the nature of a reversed toggle action. When the cam surfaces 75 of the several upper nipper jaws 67, by their upward movement, come into engagement with the rollers 78 of the pivoted dogs 77 said upper jaws are thereby swung upward from the lower jaws 68, so that the upper jaws from this point continue to act as ejectors for the last assembly, their action partaking of the nature of both a cantilever action and a reversed toggle action, the cantilever action, however, being dependent upon slippage of the upper nipper jaws with relation to the work. The particular manner in which the nipper jaws function to lift the last at different stages may vary according to proportions of the parts, but the particular character of the action at any stage is not of great consequence, since the units are sufficient in number and combined force to raise the last clear of the fingers 63 by either the cam or the reversed toggle action. The cantilever action of the upper jaws is not essential to releasing the last and supporting it in position for convenient removal, but is primarily

an incident of the reopening of the jaws to receive the next upper.

As the further rotation of the crank 40 permits the last-holder to descend, the oblique part F of the groove in cam 33 depresses the frame 84 to return the fingers 63 to their starting position, corresponding to the dwell G of said groove, while the dwell H of the groove in cam 32 permits the frame 94 to remain in starting position, with the jaws open.

The machine is automatically stopped when the pin 31 on the gear 16 strikes the cam face 30^a of the handle 30, causing the dog 26 to unlock the shipper lever 20 and permit its spring 24 to throw out the clutch member 19. This completes a cycle of operations, and the machine is then ready to operate upon another shoe in the manner described. When a last of a different size is to be used, the last holder comprising the seat 43 and jig 47 is changed and the adjusting screws 39 are manipulated correspondingly to vary the initial positions of the nipper units by shifting the frame 84 and swinging the jaw carriers 63 on their pivots, as will be evident.

Modifications.

The machine as above described is adapted to apply the margin of the upper to the insole with a determinate amount of overlap by reason of the guiding of the nipper jaws upon the last support, and I prefer this embodiment of the invention because uniformity of the overlap may be obtained thereby notwithstanding such variations in the stock as ordinarily occur in factory practice, but my invention is not wholly limited to guiding the nipper jaws. As shown in Fig. 16, for example, the actuating mechanism being appropriately timed, and the insole being suitably supported, as by lightly cementing it to the last, the last support may be withdrawn downward before the nipper jaws are projected forward to carry the upper's margin onto the insole, the last being supported, and the lining prevented from receding thereon, by contact of the fingers 63 therewith. In this modified construction and mode of operation, instead of both nipper jaws being swung upward against the insole by contact of the lower nipper jaw with the last support, the upper nipper jaw, whose pointed end engages the lining by penetration of the latter's outer face, in being projected forward is swung upward by the pull of the upper's margin, so that said margin is attached to the insole near the margin's edge while the margin is held transversely taut by the thrust and the weight of the upper nipper jaw. Thus an accurate determination of the amount of the margin's overlap may be had when the stock is of accurate dimensions, since the position of the upper's edge in the nipper jaws and also the position at which the fingers 63 bear against the last are accurately determined by the relative proportion of the several parts. However, any recession of the lining permitted by the shoulder 63^b of the finger 63 during the application of the margin may affect the amount of the latter's overlap, and as the binding of the lining upon the last in the initial stretching operation is not uniform at all points around the latter, being less at the heel, where the pull is parallel with the last surface, and greater at the toe, where the lining must be pulled about a sharper contour, this mode of operation requires somewhat more accurate cutting of the stock and adjustment of the actuating springs in order to obtain the uniformity of product desired.

My invention is susceptible of further modification within its scope, and I do not wholly limit my claims to the exact constructions shown, nor to the exact procedure described.

I claim:

1. A lasting machine comprising a set of nipper units completely surrounding a lasting position and adapted to receive the sole margin of an upper between their opened jaws, means for concurrently closing said jaws to hold said upper substantially throughout its perimeter, and means for relatively advancing a last from a non-contiguous position into an upper so held.

2. In a lasting machine, the combination of a set of stock-anchoring units defining a lasting position, means for determinately positioning the edge of an upper to be held by said units, and means for relatively advancing a last in determinate relation into an upper so held, from a position non-contiguous to said upper.

3. In a lasting machine the combination of a member adapted to be abutted by an edge face of an upper, means for lightly drawing the margin of the upper toward said member with the said edge face in advance to insure positioning of said edge face thereagainst, and means for anchoring said margin as so positioned.

4. In a lasting machine, the combination of means for holding an upper conoidally by its sole margin, means for relatively advancing a last into said upper in determinate relation from a position non-contiguous thereto, so as to draw said margin past the sole of the last, and means for applying said margin to the sole face of the last.

5. In a lasting machine, the combination of a set of nippers completely surrounding a lasting position, and adapted to receive the sole margin of an upper between their opened jaws, means for concurrently closing said jaws to hold said upper substantially throughout its perimeter, means for

relatively advancing a last from a non-contiguous position into an upper so held, and means for simultaneously actuating said nippers to cause them to apply said margin to the sole face of the last.

6. In a lasting machine, the combination of means for holding an upper conoidally by its sole margin, means for relatively advancing a last into said upper in determinate relation from a position non-contiguous thereto, so as to draw said margin past the sole of the last, means for applying said margin to the sole face of the last, and power driven mechanism adapted, upon being started, to actuate the several said means in timed relation throughout the cycle of operations described.

7. A lasting machine comprising means for supporting a last with an upper thereon having its sole margin projecting past the sole of the last, and margin-applying means adapted by non-progressive engagement with said margin to swing the latter onto the sole face of the last, the said margin-applying means comprising pairs of jaws mounted to approach the sole-face of the last from a direction non-parallel thereto, and mountings for the respective pairs of jaws so constructed and arranged as to bear against the last to position the jaws with relation to the last.

8. A lasting machine as defined in claim 7 in which the margin-applying means comprises a pointed member adapted obliquely to penetrate the outer face of the upper's margin.

9. A lasting machine comprising means for supporting a last with an upper thereon having its margin projecting past the sole of the last, margin-applying means adapted by non-progressive engagement with said margin to apply the latter to the sole face of the last, and means independent of the tautness of the upper for so guiding said margin-applying means as to apply said margin to the sole of the last with its edge at a determinate distance from the edge of the sole face of the last.

10. A lasting machine as defined in claim 9 in which the margin-applying means comprises a pointed member adapted obliquely to penetrate the outer face of the upper's margin.

11. A lasting machine comprising a set of jaw carriers surrounding and defining the lasting position, jaws on said carriers adapted to anchor the margin of an upper for the reception of a last, means for holding said carriers against the last, and means for applying the margin of the upper to the sole face of the last while said carriers bear against the last.

12. A lasting machine comprising a group of upper-stretchers defining a lasting position and adapted to anchor the margin of an upper, means for drawing the margin of the upper into engagement with said stretchers, means for determinately positioning the edge of an upper as it is received by said stretchers, a last-support, means for relatively advancing said support so as to carry a last thereon in determinate relation into an upper held by said upper-stretchers, and margin-applying means adapted to engage the margin of said upper at a determinate distance from its edge and to apply said margin to the sole face of the last by non-progressive engagement therewith.

13. A lasting machine comprising a group of upper-stretchers defining a lasting position and adapted to anchor the margin of an upper, means for determinately positioning the edge of an upper as it is received by said stretchers, a last-support, means for relatively advancing said support so as to carry a last thereon in determinate relation into an upper held by said upper-stretchers, margin-applying means adapted to engage the margin of said upper at a determinate distance from its edge, for applying said margin to the sole face of the last, and means on said last-support for guiding said margin-applying means.

14. In a lasting machine, the combination of a series of pairs of nipper jaws, including lower jaws collectively forming a support for the lower edge of the upper, a vertically movable last support adapted in its depressed position to receive the last, means for elevating said last support to the lasting position, and means for actuating said nipper jaws to cause them to close upon the upper and apply its margin to the sole face of the last.

15. A lasting machine comprising a group of upper-stretchers adapted to anchor the margin of an upper, means for drawing the margin of an upper edge-foremost toward said stretchers, means adapted to be abutted by the edge face of the said margin to position the latter with relation to said stretchers, and means to cause the stretchers to engage the margin as so positioned.

16. A lasting machine comprising a set of nipper units adapted freely to receive the margin of an upper between their opened jaws, means for lightly closing said jaws and moving them outwardly in sliding engagement with said margin, means adapted by stopping abutment with the edge face of the said margin to position the latter as it is thus drawn by said jaws, and means for anchoring said margin as it is so positioned.

17. A lasting machine comprising a set of nipper units adapted freely to receive the margin of an upper between their opened jaws and definitely to position the same by engagement with its edge face, means for closing said jaws upon the margin of said

upper to hold the same as so positioned, a last support, and means for effecting such relative movement of said nipper units or said last support as to bring together in determinate relation from isolated positions a last on said support and an upper held by said units.

18. A lasting machine comprising a set of nipper units adapted freely to receive the margin of an upper between their opened jaws and definitely to position the same by engagement with its edge face, means for closing said jaws upon the margin of said upper to hold the same as so positioned, a last support, means for effecting such relative movement of said nipper units and a last as to bring them together in determinate relation from isolated positions and insert the last into an upper held by said units, and means for applying the margin of said upper to the sole face of the last.

19. A lasting machine comprising a set of nipper units adapted freely to receive the margin of an upper between their opened jaws and anchor the same, a last support, means for effecting such relative movement between said units and said last support as to bring together in determinate relation from isolated positions a last on said support and an upper held by said units, each of said units comprising a member adapted to be abutted by the edge face of the upper determinately to position the same, a pair of jaws mounted for movement toward and from a common central position past the upper positioning face of said member, means for closing said jaws lightly upon the margin of the upper and moving them outward in sliding engagement therewith to insure contact of the upper's edge with said positioning member, and means for more firmly anchoring the upper's margin as it is positioned by said member.

20. In a lasting machine the combination of means for positioning a last and, cooperatively associated therewith, a nipper unit, and means for so moving the nipper unit with relation to the last as to stretch on the last an upper held by said unit, the said unit comprising a member adapted to be abutted by the edge face of a piece of sheet material for positioning the latter, a pair of jaws mounted for such relative movement as to be projected and retracted past the positioning face of said member, means for lightly closing said gripper jaws as they are so retracted, to draw against said positioning face the edge of a piece of sheet material engaged by said jaws, and means for anchoring said piece as it is so positioned.

21. In a lasting machine the combination of means for positioning a last and, cooperatively associated therewith, a nipper unit, and means for so moving the nipper unit with relation to the last as to stretch on the last an upper held by said unit, the said unit comprising a member adapted to be abutted by the edge face of a piece of sheet material for positioning the latter, a pair of jaws mounted for such relative movement as to be projected and retracted past the positioning face of said member, means for closing said jaws lightly upon the margin of a piece of sheet material embraced between them, means for retracting said jaws in sliding engagement with said piece to assure contact of the latter's edge with said positioning member, and means for more firmly closing said jaws upon said piece as they are retracted.

22. In a lasting machine the combination of means for positioning a last and, cooperatively associated therewith, a nipper unit, and means for so moving the nipper unit with relation to the last as to stretch on the last an upper held by said unit, the said unit comprising a member adapted to be abutted by the edge face of a piece of sheet stock to position the latter, a pair of jaws mounted for such relative movement as to be projected and retracted past the positioning face of said member, and means adapted by cam action on said jaws to close the same as they are retracted and to permit them to open as they are projected.

23. In a lasting machine, the combination of means for positioning a last and, cooperatively associated therewith, a nipper unit, and means for so moving the nipper unit with relation to the last as to stretch on the last an upper held by said unit, the said unit comprising a member adapted to be abutted by the edge face of a piece of sheet stock to position the latter, a pair of jaws mounted for such relative movement as to be projected and retracted past the positioning face of said member, and means adapted by cam action on said jaws to close the same as they are retracted and to permit them to open as they are projected, said cam means being adapted to close said jaws lightly in the first part of their retractive movement and more firmly in the latter part of said movement.

24. In a lasting machine the combination of means for positioning a last and, cooperatively associated therewith, a nipper unit, and means for so moving the nipper unit with relation to the last as to stretch on the last an upper held by said unit, the said unit comprising a member adapted to be abutted by the edge face of a piece of sheet stock to position the latter, a pair of jaws mounted for such movement as to be projected and retracted past the positioning face of said member, and means adapted by cam action on said jaws to close the same as they are retracted, and to permit them to open as they are projected, said cam means comprising a support fixed in its position with relation to said positioning member and adapted for one

of said jaws to run thereon, and a yieldingly impelled member adapted to run on the other jaw to urge it toward closed position.

25. In a lasting machine, the combination of means for positioning a last and cooperatively associated therewith, a nipper unit, and means for so moving the nipper unit with relation to the last as to stretch on the last an upper held by said unit, the said unit comprising a pair of hinged jaws mounted for movement of translation, and a cam member mounted to run on one of said jaws in front of their hinge for holding said jaws closed in a determinate range of said movement, one of said jaws being provided at its hub with a cam surface adapted to be engaged by the said cam member for opening said jaws at one end of said range.

26. In a lasting machine, the combination of means for positioning a last and, cooperatively associated therewith, a nipper unit, and means for so moving the nipper unit with relation to the last as to stretch on the last an upper held by said unit, the said unit comprising a member adapted to be abutted by the edge face of a piece of sheet stock to position the latter between the jaws of said unit, a pair of jaws mounted for projection and retraction past the positioning face of said member, a jaw-support upon which one of said jaws is adapted to run, and a yieldingly impelled cam member adapted to run on the other jaw to urge it toward closed position, the latter jaw being formed at its hub with a face adapted to be engaged by said cam member for opening said jaws at the end of their projective movement.

27. In a lasting machine, the combination of nipper mechanism including a pair of jaws adapted to receive the margin of an upper between them when the jaws are in open position, means for causing said jaws to close upon said margin and slide outwardly thereon in substantially closed relation, and then to move inwardly toward the center line of the last and then toward the sole face of the last to carry said margin against the sole face of the last, and means for causing the jaws to grip the margin of the upper to a determinate depth at the end of their outward, sliding movement.

28. In a lasting machine, the combination of a nipper mechanism including a pair of nipper jaws adapted for outward sliding engagement with the margins of an upper while the jaws are in substantially closed relation, means adapted to be abutted by the edge face of the upper as the latter is drawn, edge forward, toward said member by said jaws, a third nipper jaw adapted to engage the edge of the upper and to anchor the same only at the limit of said outward movement, and means for imparting an inward movement of translation to said jaws while said edge is thus engaged.

29. In a lasting machine, the combination of a series of pairs of nipper jaws surrounding the lasting position and including members adapted to support an upper in conoidal form in position to receive a last, means for advancing a last into the upper, means for closing said jaws and moving them outwardly while so closed, and means for moving the jaws inwardly to apply the margin of the upper onto the sole face of the last.

30. In a lasting machine, the combination of a series of nipper units surrounding the lasting position and each including a pair of jaws adapted to slide outwardly upon the margin of an upper while substantially closed thereon, and additional means for more firmly gripping the margin of the upper as the latter is positioned by said jaws, means for advancing a last into the upper, and means for moving said units inwardly toward the last and then moving said pairs of jaws simultaneously further inward to apply the margin of the upper onto the sole face of the last.

31. In a lasting machine, the combination of means for supporting a last in the lasting position, a series of work-contacting fingers mounted for movement toward and from the last, and adapted to be positioned by abutment against the latter, and a pair of nipper jaws mounted on each of said fingers and having a relative pivotal movement to open and close them and a movement of translation with relation to said fingers, and jaw-operating means adapted to be actuated by the said movement of translation to produce said pivotal movement.

32. In a lasting machine, the combination of means for supporting a last in lasting position, a series of pairs of nipper jaws having opening and closing movement, an outward movement of translation while the jaws are substantially closed upon the margin of an upper, and an inward movement of tranlation to carry the edge of the upper onto the sole face of the last, a series of fingers carrying said jaws, each having means for positioning the upper by engagement with its edge as it is drawn outward by said jaws, means for nipping the edge of the upper as it is so positioned, and means for imparting an inward movement to said fingers while the edge is thus nipped.

33. In a lasting machine the combination of a last support formed with a guiding face disposed at an angle to its last-supporting face, a pivoted margin-applying member adapted to swing, onto the sole face of a last overhangingly mounted on said last-support. the margin of an upper on said last, means for causing the said margin-applying member to engage the margin of the upper at a determinate distance from its edge, and means for so moving the pivot of said member toward said last support as to cause the

extremity of said member to be swung upward against said last by the guiding face of said last-support.

34. A lasting machine comprising a last support and, cooperatively associated therewith, a pivoted, nipper-supporting finger, adapted to swing from and toward the last, a lever pivoted on said finger, a pair of nipper-jaws on said lever and adapted to be opened and closed by pivotal movement of said lever on said arm, said lever being formed with a curved face adapted to be engaged for actuating said lever to close said jaws, said face being concentric with the pivot of said finger when the jaws are closed, and means running on said curved face for holding said jaws closed while permitting said finger to be turned on its pivot.

35. A lasting machine as defined in claim 34 in which a yieldingly impelled dog is adapted to run on one of the jaws to urge it toward closed position.

36. A lasting machine as defined in claim 34 in which a yieldingly impelled dog is adapted to run on one of the jaws to urge it toward closed position and to abut a projection on said jaw at its pivot to open said jaw.

37. In a lasting machine, the combination of means for supporting a last upright in the lasting position, a series of nipper units surrounding and defining said position and adapted to receive the lower edge of a conoidal upper, a plurality of frames mounted for relative vertical movement, and connections between said frames and the nipper units so constructed and arranged that the relative movement of the frames causes said units to grip the margin of the upper and independently of tension in the margin to carry it onto the sole face of the last.

38. In a lasting machine, the combination of a series of nipper units surrounding and defining the lasting position and adapted to receive the lower edge of a conoidal upper in upright posture, three annular frames connected with said nipper units, and means for causing suitably-timed vertical movement of certain of said frames relative to each other to cause said units to grip the edge of the upper and independently of tension in the margin to carry it onto the sole face of the last.

39. In a lasting machine, the combination of a series of nipper units surrounding and defining the lasting position, a fixed frame supporting said units, a pair of vertically movable frames connected to operate said units and means for causing suitably-timed movement of said pair of frames relative to each other and to the fixed frame to cause the units to grip the edge of an upper and to carry it onto the sole face of the last.

40. In a lasting machine, the combination of means for supporting a last in the lasting position, and a nipper unit including a pair of nipping jaws having relative pivotal movement to close them upon the upper, a lever adapted to project said jaws to produce their pivotal movement and cause them to carry the edge of the upper onto the bottom of the last, and a finger carrying said lever and jaws and pivoted to permit movements of the nipper unit toward and from the last.

41. In a lasting machine, the combination of means for supporting a last in the lasting position, and a nipper unit including a finger pivoted for movement of its free end toward and from the last, a jaw-carrying lever pivoted on said finger, a pair of nipper jaws pivoted for opening and closing movements on said lever and for projective and retractive movement with the lever relative to said finger, and a third nipper jaw on said finger coacting with said pair of jaws at the limit of retractive movement of the latter.

42. In a lasting machine, the combination of means for supporting a last in the lasting position, and a nipper unit comprising a finger pivoted for movement of its free end toward and from the last, a lever pivoted to said finger, a pair of nipper jaws mounted for pivotal movement on said lever and for projective and retractive movement with said lever on the finger, a third nipper jaw on said finger, members on the finger and one of said pair of jaws for producing the nipping action of the three jaws at the limit of the retractive movement of the pair of jaws, and a dog pivoted to said finger and coacting with the other one of said pair of jaws to open said pair at the limit of the projective movement of the latter.

43. In a lasting machine, the combination of a series of nipper units surrounding and defining the lasting position and each comprising a finger pivoted for movement toward and from the work, a lever pivoted to said finger, a pair of nipper jaws pivoted to said lever and slidable upon the finger, and a frame adapted for movement relative to the series of fingers for simultaneously acting upon their levers to operate the nipper jaws.

44. In a lasting machine, the combination of a series of nipper units each comprising a finger pivoted for movement toward and from the work, a movable frame having connections with the respective fingers for simultaneously producing their pivotal movements, a series of levers pivoted on said fingers, a series of pairs of nipper jaws pivoted to said levers and slidable on said fingers, and a second movable frame having connections with the respective levers for simultaneously swinging them to operate the respective pairs of nipper jaws.

45. In a lasting machine, the combination

of a series of nipper units surrounding and defining the lasting position and each including a pivotal L-shaped finger having an upright arm and an outwardly-projecting arm, a fixed frame supporting the pivots of the respective fingers, a vertically-movable, annular frame surrounding said fixed frame and having connections with the outwardly-projecting arms of said fingers for swinging them on their pivots, nipper jaws carried by said fingers, and means for operating said jaws.

46. In a lasting machine, the combination of a last holder, a jaw-carrier movable inwardly toward and outwardly from said holder, nipper jaws mounted on said carrier, means for yieldingly producing the inward movement of said carrier and causing a part of the carrier assembly to bear yieldingly against the last, and means opposed to and overcoming the force of the said yielding means for positively producing the carrier's outward movement.

47. In a lasting machine, the combination of a nipper unit comprising an upright jaw carrier pivoted at its lower end and having an outwardly-projecting arm, a pair of frames mounted for relative vertical movement, to one of which said carrier is pivoted, a positive connection between said arm and the other frame for swinging said carrier outwardly by relative depression of said other frame, and a spring connection between said other frame and the arm for yieldingly swinging said carrier inwardly.

48. In a lasting machine, the combination of a series of pairs of nipper jaws surrounding and defining the lasting position and having opening and closing movements and inward and outward movements of translation, means for simultaneously producing said opening and closing movement of the several pairs, means for simultaneously, yieldingly producing their inward movement of translation whereby they are caused to bear yieldingly against the last, and means opposed to and overcoming the force of the said yielding means for simultaneously, positively producing their outward movement of translation.

49. In a lasting machine, the combination of a last-holder, nipper mechanism comprising a jaw-carrier movable inwardly toward and outwardly from said holder, a pair of nipper jaws mounted for sliding movement on said carrier to open and close the jaws and move them inwardly in closed relation to carry the edge of the shoe upper onto the bottom of the last, means for yieldingly producing the inward movement of said jaws whereby they are caused to bear yieldingly against the last, and means for positively producing their outward movement.

50. In a lasting machine, the combination of a series of nipper units surrounding and defining the lasting position and each comprising a jaw carrier, a pair of nipper jaws mounted for opening and closing movements and inward sliding movement thereon, a jaw-actuating lever pivotably connected with said carrier and jaws, means for simultaneously, yieldingly swinging the levers of the several units to move the jaws inwardly to carry the edge of a shoe upper onto the bottom of the last, and means for simultaneously, positively swinging said levers in the opposite direction.

51. In a lasting machine, the combination of a series of nipper units surrounding and defining the lasting position and each comprising a jaw carrier, a pair of jaws mounted for sliding and pivotal movement thereon and a jaw-actuating lever pivoted to said jaws and carrier, an axially movable annular frame, means on said frame for simultaneously, positively swinging the jaw-actuating levers of the several units to retract their nipper jaws, and a series of springs connecting said frame with the respective levers for yieldingly swinging the latter in the opposite direction to project the jaws into upper-lasting position.

52. In a lasting machine, the combination of a fixed annular frame, a pair of annular frames movable axially relative to each other and to the fixed frame, a series of nipper units surrounding and defining the lasting position and each comprising an L-shaped jaw carrier pivoted to said fixed frame and having a yielding connection with one of the movable frames for projecting the carrier and a positive connection therewith for retracting it, a pair of nipper jaws on each carrier, a lever on each carrier for actuating said jaws, means on the other of said movable frames for positively swinging the several said levers to retract the jaws, and a series of springs connecting the last said frame with said levers for yieldingly projecting the jaws.

53. In a lasting machine, the combination of a series of nipper units surrounding and defining the lasting position, means for automatically positioning an upper in said nipper units, means for holding said units in determinate initial positions to receive the upper and for simultaneously actuating said units to effect the lasting operation, and means for simultaneously adjusting the initial positions of said units with relation to each other to accommodate lasts of different sizes.

54. In a lasting machine, the combination of a series of nipper units surrounding and defining the lasting position and each comprising a pivoted jaw carrier and a pair of nipper jaws, a frame connected with the respective carriers for simultaneously swinging them on their pivots, mechanism for reciprocating said frame, and an adjustment

in said mechanism for varying the initial position of the frame and jaw carriers to vary the positions of the jaw carriers with relation to each other to accommodate lasts of different sizes.

55. A lasting machine comprising a set of upper-manipulating elements disposed about a lasting position and pivotally mounted to tilt inward and outward with relation to said position, and a movable frame having connections to said elements for so tilting them, said connections comprising connections which engage said elements at different distances from the latter's pivots, as to elements located at different stations about the lasting position.

56. In a lasting machine, the combination of a last holder, and lasting instrumentalities adapted by a projective movement non-parallel to the sole face of a last on said holder to apply the margin of an upper to said face, and by further movement to project said last from said holder.

57. In a lasting machine, the combination of a last holder, a nipper jaw for lasting the upper, and means for imparting a last projecting movement to said jaw with relation to the last holder whereby the last is projected from the last holder.

58. In a lasting machine, the combination of a last holder, a series of nipper units including nipping jaws for lasting the upper, and means for imparting lasting movements to said jaws, followed by a last-projecting movement thereof with relation to the last holder whereby the last is projected from the last holder.

59. In a lasting machine, the combination of a last holder, upper-receiving and lasting instrumentalities, means for relatively moving said holder and instrumentalities to assemble the upper with the last, and means for imparting to said instrumentalities lasting movements followed by movement of the lasting instrumentalities with relation to the last holder whereby the last is projected therefrom.

60. In a lasting machine, the combination of a vertically-movable holder adapted to support a last in upright position, upper-receiving and lasting instrumentalities surrounding and defining the lasting position, means for elevating said holder to assemble the upper with the last, and means for imparting to said instrumentalities lasting movements followed by a movement for projecting the last above the lasting position.

61. In a lasting machine, the combination of a holder adapted to support a last in upright position, means for raising the same into and lowering it out of lasting position, and lasting instrumentalities including a pair of nipper jaws having upper-engaging and lasting positions and a last projecting movement from lasting position to upper-engaging position.

62. A lasting machine comprising means for positioning a conoidal upper by abutted, stopping engagement with the edge face of its sole margin, means for drawing the edge face of an upper against said positioning means, means for holding its margin as so positioned, and means for relatively forcing a last into the upper while its margin is so held.

63. A lasting machine comprising means for positioning a conoidal upper, means for gripping its sole margin to a determinate depth while it is so positioned, means for relatively forcing a last into the upper while it is held by the gripping means, and means for moving the gripping means to apply the sole margin of the upper to the bottom of the last at a determinate position thereon not governed by tension in the upper.

64. A sheet-manipulating device comprising a plurality of sheet-anchoring members arranged in determinate relation to each other and mounted for movement in respective directions non-parallel to each other, positioning means for the said members adapted to be abutted by the edge of the sheet to position the latter, means for drawing the edge of the sheet against the said positioning means, the said drawing means being mounted for movement with relation to the said positioning means, and means for moving the sheet-anchoring members while the sheet is held thereon as so positioned.

65. A sheet-manipulating device comprising a plurality of jaw carriers arranged in determinate relation to each other and mounted for determinate movement with relation to each other, positioning means adapted to be abutted by the edge of the sheet to position the latter, a pair of jaws mounted on each jaw carrier for movement of translation thereon to draw the edge of the sheet against said positioning means, additional means for anchoring the margin of the sheet as positioned by each pair of said jaws, and means for determinately moving the said anchoring means with relation to each other while the sheet is anchored thereon.

66. A lasting machine comprising means for supporting a last with an upper thereon, and means for folding the sole margin of the upper onto the sole face of the last and pressing it thereagainst and for removing the last with the upper thereon from the last-supporting means.

67. A lasting means as defined in claim 66 including means for effecting cyclic, timed operation of the instrumentalities defined.

In witness whereof I have hereunto set my hand this 1st day of April, 1924.

FRANK J. MacDONALD.