

Jan. 24, 1967

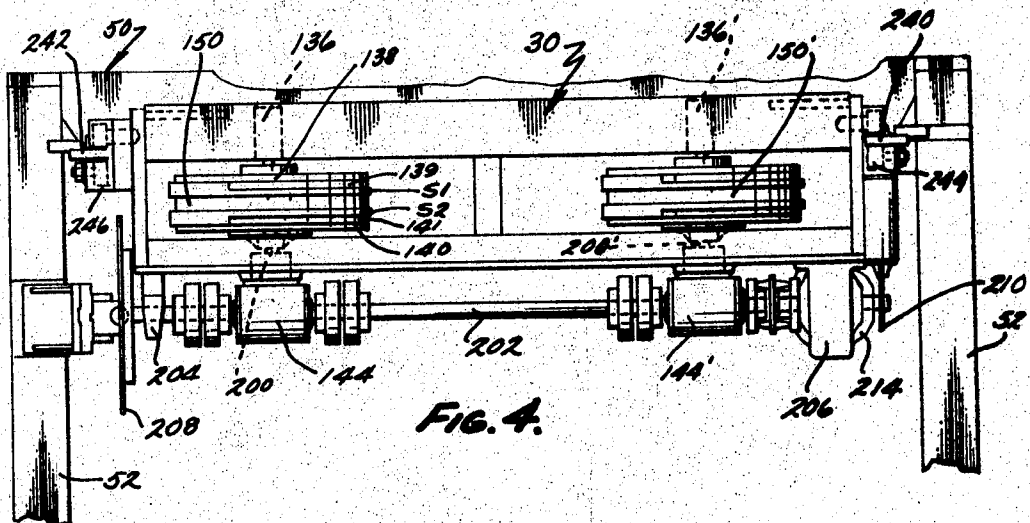
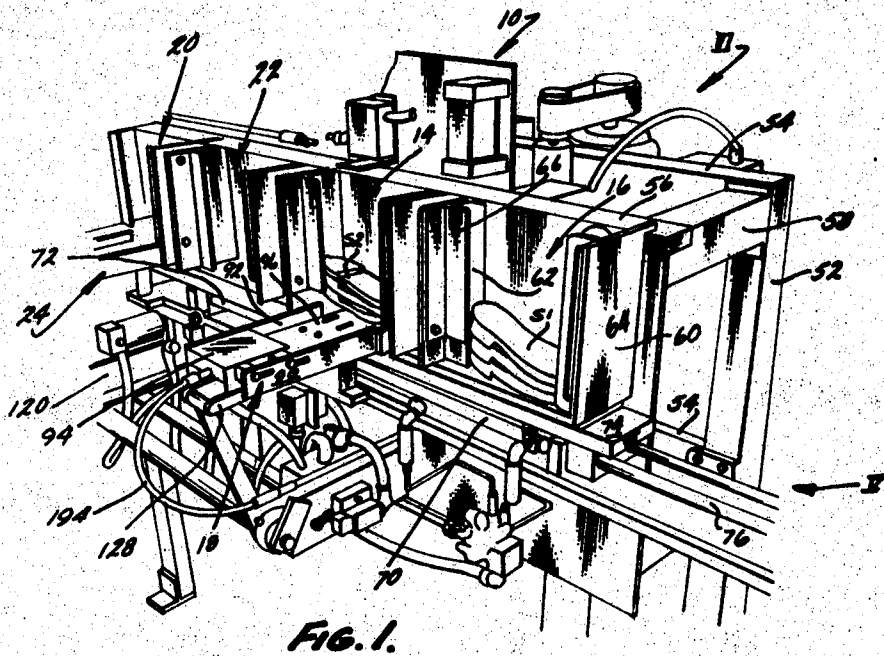
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3,299,455

HEEL AND SOLE TRIMMER

Filed Oct. 26, 1964

8 Sheets-Sheet 1



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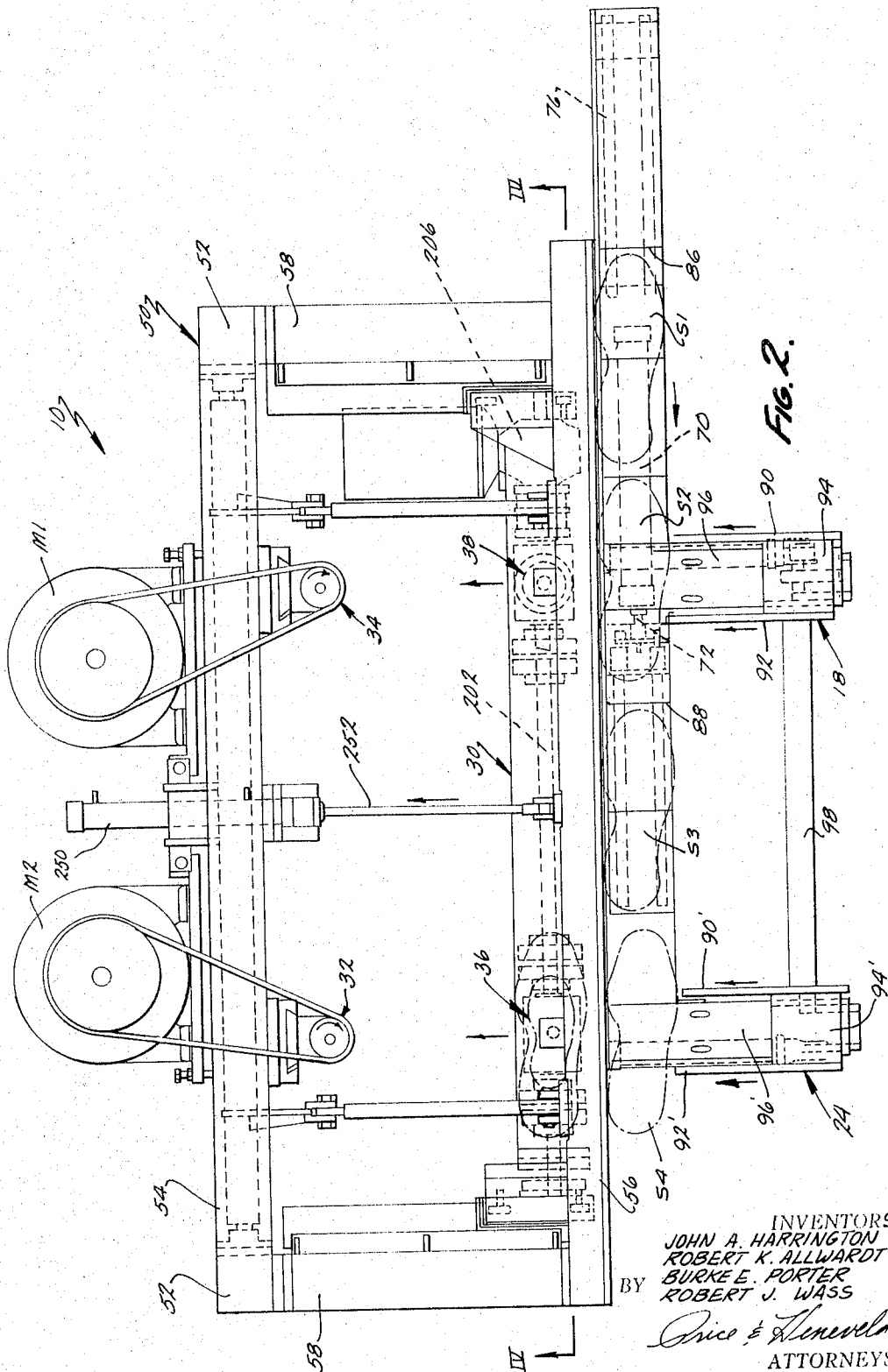
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HEEL AND SOLE TRIMMER

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8 Sheets-Sheet 2



Jan. 24, 1967

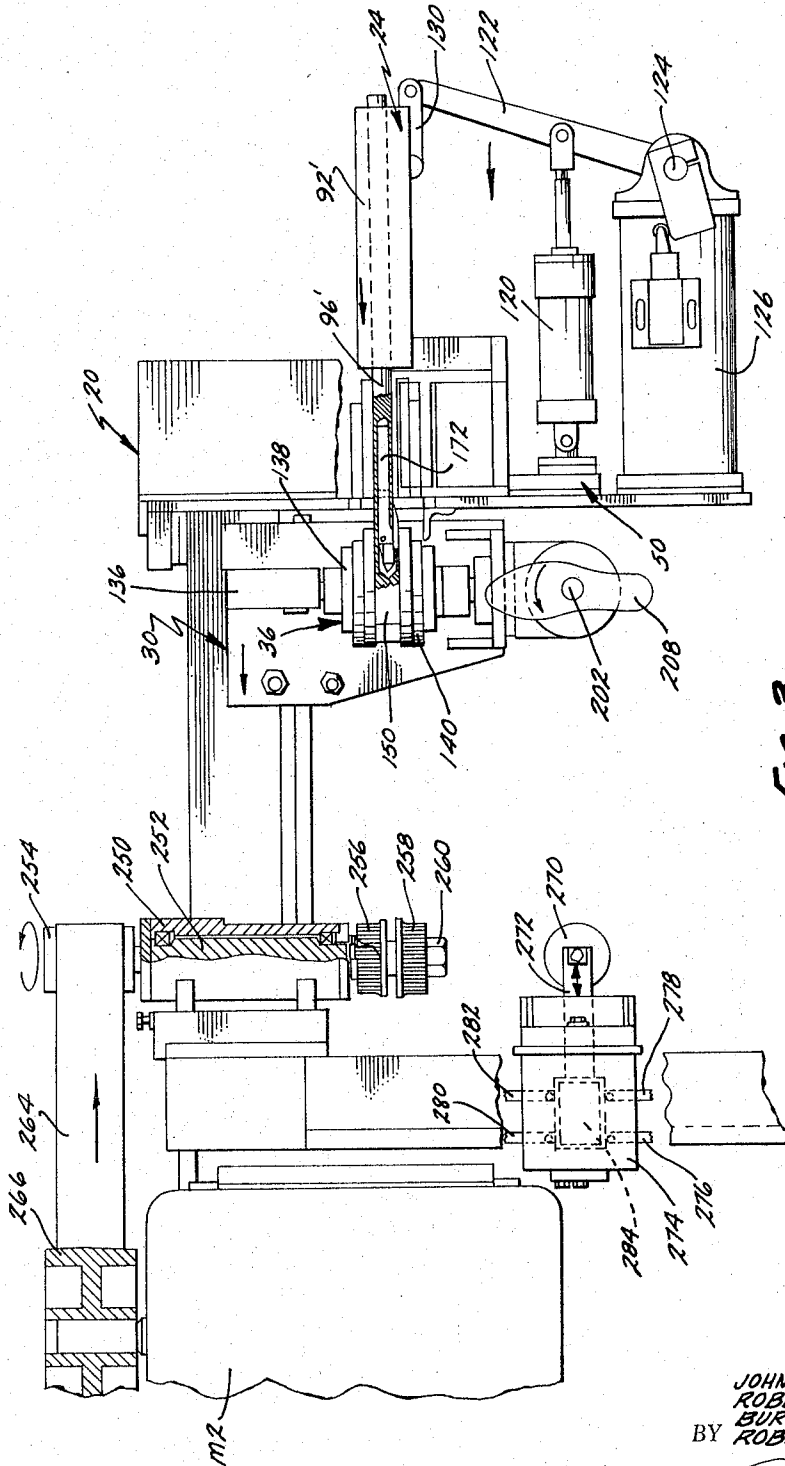
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8 Sheets-Sheet 3



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8 Sheets-Sheet 1

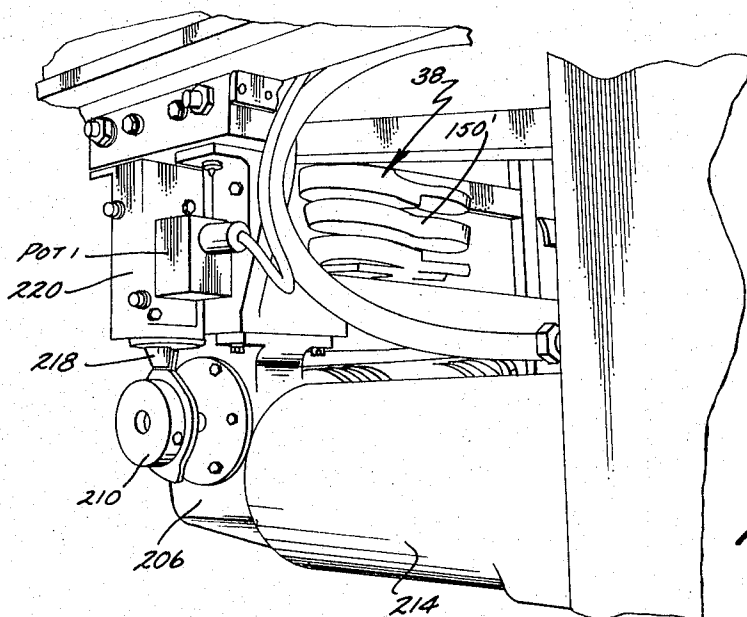


FIG. 5.

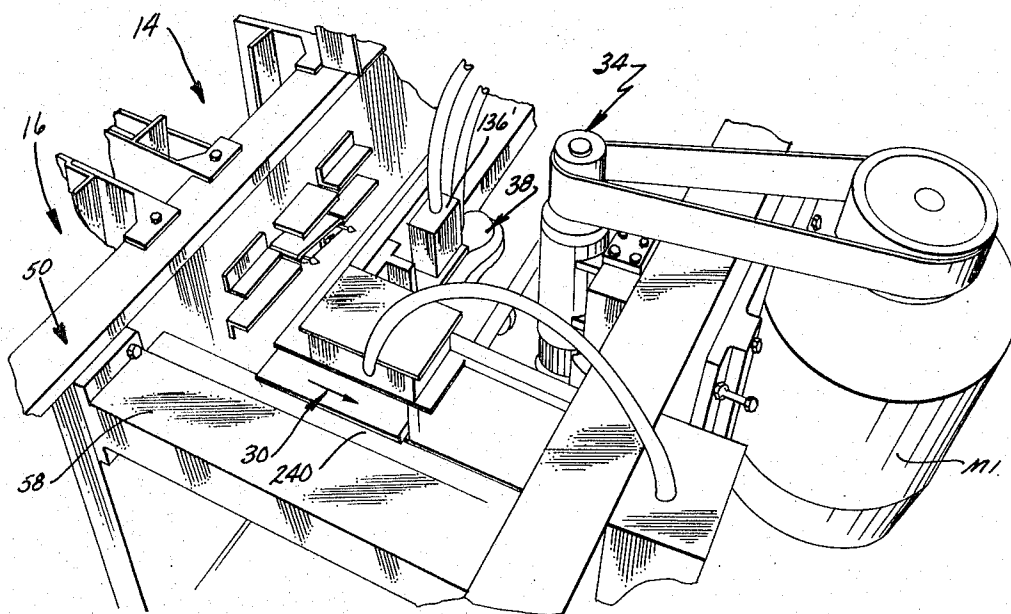


FIG. 6.

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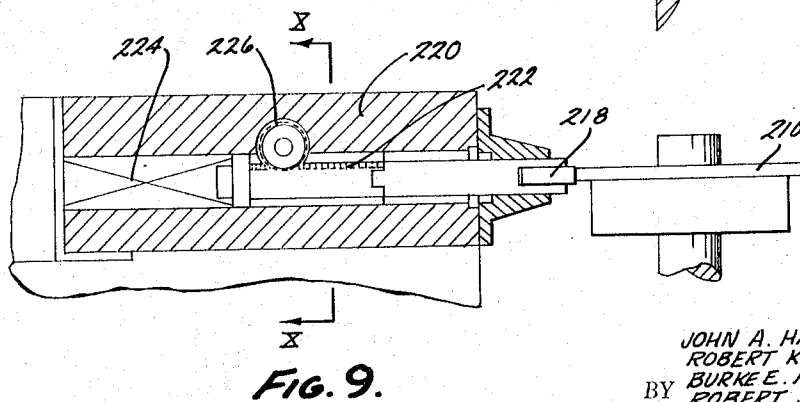
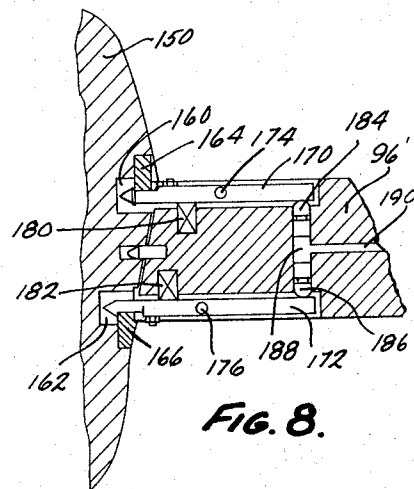
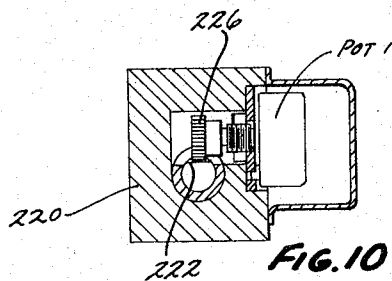
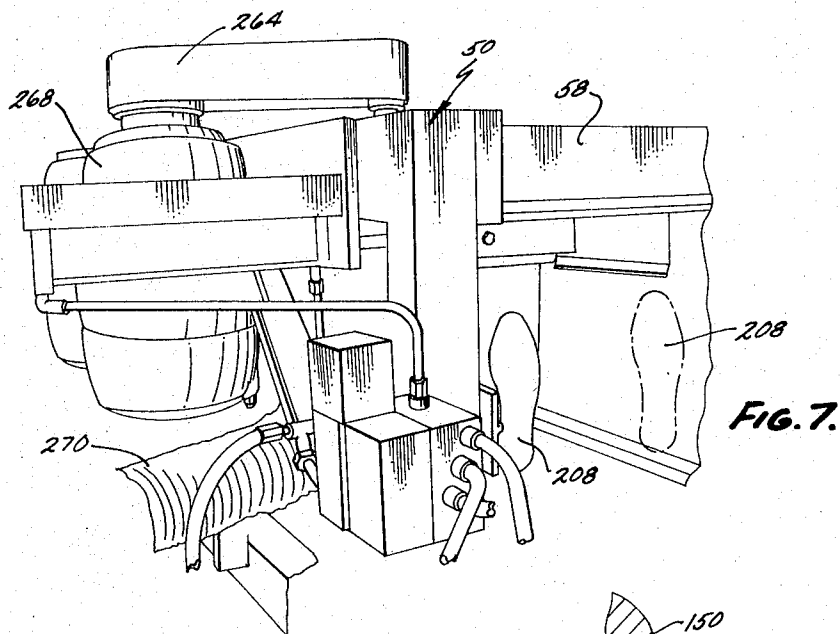
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8 Sheets-Sheet 5



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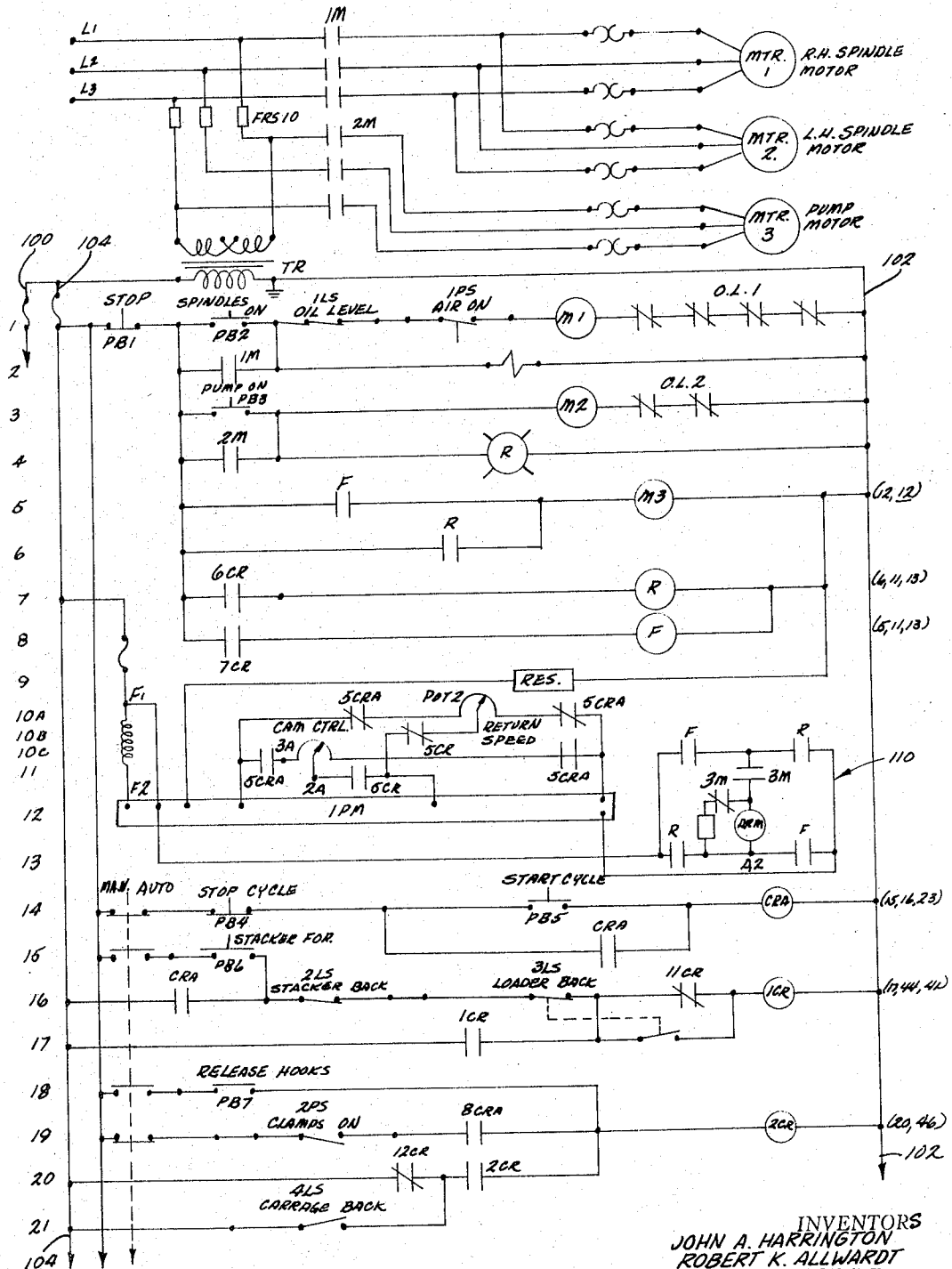
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8 Sheets-Sheet 6



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3,299,455

HEEL AND SOLE TRIMMER

Filed Oct. 26, 1964

8 Sheets-Sheet 7

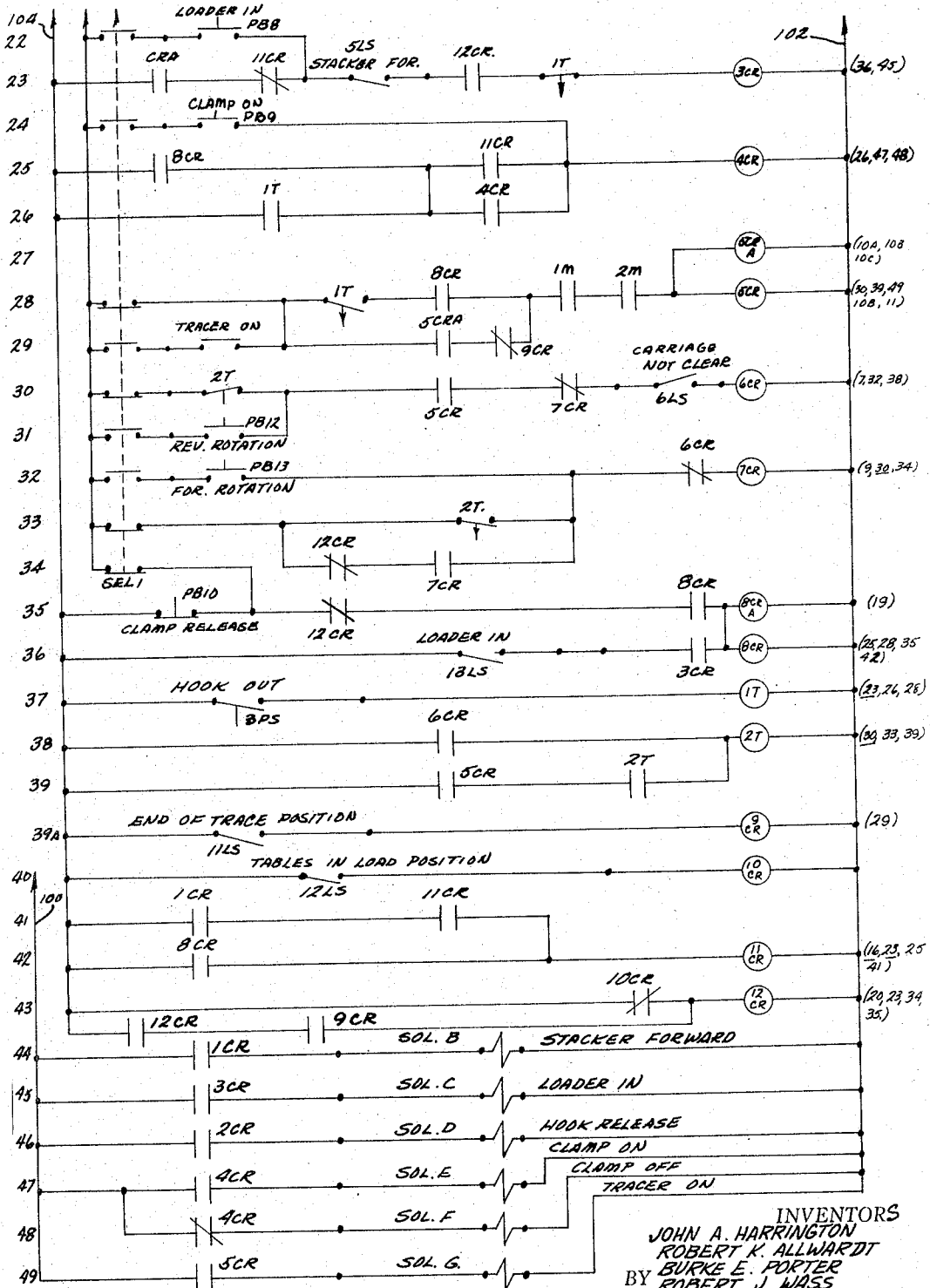


FIG. 11B.

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8 Sheets-Sheet 8

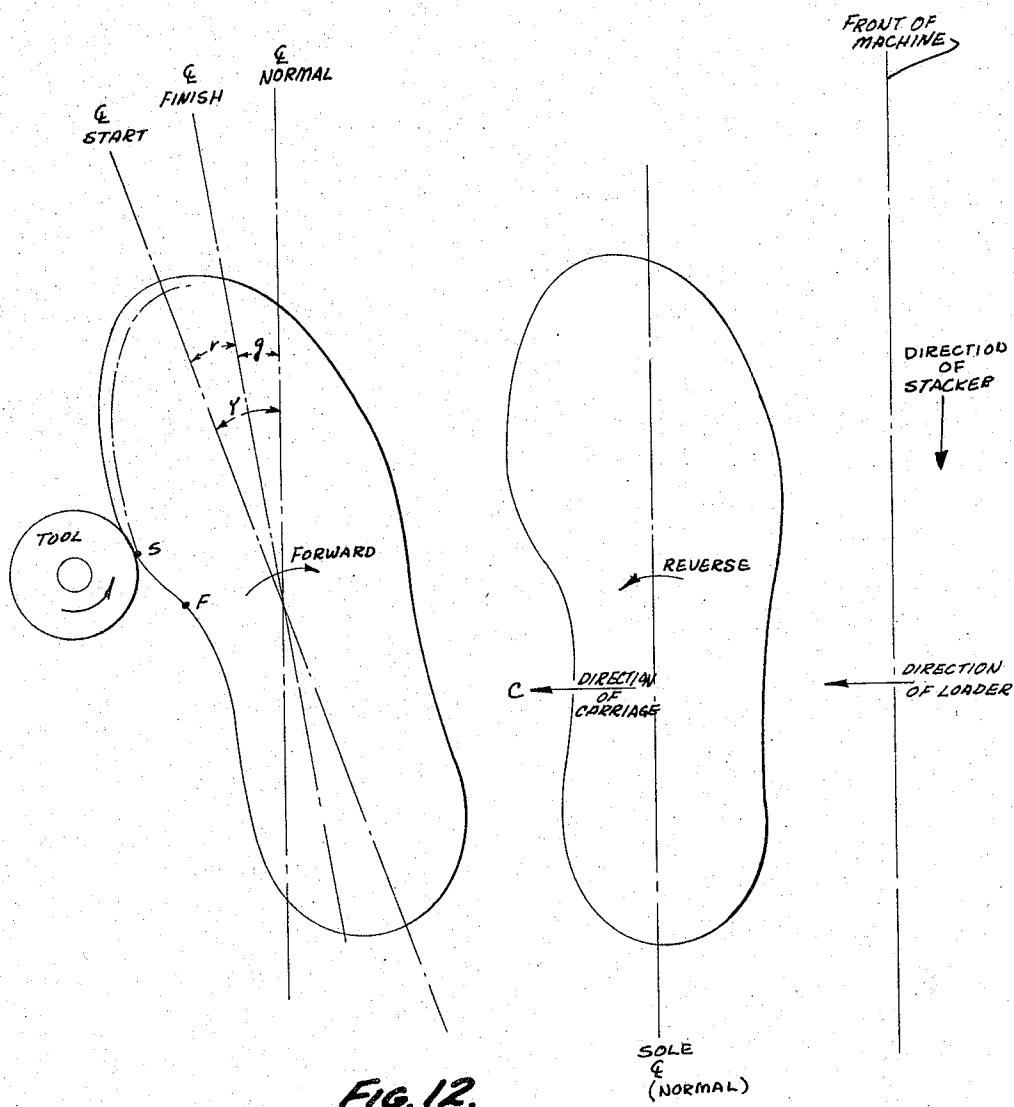


FIG. 12.

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HEEL AND SOLE TRIMMER

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Filed Oct. 26, 1964, Ser. No. 406,234

15 Claims. (Cl. 12—87)

This invention relates to a shoe sole and heel trimming machine, and more particularly to apparatus for automatically peripherally trimming a plurality of shoe soles with or without attached heels, prior to attachment thereof to the shoes.

The soles and heels on shoes are altered during manufacture from a rough edged, coarsely cut workpiece to accurately shaped smooth edged elements having a curved upper edge corner. Although various devices have been made heretofore to achieve this change automatically, to date no apparatus has been devised which is really capable of accurately reproducing the hand work of skilled edge trimmers on a high speed, multiple unit production scale.

Several problem areas occur with efforts to peripherally machine the sole. These include the small radius toe and heel area which present real machining problems. Ordinarily the skilled trimmer must exert extra special care to achieve accuracy here. Also, the machined edge must be uniform and smooth all the way around, yet the edge portion where the cutter originally starts is often gouged deeper or alternatively left with a protrusion. Consequently, shoe manufacturers today regularly employ hundreds of highly skilled, highly paid, edge trimmers to achieve the unique contoured finishing operation, by holding each shoe edge against a high speed trimming wheel.

It is an object of this invention to provide a unique machine capable of trimming shoe soles and heels on a mass production basis, yet extremely accurately, and to do so without the need of skilled workers.

It is another object of this invention to provide a refined sole edge trimming apparatus achieving accurate, smooth edge trimming without any cutting gouges resulting, not even at the edge portion initially contacted by the revolving cutter, or even at the small radius toe and heel edges.

Another object of this invention is to provide a sole edge trimming apparatus effecting the desired rounded upper edge corner by trimming simultaneously with edge trimming, yet while holding and trimming a plurality of soles simultaneously.

Other objects will be apparent to those having ordinary skill in the art upon studying the following specification in conjunction with the drawings in which:

FIG. 1 is a perspective view of the front and one end of the novel apparatus;

FIG. 2 is a plan view of the apparatus;

FIG. 3 is an end fragmentary elevational view of the apparatus, viewed from the opposite end as that shown in FIG. 1;

FIG. 4 is a fragmentary, sectional, elevational view taken on plane IV—IV of FIG. 2;

FIG. 5 is a fragmentary elevational view taken from the direction V indicated in FIG. 1;

FIG. 6 is a fragmentary perspective view taken from the direction VI indicated by the arrow in FIG. 1;

FIG. 7 is a fragmentary perspective view of the end of the apparatus illustrated in FIG. 3, but showing the carriage shifted into trimming condition;

FIG. 8 is a plan, enlarged, sectional view of the sole spacer and spacer hooking mechanism of the apparatus;

2

FIG. 9 is a sectional view of the speed control timing mechanism illustrated in FIG. 5 of the apparatus;

FIG. 10 is a sectional view of the apparatus in FIG. 9 taken on plane X—X;

FIGS. 11A and 11B cooperatively form a schematic circuit diagram of the control system for the apparatus;

FIG. 12 is a diagrammatic plan representation of a sole trimming tool during operation steps.

Referring now specifically to the drawings, the complete sole trimming machine 10 (FIG. 1) basically is a double mechanism with a pair of like areas including two stackers, two loaders, two forming tools mounted on two spindles, etc. It will be obvious from a study of the following description that one of these could be employed at a time, or alternatively, more than two.

Framework

Supporting structure for this machine may be varied in detail. In this instance it comprises an elongated structure 50 made up of tubular frame stock which includes a plurality of four vertical corner legs 52, upper and lower cross supports 54 in the back and 56 in the front, and transverse interconnecting beams 58 between the front and back frame portions. The stacking and loading occurs adjacent the front end of the framework while the trimming occurs within the confines of the framework adjacent the back and thereof.

Stack retention means

Four stacks of joined untrimmed shoe soles and heels are included on the particular form of the machine illustrated. The stack retention means 14, 16, 20 and 22 are formed by a plurality of vertical end plates. For example, plates 60 and 62 form the end of stack holder 16, supplemented by a pair of front flange plates 64 and 66 connected transversely thereto. The stack holders cooperate in pairs, i.e. 14 and 16, and 20 and 22. In each pair one retains right foot soles, e.g. S1, and the adjacent one retains left foot soles, placed bottom side up. In practice, these retention means are kept filled by a workman who inserts them from the top. The first pair of stack retainers 14 and 16 is for the first loader mechanism 18, and the second pair of stack retainers 20 and 22 is for the second loader mechanism 24. Both loaders 18 and 24 are cooperative with a common carriage 30 which shifts toward and away from the trimming or forming means 32 and 34 in controlled fashion. Each of the loaders is of the same internal construction, as are each of the clamping means 36 and 38 on opposite ends of carriage 30. With this apparatus, the stacked shoe soles are placed in the clamping means in pairs of one "upper" and one "lower," and are advanced on the carriage into engagement with the stationary but revolving work forming means.

Stacker advance means

For convenience one advance means is utilized for all four stacks. Actually, the soles in the stacking retention means 16 and 22 are shifted laterally first before being advanced to the clamp. Stacks 14 and 20 are directly in line with the respective loading means. The stack shifting means moves laterally, transverse to the direction of the loading means. More specifically, it shifts soles S1 and S3 (FIG. 2) across the front of the machine to place them directly beneath soles S2 and S4. This is achieved with a fluid cylinder 70 affixed to the framework in the front, and having its extended rod 72 (FIG. 1) attached to a slider 74. The slider has a vertical pushing surface 86 adjacent stack 16 and a vertical pushing surface 88 adjacent stack 22. It shifts on fixed guide rods 76 to push one sole from the bottom of stack 16 and one from the bottom of stack 22 into the loader. This shifter is

shown in its retracted position in FIG. 2 and in its extended position in FIG. 1.

Loaders

Each of the loaders 18 and 24 comprises a reciprocable device having a pair of side plates, for example plates 90 and 92 (FIGS. 1 and 2) on loader 18. The inner ends of these plates serve to push a pair of aligned upper and lower soles (in the position of S2 in FIG. 2) into the clamping mechanism 38 (FIGS. 2, 5, and 6). A fixed support plate 96 (FIGS. 1 and 2) is mounted beneath sides 90 and 92 to guide the upper and lower soles from the front of the framework into the clamping mechanism while holding them in spaced relation. The side plates move past fixed plate 96. These plates 90 and 92 are interconnected by supports 94 (FIG. 1). These elements are shifted by fluid cylinder 120 (FIGS. 1 and 3) mounted at one end to the frame and at the opposite end to a crank arm 122 intermediate its ends. This crank is mounted on a pivot axis 124 on an extended support 126 at its lower end, and pivotally connected to loaders 18 and 24 on the upper ends by respective clevises 128 and 130. Loader 24 includes corresponding side plates 90' and 92', with intermediate fixed element 96', and connecting plate 94'.

Clamping mechanism

Each of the clamping mechanisms 38 and 36 is basically of the construction illustrated in FIGS. 3 and 4. For example, clamping mechanism 36 includes a vertical fluid cylinder 136 attached to carriage 30, and having its rod extend out the lower end thereof. The rod is mounted to upper clamp plate 138. The lower clamp plate 140 is attached to a collar 142 having its shaft extend down through the base of carriage 30 into a differential gear housing 144. As illustrated in FIG. 4, the clamp plate 138 includes a subplate 139 shorter than plate 138 so that the two can interfit with a shoe sole and heel combination S2. The lower plate 140 also includes an upper subplate 141 which enables it to interfit with the connected sole and heel S1. Between these two plates and between the right and left soles is a special spacer plate 150. This spacer plate is shaped like the soles to be trimmed, except smaller in diameter, as are the clamping plates. It has a unique interfit with the respective guide and support plates 96 and 96' for each clamping means 38 and 36.

Thus, referring to FIGS. 3 and 8, spacer plate 150 has along one of its sides a pair of female recesses 160 and 162, each including inserts 164 and 166 defining hooking ledges therein. These cooperate with a pair of spaced hooking fingers 170 and 172, both pivotally mounted to support 96' on vertical pivot axes 174 and 176. These hooking fingers have on the outer ends thereof a pair of hooks which cooperate with inserts 164 and 166 to retain the spacer 150 on the diagonal end of support 96', and specifically, on the extended ends of fingers 170 and 172.

These fingers are normally divergently biased from each other into hooking engagement with the inserts by a pair of compression springs 180 and 182. The fingers are shiftable toward each other against the bias of these springs by a pair of biasing, aligned, shiftable piston plugs 184 and 186 located in passage 188 transverse to support 96'. These engage the inner ends of the fingers on the opposite side of their pivot points from the hooks. Therefore, air pressure through passage 190 shifts these piston plugs outwardly, to shift the opposite hooking ends of the fingers inwardly to disengage the fingers from spacer 150. Spacer 150' on the opposite clamping means includes these same elements. Both are actuated in like manner through air lines 194 extending to passageway 190 (FIG. 1).

Clamp rotation drive mechanism

The lower clamping plates on each of the clamping mechanisms are rotatably driven. The upper clamping plates are rotatable with respect to clamping cylinders 136 and 136'.

The shafts 200 and 200' extending down from the bottom plates of the clamping mechanisms (FIG. 4) extend down into the differential gear box housings 144 and 144'. An elongated shaft 202 extends through both of these differentials. It is supported on bearing 204 attached to the carriage on one end, and gear box 206 attached to the carriage on the opposite end (FIGS. 2 and 5). Mounted to the extended end of shaft 202 is a vertical template 208 shaped like the final trimmed sole.

On the opposite end of the shaft is a two lobed rotational cam 210 (FIG. 5) and (FIG. 4). Gear box 206 also receives the drive shaft of an electric motor 214 attached to carriage 30. This motor is driven electrically by power which passes through a potentiometer or rheostat POT1 (FIGS. 5, 9, and 10). This potentiometer is controlled by movement of cam 210. More specifically, as the cam rotates, it reciprocates cam follower 218 (FIG. 5) within housing 220 to reciprocate gear rack 222 (FIGS. 9 and 10), which is biased outwardly toward the cam by a compression spring 224. Longitudinal movement of the gear rack causes rotational movement of a spur gear 226 intermeshed with the rack. This spur gear is mounted on a shaft of the potentiometer POT1 to rotate it and thus vary the current to motor 214.

It will be noted that the cam has two elongated lobes generally opposite to each other, especially configured, and intermediate portions of less radial extent. Depression of cam follower 218 into the housing by these individual lobes increases the resistance of the potentiometer, and thus decreases the power to motor 214 to slow its action. Consequently, this decreases or increases the rotational speed of the output shaft of the motor and thus of the main clamp rotation drive shaft 202 from this motor. Thus, rotation of the clamping mechanism is controlled in speed throughout the entire revolution.

Motor 214 is reversible. It is initially operated for a fraction of a revolution of the clamping mechanism in reverse direction, and then subsequently operated for the fraction plus a total 360° revolution, to achieve a smooth cutting action. The cutting tools contact the soles when the soles are moving in the forward rotation and the tools start in on a generally tangential basis. This is described more specifically hereinafter.

Template 208 on the opposite end of drive shaft 202 controls the carriage position with respect to the forming tools at rotation occurs, in respect to the clamping means rotation. This also will be explained more fully hereinafter.

Carriage

Carriage 30 supports the clamping mechanisms, the drive means therefor, the driving motor, and the controlling rheostat. The carriage is elongated from end to end of the machine. It shifts back and forth between the front and rear of the frame. The opposite ends are slidable mounted on fixed track guideways 240 and 242 on the ends of the frame. The carriage has roller wheels 244 and 246 above and below each of these tracks. Its reciprocation is caused by fluid cylinder 250 attached fixedly to the back of frame 50 (FIG. 2), and having its rod 252 extending into engagement with the center of carriage 30, so that extension of the cylinder returns the carriage to its initial loading position, and contraction of the cylinder moves the carriage toward forming tools 32 and 34.

When the carriage is near the forming tools, its movement is controlled by template 208. More specifically, when the template moves from the phantom line position in FIG. 7 to the solid line position as the carriage is

moved into active trimming relationship, the template moves into engagement with a cam follower 270. The follower is rollably mounted on the end of a reciprocable shaft 272 extending into a tracer control valve 274. This valve has four main fluid connections 276, 278, 280 and 282 to opposite sides thereof, in pairs. Reciprocation of valve 284 by rod 272 opens and closes respective ones of these passageways to allow fluid flow from a pressurized source or pump to the opposite ends of cylinder 250 (FIG. 2) to controllably reciprocate the cylinder back and forth in "slave" fashion. Thus, as template 208 rotates, if cam follower 270 is pressed to reciprocate a small fraction of an inch inwardly of the valve, fluid pressure flow to the rear end of cylinder 250 is increased and that to the front end is decreased so that the cylinder extends a proportionate amount. This pushes the carriage 30 away from the forming tools the exact required amount. This follower or slave action is continuous, and activated by slight changes in pressure on the cam follower by the rotating template. Therefore, the carriage continually moves toward and away from the forming tools in exact controlled fashion as the clamping means on the retained soles and heels rotate adjacent the forming tools. Consequently, the position of the workpieces with respect to the fixed, but rotating forming tools is exactly and accurately controlled.

Forming tools

Two forming tool mechanisms 32 and 34 are here utilized, as explained previously. Each comprises a rotational spindle assembly including an outer housing 250 affixed to the back of the framework, and an inner rotational shaft 252 supported on bearings in the housing. A drive pulley 254 is attached to the upper end of the shaft. A pair of spaced rotational cutters 256 and 258 is secured to its lower end of the shaft by nut 260. Each of these cutters includes a plurality of cutting teeth. The upper cutter 256 has an outwardly curved and projecting lower cutting edge. The lower cutter has an outwardly curved and projecting upper cutting edge. The edges are spaced from each other an amount sufficient to curve the edges of the spaced clamped soles as the peripheral edge is being trimmed. This enables the upper and lower clamped soles on the clamping mechanism to not only be peripherally trimmed, but edge beveled at the same time with the smooth required curvature.

The pulleys for the spindles are driven by belts 264 from motor pulleys 266 of a pair of electrical motors M1 and M2. Suitable ventilating flexible ducts 270 may be employed adjacent each of the cutters.

Circuit

The circuitry illustrated in FIGS. 11A and 11B will be described in relation to one operational sequence thereof. From this, the circuit diagram will be relatively obvious to one having ordinary skill in the art. (The complete circuit may be formed for study by placing the sheet containing FIG. 11A above the sheet containing FIG. 11B and aligning the arrows.)

The circuit includes two spindle motors M1 and M2 and a fluid pump motor, M3. These are connected across three lines L1, L2 and L3 of 440 volts, three phase, sixty cycle power. These lines are also connected across transformer TR to supply lower voltage power to the control circuitry. The leads 100 and 102 supply power to the various relays and other switching mechanisms controlling the circuitry.

The machine is started by actuating the spindles with push button switch PB2, which is in electrical series with an oil level safety switch 1LS, air pressure safety switch 1PS, actuating relay 1M, and normally closed overload relays OL-1. Relay contacts 1M in line 2 of the circuit activate solenoid A to open a valve for the lubricant.

Also, push button switch PB3 is depressed to activate the hydraulic pump, which is in electrical series with

relay contacts 2M and normally closed overload relays OL-2. Relay 2M actuates its contacts to hold it in circuit. An indicator light 106 is then lit.

Push button switch PB5 in line 14 is closed to start the operating cycle. (For convenience, each line of the circuit is numbered, i.e. 1-49. As indicated on the right-hand side of each individual line, when a particular relay in that line is activated, it closes or opens contacts in other respective lines indicated in parentheses.) Therefore, when relay CRA is activated, it closes contacts in lines 15, 16 and 23. The contacts in line 15 hold the circuit in when switch PB5 is released. In line 16, the circuit across the normally closed relay contacts 11CR is completed to activate relay 1CR. This in turn closes its contacts in lines 17, 41, and 44. The closed contacts in line 17 hold the relay in. Line 44 includes solenoid valve B which is actuated and allows fluid pressure to be exerted on the rear end of stacker cylinder 70, causing the stacker to move forwardly across the front of the machine and shift two soles S1 and S3 from under the stacks in holders 16 and 22 to a position under plates 96 and 96', and under and spaced from soles S2 and S4.

As the stacker moves, it closes limit switch 5LS in line 23. If the tables are then in the proper load position, i.e. the clamps and their spacer plates are properly oriented, limit switch 12LS in line 40 would be closed. This holds relay 10CR closed. Contacts 10CR in line 43 then being closed, relay 12CR is active. This closes contacts in line 23, which then completes a circuit, providing limit switch 5LS is closed by the shifter.

When the stacker is forward, it closes limit switch 5LS to actuate relay 3CR. Relay contacts from 3CR close line 45 to actuate solenoid C, causing the loader to move in, shifting the soles into the clamping mechanism. (Relay contacts of 3CR in line 36 serve a safety purpose to prevent this line from closing prior to actuation of these contacts.) Once the loader is in, it closes limit switch 13LS in line 36. This closes the circuit to actuate relay 8CR and 8CRA.

Relay 8 CR locks itself in through the contacts in line 35. The contacts in line 19 are closed also. Contacts closing in line 42 bring in relay 11CR to close its contacts in line 25. Since the contacts 8CR in line 25 are closed, the relay 4CR in line 25 is actuated. It closes its contacts in line 47 to actuate the clamps through solenoid valve E controlling the clamping fluid cylinders. The contacts 4CR in line 26 lock in this relay.

The relay 11CR holds itself in through contacts 1CR in line 41, once relay 11CR is brought in by relay 8CR. Shifting of the clamps closes the limit switch 2PS in line 19. This brings in relay 2CR since contacts 8CRA were previously closed. Closing of contacts 2CR in line 20 does not close this circuit since contacts 12CR in this line are still open, and limit switch 4LS in lines 21 is open since the carriage has not yet moved and returned.

Closing of contacts 2CR actuates solenoid valve D in line 46 to unhook the hooking fingers from the spacers or separator plate in the clamping mechanisms. As the hooks move out they actuate limit switch 3PS in line 37, and actuate timer IT to delay carriage movement momentarily and give the hooks time to move out first. Closing of the contacts IT in line 26 occurs and relay 4CR is interlocked in to hold this circuit, since the relay 8CR will subsequently be dropped out.

After a small time interval, the relay timer IT opens in line 23 to drop out relay 3CR in this line and cause the loader to return to its initial position. Once it has returned, it opens its switch in line 17 which it previously closed, allowing the stacker to return. The stacker is purposely held in until the loader returns, since return of the loader transverse to the stacker plate would cause a conflict of the mechanism.

The timer relay IT closes the contacts in line 28. Since the spindle motors are running, causing the contacts of

7

1M and 2M to be closed, this brings in relays 5CR and 5CRA in line 28. (Relay 8CR is already actuated.) Relay 5CRA holds itself in through its contacts in line 29. It also activates the solenoid valve G in line 49 to turn the tracer mechanism on, to control carriage movement adjacent the cutters.

The relay contacts in line 30 actuate relay 6CR if the carriage is clear so that limit switch 6LS is closed. This starts the reverse rotation of the drive motor for the clamping mechanism since it brings in the motor starter R in line 7, causing the motor to move in reverse direction.

Referring to FIG. 12, this reverse movement turns the soles from the position in which their centerline is normal to the direction of carriage movement (shown by arrow C), to a position where the centerline is at a "start" position a small acute angle "y" from the normal centerline position. This reverse rotation occurs while the carriage is moving from the front of the machine toward the rotating tool. This initial, small, angular movement in the reverse direction, occurring as the carriage is moving across and prior to contact of the soles with the trimming tools, is initiated by the limit switch 6LS in line 30, as soon as the carriage moves away from the front of the machine. The total angular movement is limited and controlled by timer 2T which is actuated by the contacts 6CR and held in by contacts 5CR in lines 38 and 39. Actuation of the starter relay in line 7 brings in the power to motor M3 in lines 6 and 7, and controls the current direction flow through the motor armature ARM in line 12 by actuating the contacts R in lines 10a, 10b, 10c, 11 and 12. Simultaneously, closing of the contacts of 5CR and 5CRA in lines 10a, 10b, 10c, and 11 throws in the potentiometer POT1 which controls the rotational speed of the mechanism in reverse direction.

Potentiometer POT2 is not yet actuated. It is subsequently actuated when the machining is done and the sole is being returned to its proper alignment as will be explained hereinafter.

At the end of the reverse movement, relay 7CR is brought in in line 32, which causes actuation of motor starter F in line 9 to cause forward actuation of the motor armature. It then moves in the forward rotational direction, or i.e., the opposite rotational direction as originally, to cause machining. This rotational movement occurs just as the sole is contacting the rotating spindle cutter. The cut starts on a generally tangential basis from point "S" (FIG. 12) to feed in gradually. The rotational speed again is controlled in response to the cam mechanism. The sole then rotates an entire revolution from the point at which it started to machine, and a small angle "y" further, to end up at "f." This is necessary for complete machining, since the initial cut on the sole was introduced on a tangential basis and did not remove all of the stock adjacent point "S." Consequently, the cutter must move over and past this same area at the end of the trimming action, to clean off the stock remaining.

However, when the machining is finished, the sole is still not accurately aligned with its centerline normal to the direction of carriage movement, to return properly to the initial loading position. The centerline of the sole is still at a small acute angle "q" with respect to its necessary centerline position to engage the spacer plates with the hooking fingers. This is because the machining overlap angle "q" in excess of one complete revolution is not quite as large as in the initial reverse direction "y" angle that the clamp was rotated in reverse prior to starting the actual cut on the sole. Thus, as the carriage returns back to the loading position, the remaining small angle "r" is covered by further forward rotation of the soles and clamps, to be accurately aligned. Referring to the circuit, at the end of the trace, in other words when the trimming is complete, the limit switch 11LS in line

8

39a is closed to actuate relay 9CR. Then, if the contacts of relay 12CR and 8CR are de-energized, the relays 5CR and 5CRA in line 28, 29 and 27 will be dropped out. Even though timer 2T is out in line 33, relay contacts 12CR and 7CR in line 34 will carry the rotation on around until the sole centerline is exactly normal to the direction of carriage movement. The clamps are then in the proper loading position as the carriage returns. The sole is always accurately aligned with the loader mechanism as it returns. The potentiometer POT2 takes over during this return carriage movement to slow down the speed of clamp rotation during the few degrees of angle "r." The alignment must be exact and, the regular rotation of the sole during this part of the cycle would be too rapid under the control of potentiometer POT1 to stop it in exact position.

When the carriage moves back, so that limit switch 4LS in line 29 is closed, this allows the finger hooks to drop back in by de-actuation of solenoid D with de-actuation of relay 2CR. When the hooks move out, they shift the limit pressure switch 3PS in line 37 to de-actuate timer IT, and thereby release the clamps through solenoid F by releasing relay 4CR in lines 25 and 26. Thus, the machine is ready for another cycle to occur by shifting of the stacker fluid cylinder again.

During this operation, the exact reciprocable position of the carriage and thus of the clamps and soles is accurately controlled. The direction of the rotational movement is also thus accurately controlled with respect to the reciprocable position and the position of rotation, so that all of the stock is neatly machined off the soles without gouges, protrusions, machining lines, etc.

During actual machining or trimming, the rotational speed is also controlled in variable speed fashion due to the follower response of the previously described cam and potentiometer POT1 as certain portions of the periphery of the sole are machined. This enables the two carefully shaped opposite cam lobes (FIG. 5) to shift the potentiometer and apply a greater electrical load resistance in the circuit to the motor armature at certain times. This slows the sole rotating motor down as the toe and heel portions contact the machining cutters. This is purposely done since the radius of curvature is small in these areas and machining is very delicate. It has been found that by slowing the feed rate down in these areas, in this controlled variable fashion, excellent results occur. The cam accelerates the rotational motion to higher speeds by decreasing the resistance to the motor along the fairly large curvature side edges of the soles.

During this machining operation, therefore contact of template 208 with follower 270 of slave valve 274 constantly shifts the carriage and thus the soles and clamps back and forth small controlled amounts to and from the rotating cutters. This is in synchronism with the rotational speed controlling mechanism, since template 208 and speed control cam 210 are mounted on opposite ends of the same shaft 202 (FIG. 4).

Operation

Although the operation of the machine will be fairly obvious from the above description, a brief outline thereof is presented to be thorough.

When utilizing the mechanism, the series of steps can be activated manually using the manual selector switches illustrated in the circuit diagram, or may be achieved automatically with the relay circuitry described above.

The workman need not be skilled but merely needs to keep the stacks 14, 16, 20 and 22 filled with respective upright and inverted left and right shoe soles and attached heels. With the spindles started, the pump motor on, and potentiometer POT2 preset to control the return speed on the clamp driving mechanism, the cycle is started by pushing push button 5 to begin the operation. The lower soles S1 and S3 in stacks 16 and 22 are shifted across the front of the machine by cylinder 70, and the loader is

reciprocated inwardly toward the machine by actuation of cylinder 120 to push the two pairs of upper and lower soles into the two clamping mechanisms. Clamping cylinders 136 and 136' are then actuated to grip the soles and adjacent heels within the clamping plates and against the spacer plates. The hooking fingers (FIG. 8) are then released from spacer plates 150 and 150' by actuation of piston plugs 184 and 186 in each of supports 96 and 96'. The carriage is then reciprocated on its tracks from the front to the rear of the framework by actuation of cylinder 250.

When the carriage is part way across the space (as illustrated in FIG. 6), the tracer valve circuit is actuated, and also drive motor 214 (FIG. 5) is actuated in reverse to rotate the clamping mechanisms backward a fraction of a revolution. As the clamped shoe soles come into contact with the spinning cutting tools, motor 214 is timed to be shifted from reverse to forward direction to rotate the clamping mechanisms and soles forwardly. As the cutter contacts the shoe soles it does so on a tangential basis, with increasing bite, rather than moving directly into the shoe sole on a perpendicular plane.

The drive mechanism rotates the clamping mechanisms and soles a complete revolution plus a fraction of revolution further. Thus, as the cut nears its completion, it has the tapered portion to machine last and provides a neat feathered edge at the termination of the cut. It has been found with this mechanism operating thusly, no ridge is left on the soles at the end of the cut, and no gouges are made in the soles at the beginning of the cut. As the soles are rotated, moreover, they are not only shifted toward and away from the cutter with precision due to the slave-follower valve control using template 208, but also the speed of rotation of the clamping mechanism is exactly controlled as previously indicated, so that, when the cutter is machining the elongated side edges of the soles it can move rapidly due to the relatively straight line action. As it approaches the sharp bends at the toe and heel, the cutting action is slowed controllably and variably with cam mechanism 210 controlling potentiometer POT1 to motor 214. Thus, in these areas where difficulty was previously encountered and rough cutting was caused, the novel machine achieves a smooth, efficient and completely accurate surface, with no difficulty of the slave-follower retaining complete machining control even though the work is being reciprocated and rotated constantly and variably.

It has been found with repeated use of the machine that the trimming is extremely accurate time after time. Since the spacers position the upper and lower soles apart with respect to the cutters, the latter can form the curved edge corner on the soles in required fashion. The spacers enable at least two soles to be machined simultaneously. If desired, conceivably several intermediate spacers could be employed to enable several spaced shoe soles and attached heels to move into a plurality or gang of cutters at spaced intervals like the two illustrated on each spindle.

It will be noted that the template is in a plane perpendicular to the plane of the shoe soles. It is also on the end of the machine out of the dirt and readily exchanged for another size template to suit the particular sole shape and size. This is achieved by the use of the hydraulic sleeve-follower system. Yet, it can be readily synchronized with the speed control mechanism on the same shaft.

It is conceivable that certain obvious structural or circuitry changes could be made in the particular details of the preferred form of the apparatus without departing from the concept presented. This apparatus achieves, as far as is known, the first practical, automatic multiple unit, shoe sole and heel trimming mechanism capable of trimming the complete periphery, while the stock rotates a complete revolution, and one cutter accomplishes the entire trim. Therefore, this invention is not to be limited merely to the specific preferred structures shown in the

drawings, but only by the scope of the appended claims and the reasonably equivalent structures to those defined therein.

We claim:

1. Apparatus for trimming shoe soles comprising: a framework; rotatably driven forming tool means mounted in one position on said framework; sole clamping means; a carriage supporting said sole clamping means and movably mounted on said framework for reciprocation toward and away from said forming tool means; powered carriage shifting means between said framework and said carriage; said clamping means being rotatably mounted to said carriage; rotational drive means operably connected to said clamping means including means to rotate said clamping means complete revolutions at a time; motion controlling template means drivingly connected to said rotational drive means, and template follower control means operably associated in control relationship with said powered carriage shifting means, to controllably reciprocate said clamping means with respect to said forming tool means during rotation of said clamping means.

2. Shoe sole trimming apparatus comprising: supporting framework; forming tool means rotatably mounted to said framework, and including drive means therefor; a carriage shiftable mounted to said framework to move toward and away from forming tool means; carriage shifting means; sole clamping means on said carriage engageable against opposite faces of soles, and shiftable with said carriage; clamp actuating means; a rotatable connection between said clamping means and said clamp actuating means; rotating means for said clamping means; and template control means operably associated with said rotating means and with said carriage shifting means to control the rotation and shifting of said clamping means with respect to said forming tool means.

3. Apparatus for trimming shoe soles comprising: a framework; rotatably driven forming tool means mounted on said framework; sole clamping means; a carriage supporting said sole clamping means and movably mounted on said framework for movement toward and away from said forming tool means; powered carriage shifting means between said framework and said carriage; said clamping means being rotatably mounted on said carriage; rotational drive means operably connected to said clamping means; motion controlling template means drivingly connected to said rotational drive means; template follower means operably associated with said template means and in control relationship with said powered carriage shifting means, to controllably shift said clamping means with respect to said forming tool means during rotation of said clamping means; power motor means operably connected to said rotational drive means to rotate said drive means and said clamping means an entire revolution; and rotational control means actuable with carriage shift toward said forming tool means and operably associated with said rotational drive means to initially cause rotation of said clamping means in reverse direction for a fraction of a revolution prior to positioning of said clamping means adjacent said forming tool means, and subsequent forward rotation thereof for a complete revolution plus a fraction.

4. Apparatus for trimming shoe soles comprising: a framework; rotatably driven forming tool means mounted on said framework; sole clamping means; a carriage supporting said sole clamping means and movably mounted on said framework for movement toward and away from said forming tool means; powered carriage shifting means between said framework and said carriage; said clamping means being rotatably mounted on said carriage; rotational drive means operably connected to said clamping means; motion controlling template means drivingly connected to said rotational drive means; template follower means operably associated with said

11

template means and in control relationship with said powered carriage shifting means, to controllably shift said clamping means with respect to said forming tool means during rotation of said clamping means; power motor means operably connected to said rotational drive means to rotate said drive means and said clamping means; rotational cam actuated electrically responsive speed control means electrically associated with said power motor means and responsive to positioning of said rotational drive means and said template means to lower the power input to and thus the rotational speed of said power motor means at the toe and heel areas of the soles, and increase the power input and thus the rotational speed along the side edges of the soles.

5. Apparatus for trimming shoe soles comprising: a framework; rotatably mounted and driven forming tool means mounted on said framework; sole clamping means; a carriage supporting said sole clamping means and movably mounted on said framework for movement toward and away from said forming tool means; powered carriage shifting means between said framework and said carriage; said clamping means being rotatably mounted on said carriage; rotational drive means operably connected to said clamping means; motion controlling template means drivingly connected to said rotational drive means; template follower means operably associated with said template means and in control relationship with said powered carriage shifting means, to controllably shift said clamping means with respect to said forming tool means during rotation of said clamping means; power motor means operably connected to said rotational drive means to rotate said drive means and said clamping means; rotational directional control means actuatable with carriage shift toward said forming tool means and operably associated with said rotational drive means to initially cause rotation of said clamping means in reverse direction for a fraction of a revolution prior to positioning of said clamping means adjacent said forming tool means and subsequent forward rotation thereof for 360° plus said fraction; and rotational speed control means operably associated with said power motor means and responsive to positioning of said template control means to lower the speed of said power motor means at the ends of the soles and increase the speed along the side edges of the soles.

6. Apparatus for trimming shoe soles comprising: a framework; rotatably driven forming tool means mounted on said framework; sole clamping means; a carriage supporting said sole clamping means and movably mounted on said framework for movement toward and away from said forming tool means; powered carriage shifting means between said framework and said carriage; said clamping means being rotatably mounted to said carriage; rotational drive means operably connected to said clamping means, and motion controlling template means drivingly connected to said rotational drive means and operably associated in control relationship with said powered carriage shifting means, to controllably shift said clamping means with respect to said forming tool means during rotation of said clamping means; said clamping means comprising a pair of spaced plates and an intermediate spacer; cooperative gripping means between said framework and said spacer to support said spacer with separation of said plates; and release means on said gripping means actuated prior to shifting of said carriage.

7. The apparatus in claim 6 wherein said gripping means comprises a pair of hooking elements and cooperative receiving sockets and said release means comprises powered biasing means for said elements.

8. The apparatus in claim 6 including sole loading means shiftable against a pair of soles to shift them into said clamping means and having a support plate aligned with said spacer plate.

9. Apparatus for trimming shoe soles comprising: a

12

framework; forming tool means rotatably mounted on said framework, and drive means therefore; a carriage supported on said framework and shiftable toward and away from said tool means; a pair of spaced sole clamping plates mounted on said carriage and a spacer plate therebetween; a pair of sole stack retention means on said frame for right and left foot soles; sole shifting means aligned with the bottom of one of said pair of retention means and directed toward the other of said retention means; sole advancing means cooperative with the bottoms of the other of said retention means and shiftable toward said plates; a guide platen in said other retention means and aligned with said spacer plate; gripping and support hooking fingers extending from said platen; finger receiving openings in said spacer plate; finger shifting release means operably associated with said fingers, allowing release of said spacer plate therefrom; clamping plate reciprocating means operably connected to one of said clamping plates; rotational drive means operably connected to the other of said clamping plates; power motor means operably connected to said rotational drive means to rotate said clamping means about a revolution at a time; motion controlling template means drivingly connected to said rotational drive means to revolve therewith; template follower means cooperatively associated with said template means to control reciprocal movement of said carriage and including a fluid flow control valve having a cam follower thereon engageable with said template means; fluid cylinder means operably connected to said carriage and operably associated with said valve to shift said carriage back and forth in proportion to shifting of said follower; rotational directional control means actuatable with carriage shift toward said forming tool means and operably associated with said rotational drive means to initially cause rotation of said clamping means in reverse direction for a fraction of a revolution prior to positioning of said clamping means adjacent said forming tool means and subsequent forward rotation thereof for 360° plus said fraction; and rotational speed control means including camming means driven by said rotational drive means; and said speed control means being electrically associated with said power motor means and synchronized with said template control means to lessen the speed of said power motor means when trimming the ends of the soles and increase the speed when trimming the side edges of the soles.

10. Apparatus for trimming shoe soles comprising: a framework; forming tool means rotatably mounted on said framework, and drive means therefore; a carriage supported on said framework and shiftable toward and away from said tool means; a pair of spaced sole clamping plates mounted on said carriage and a spacer plate therebetween; a pair of sole stack retention means on said frame for right and left foot soles; sole shifting means aligned with the bottom of one of said pair of retention means and directed toward the other of said retention means; sole advancing means cooperative with the bottoms of the other of said retention means and shiftable toward said plates; a guide platen in said other retention means and aligned with said spacer plate; gripping and support hooking fingers extending from said platen; finger receiving openings in said spacer plate; finger shifting release means operably associated with said fingers allowing release of said spacer plate therefrom; clamping plate reciprocating means operably connected to one of said clamping plates; rotational drive means operably connected to the other of said clamping plates; and power motor means operably connected to said rotational drive means to rotate said clamping means about a revolution at a time.

11. The apparatus in claim 9 wherein said rotational drive means include a drive shaft and a differential gear housing to said clamping means, and said template and said camming means are mounted to opposite ends of said shaft in planes normal to the planes of said clamps and clamped soles.

13

12. Apparatus for peripherally trimming shoe soles, comprising: rotatably driven trimming means, sole clamping means; shifting means to move said clamping means and trimming means varying controlled amounts together and apart to trim clamped soles; rotational drive means operably connected with said clamping means to expose the periphery of the soles to said trimming means; template guide means operably associated with said shifting means; and rotational speed control means operably associated with said template guide means and said rotational drive means, pre-set to lessen rotational speed thereof during trimming of the heel and toe areas of the soles, and to increase rotational speed along the side edges of the soles.

13. Apparatus for peripherally trimming shoe soles comprising: rotatably driven trimming means; sole clamping means; shifting means to move said trimming means and clamping means varying controlled amounts together and apart; reversible rotational drive means operably associated with said clamping means; rotational directional control means operably associated with said shifting means and said drive means, and responsive to movement of said trimming and shifting means together to initially cause rotation of said clamping means a small angle in one direction, and then in reverse direction with contact of said trimming means on the soles, for a complete revolution plus said small angle.

14. Apparatus for peripherally trimming shoe soles comprising: rotatably driven trimming means; sole clamping means; shifting means to move said clamping means and trimming means varying controlled amounts together

14

and apart to trim clamped soles; rotational drive means operably associated with said clamping means; template guide means operably associated with said shifting means to expose the sole peripheries to said trimming means; rotational speed control means operably associated with said template guide means and said rotational drive means and preset to lessen rotational speed thereof during trimming of the heel and toe areas of the soles, and to increase rotational speed along the side edges of the soles; rotational directional control means operably associated with said shifting means and said drive means, and responsive to movement of said trimming and shifting means together to initially cause rotation of said clamping means a small angle in one direction, and then in reverse direction with contact of said trimming means on the soles, for a complete revolution plus said small angle.

15. The apparatus in claim 14 wherein said rotational drive means includes electrical motor means, said rotational speed control means comprises a cam controlled potentiometer electrically connected to said motor means, and said speed control means includes a second potentiometer operatively associated with said motor means during the last few degrees of said small angle to slow down the rotation of said clamping means.

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