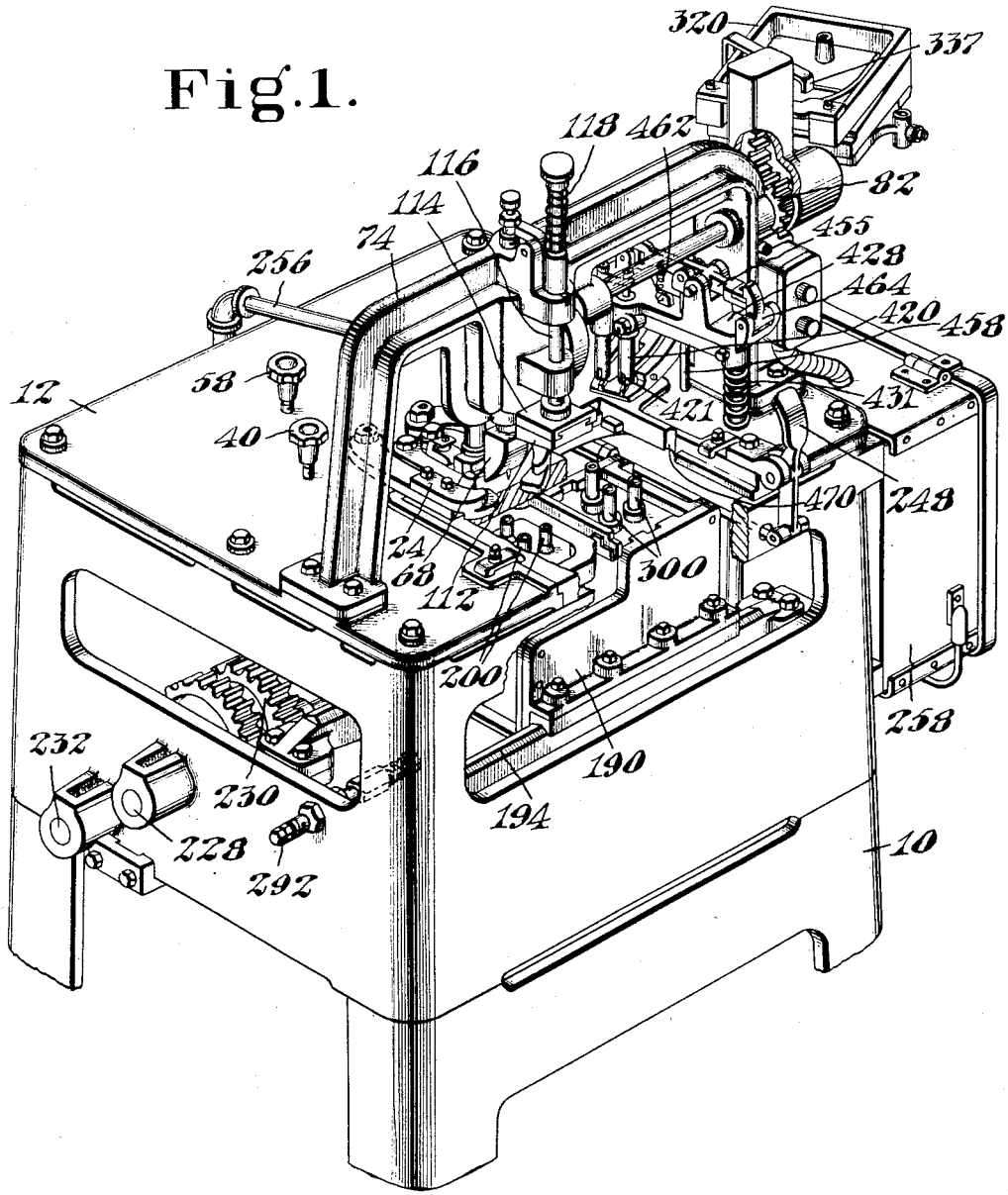
Dec. 12, 1933. I. C. BUCKMINSTER 1,938,689

MACHINE FOR OPERATING UPON LASTS

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Fig.1.



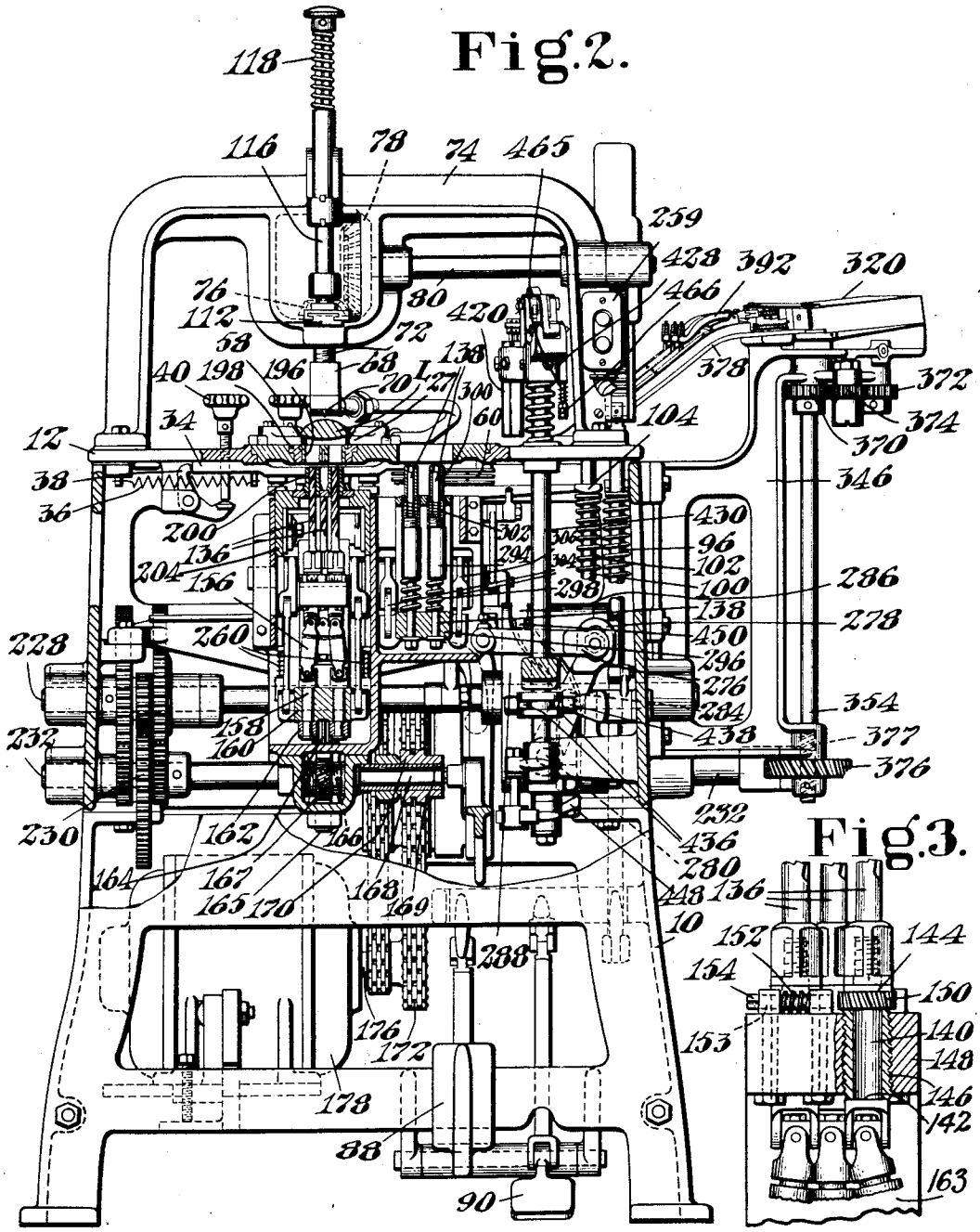
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MACHINE FOR OPERATING UPON LASTS

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Fig.2.



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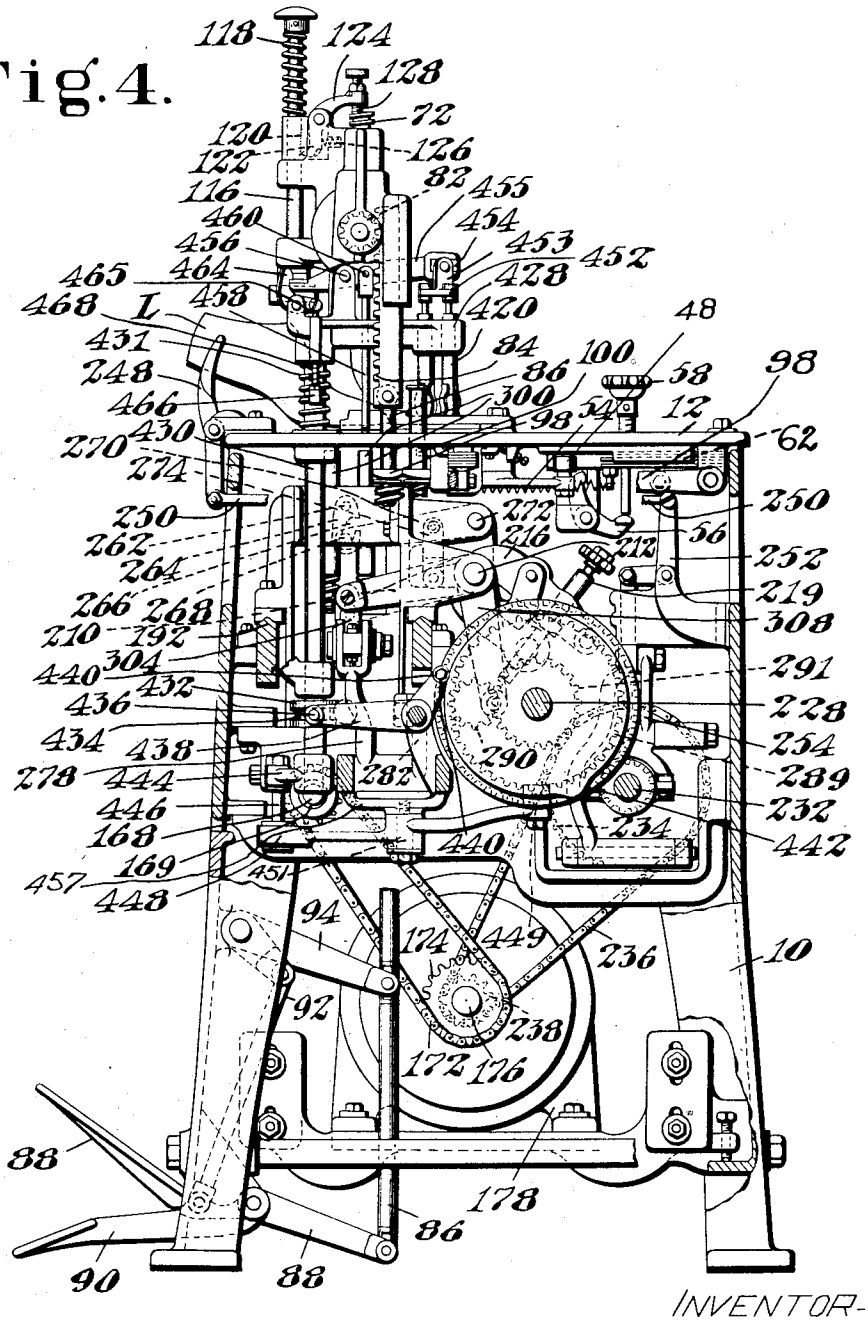
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MACHINE FOR OPERATING UPON LASTS

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Fig. 4.



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MACHINE FOR OPERATING UPON LASTS

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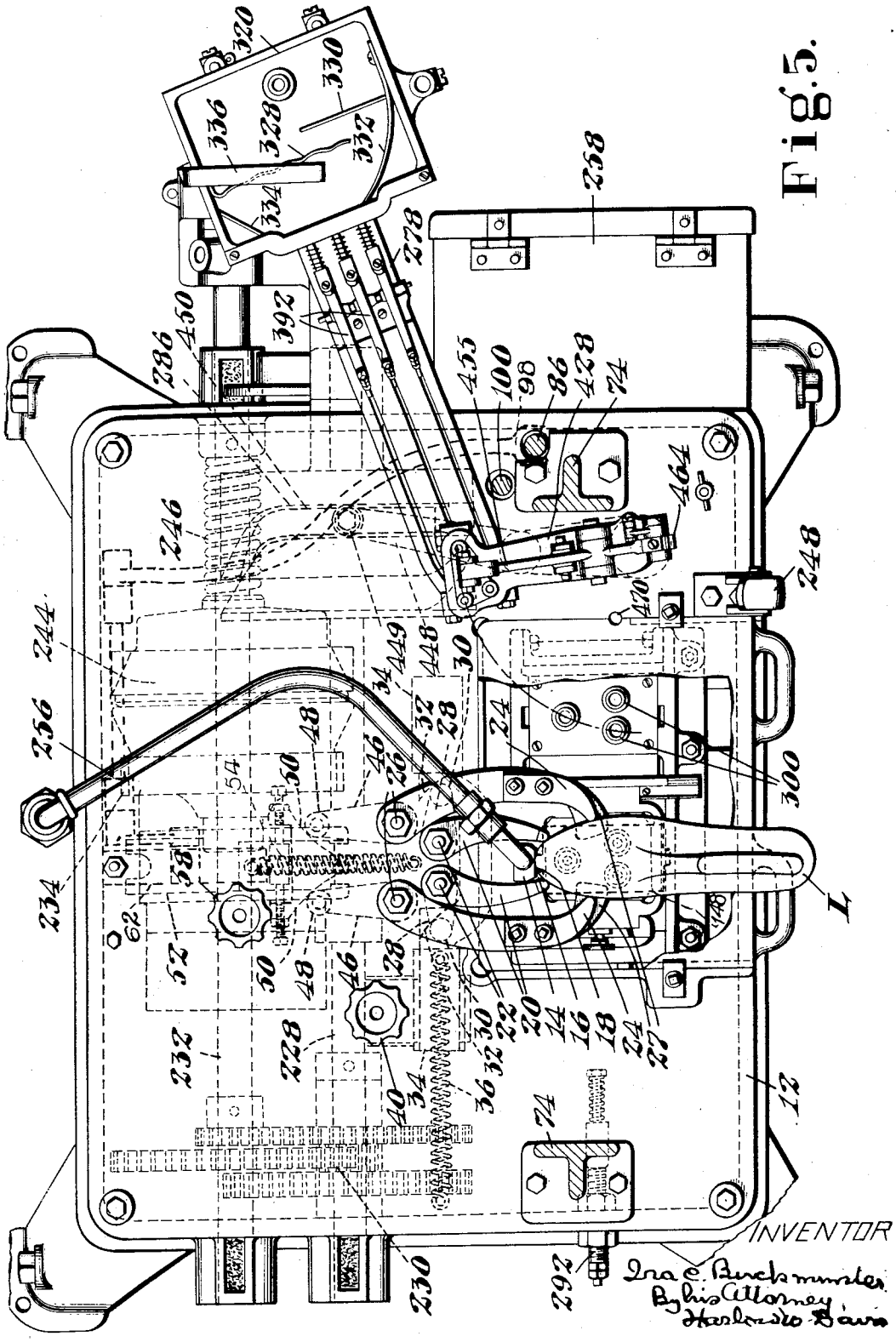


Fig. 5.

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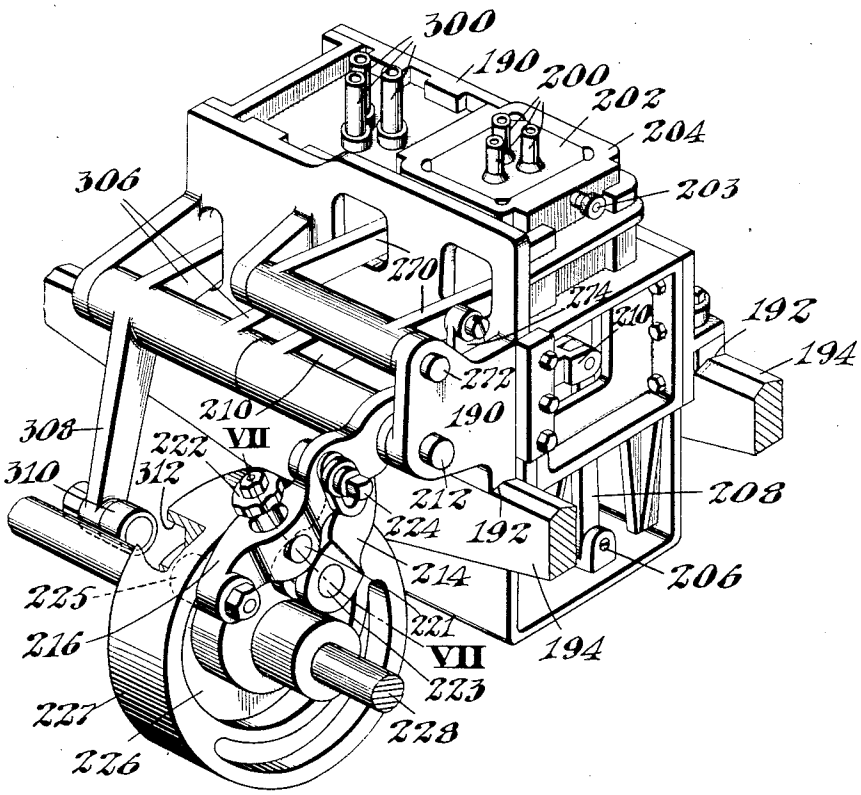
Hazlewood & Davis

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MACHINE FOR OPERATING UPON LASTS

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Fig.6.



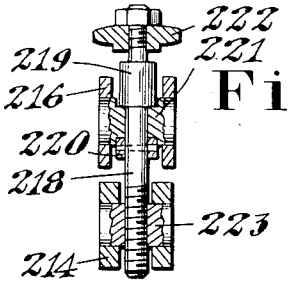


Fig.7.

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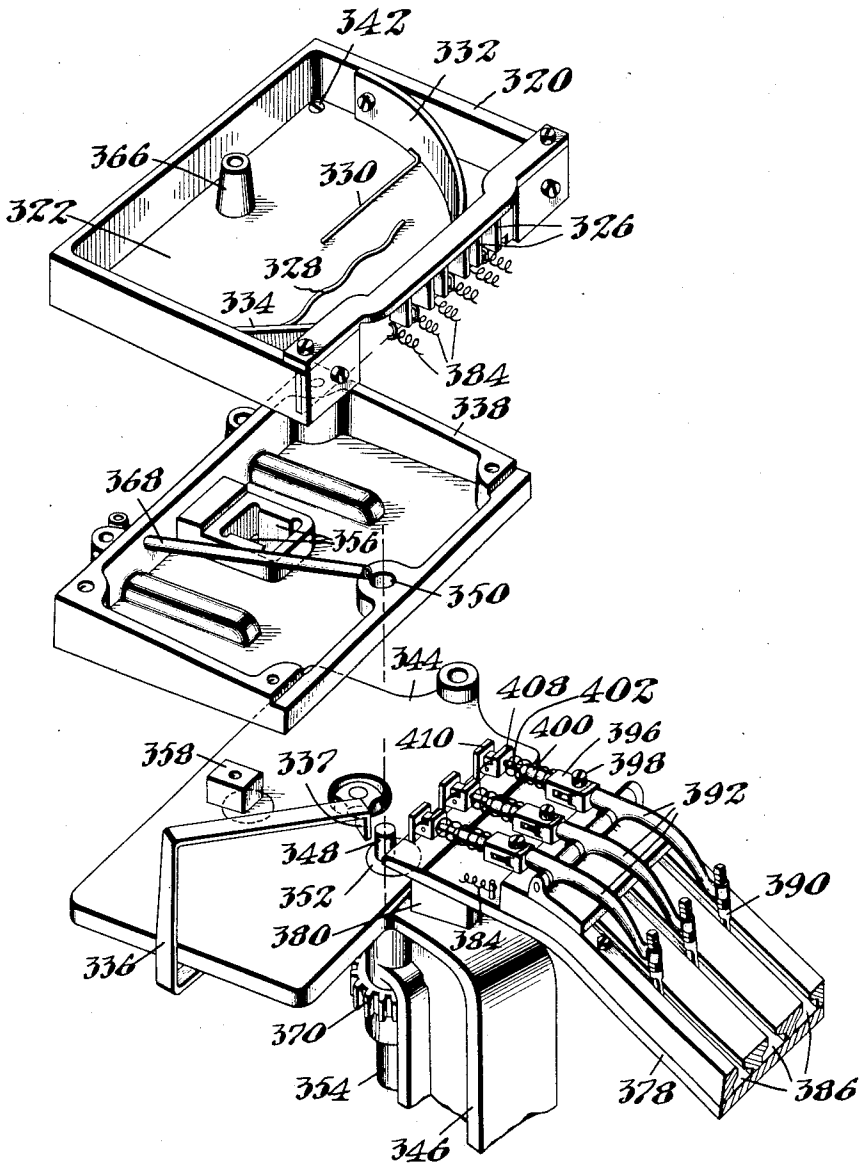
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Fig.8.



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MACHINE FOR OPERATING UPON LASTS

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Fig.9.

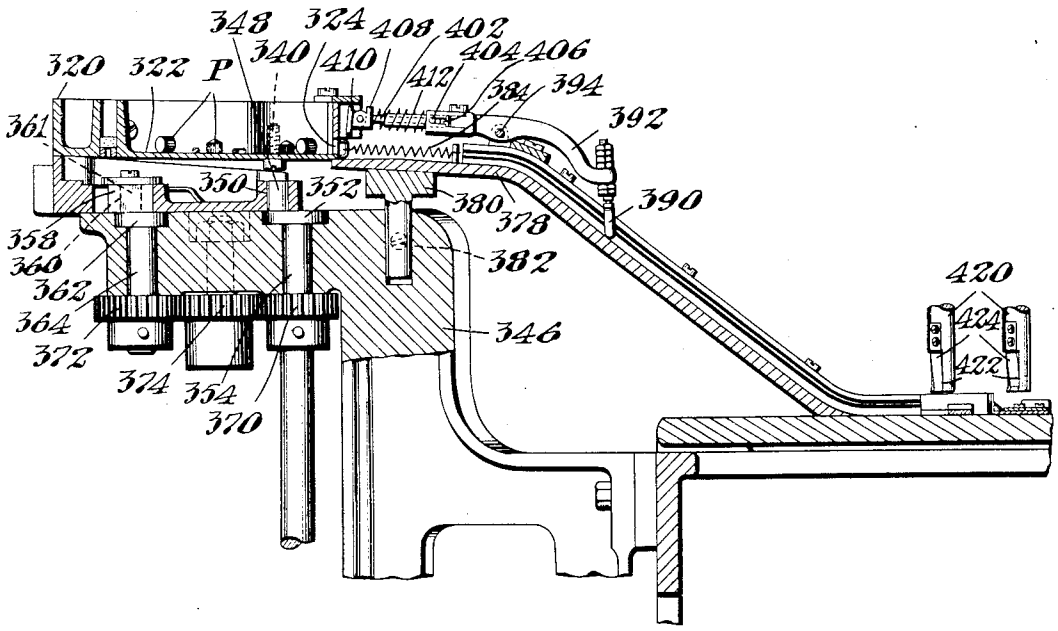


Fig.11.

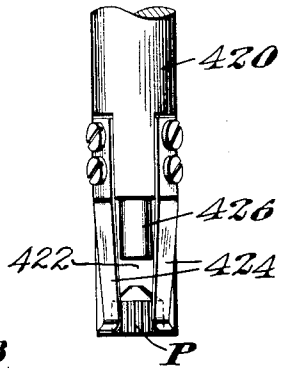
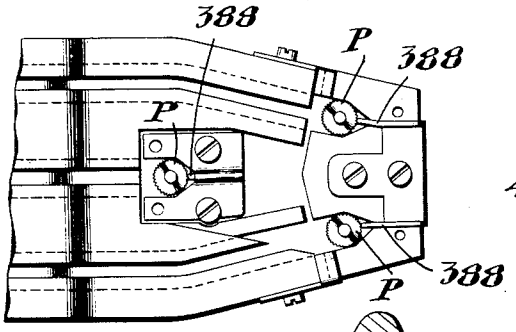


Fig.10.



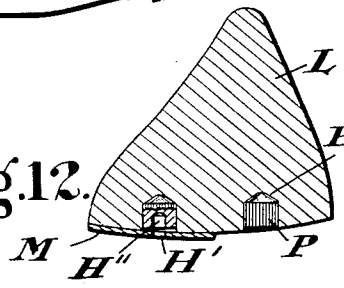


Fig.12.

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MACHINE FOR OPERATING UPON LASTS

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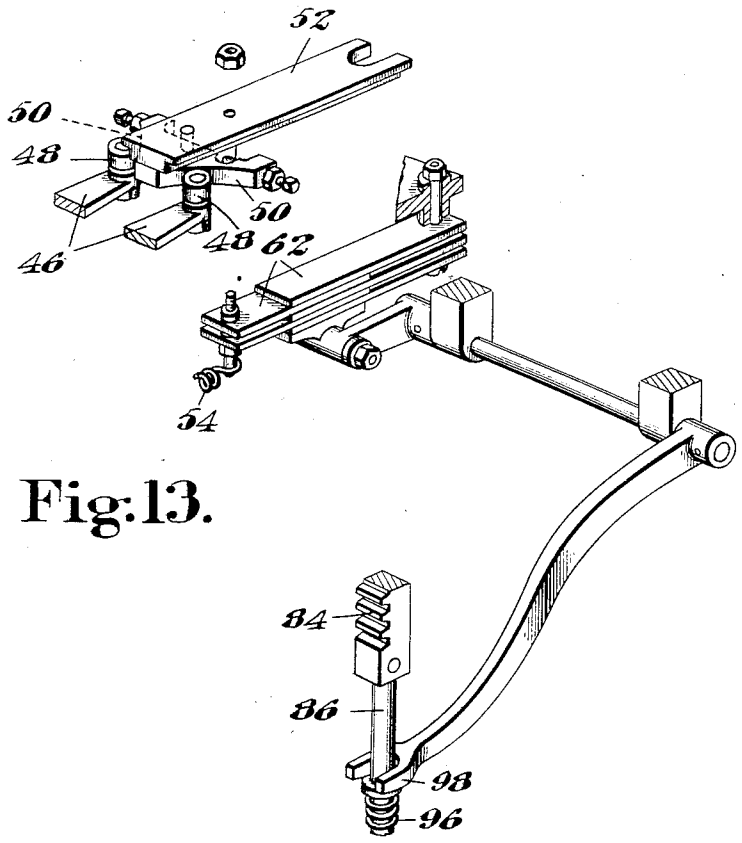


Fig:13.

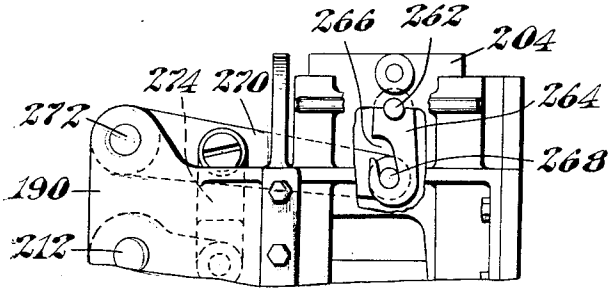


Fig:14.

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Patented Dec. 12, 1933

1,938,689

UNITED STATES PATENT OFFICE

1,938,689

MACHINE FOR OPERATING UPON LASTS

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Application December 10, 1930. Serial No. 501,345

11 Claims. (Cl. 144—31)

This invention, in important aspects, relates to machines for operating upon lasts. The invention is herein illustrated as embodied in a machine for forming a plurality of positioning holes extending from the bottom face of a last and for inserting metallic plugs or bushing blanks in the respective holes.

As more fully explained in Letters Patent No. 1,674,060, Pym, granted June 8, 1928, for Method and means for positioning lasts and their shoe materials, and also in Letters Patent No. 1,723,301, Pym, granted August 6, 1929, for Machine for operating upon lasts, a last having such positioning holes in its bottom plays an important part in the practice of a method of lasting the toes of shoes according to which the last and the shoe materials to be shaped thereover are positioned in predetermined relation to the wipers and other operating instrumentalities of a lasting machine without the need of any high degree of care or skill on the part of the operator. Preferably these positioning holes are provided by holes drilled in three metallic plugs or bushing blanks which fit tightly into corresponding holes drilled in the bottom of the wooden last.

The particular machine disclosed in the said Patent No. 1,723,301 is operated to a considerable extent through handles and treadles actuated by the machine operator and the plugs are supplied by hand to the tools which insert them into the last.

An important object of the present invention is to provide a machine which will be more nearly completely automatic than is the said prior machine.

Accordingly, with this and other objects in view, the preferred embodiment of the invention, herein illustrated, comprises means for positioning a last and clamping it in predetermined position in combination with one or more—preferably three—drills, power means for rotating the drills and for moving them axially to form holes in the last, plug-inserting tools and power means for operating them to force a plug into each drilled hole and automatic means for presenting said drills and said tools alternately in operative relation to the bottom of the last at predetermined times in the cycle of the machine. Preferably, also, the plugs are delivered automatically to the inserting tools by novel plug-assorting, feeding and transferring mechanism. Among other important features of this mechanism is novel means for automatically controlling the delivery of plugs from a hopper to one or more raceways from which they are transferred to the inserting tools. The combination of this mechanism, generically, with other elements in a complete machine for operating on lasts is claimed herein but the said mechanism, per se, constitutes the subject-matter of a divisional application Serial No. 679,409, filed July 7, 1933.

Another important feature of the illustrated machine comprises a single cam having two cam grooves arranged for alternative, operative engagement with two sets of connecting devices by which the tools, e. g. the drill or drills and the plug-inserting tool or tools, are operated. Preferably, the cam is axially stationary and the tools are mounted in a carriage which is movable in a line parallel to the axis of the cam.

However, the invention in these, as well as in other, aspects is not limited to embodiment in machines of the particular type herein illustrated, by way of example, or in machines for performing the specific operations for which the illustrated machine has been especially designed.

Furthermore, the invention comprises also various other combinations and arrangements of parts, as well as particular features of construction, which will now be described in detail in connection with the accompanying drawings which illustrate a preferred embodiment of the invention.

In the drawings:

Fig. 1 is a perspective view of the upper part of the machine;

Fig. 2 is a front elevation with certain parts shown as broken away and certain parts, including a last, shown in section;

Fig. 3 is a detail view on a larger scale of certain of the drill supporting and driving parts shown in Fig. 2;

Fig. 4 is a side elevation;

Fig. 5 is a plan view;

Fig. 6 is a view in perspective of part of the mechanism for operating the tools;

Fig. 7 is a section, approximately on the line VII—VII, of a part of the mechanism shown in Fig. 6;

Fig. 8 is an exploded view in perspective of parts of the plug agitating and feeding devices;

Fig. 9 is a sectional elevation of the same devices;

Fig. 10 is a plan view on a larger scale of the lower ends of the raceways;

Fig. 11 is a detail view on a still larger scale of one of the plug transferring devices;

Fig. 12 is a transverse section of a last showing two of the metallic plugs in position but at different stages in the manufacture of the last;

Fig. 13 is an exploded view in perspective of one of the side gage clamping mechanisms, and Fig. 14 is a side elevation, from the side of the machine opposite to that represented in Fig. 4, showing a lost-motion connection in the mechanism for operating the tools.

As disclosed in the prior Patent No. 1,723,301 above mentioned, the holes were drilled in the metallic plugs to form bushings before the latter were inserted in the last and the present machine could be used to insert such bushings but, as hereinafter described, solid metallic plugs are inserted in the holes in the last and thereafter the holes are drilled in the plugs.

As indicated in Fig. 5 and at the right in Fig. 12, the illustrated machine drills three holes H to a predetermined depth in the bottom of the last L and then the solid or undrilled metallic plugs P are forced home into the holes. As illustrated at the left in Fig. 12, the last L, if it is to be used for McKay shoes, has thereafter secured to its bottom a metallic clenching plate M and then holes H' and H'' are drilled through this plate and to a predetermined depth in the plugs P. This drilling of the holes H' and H'' may be accomplished in any desired manner—for example, by the use of a machine of the same general character as the machine of said prior Patent No. 1,723,301.

The illustrated machine includes a main frame 10 to the top of which is bolted a table 12 which carries various parts including the last positioning and clamping devices. These latter devices are generally similar to, but different in some respects from, those disclosed in said prior Patent No. 1,723,301. They include a toe gage 14 (Fig. 5) secured to the table 12 and provided not only with a horizontal surface 16 to engage the bottom of the last closely adjacent to the toe but also with a slightly inclined but generally vertical surface 18 to engage the approximately vertical toe end of the last. Co-operating with this toe gage are two pairs of side gages in the form of levers, the two gages of each pair being interconnected to move simultaneously toward or from the longitudinal axis of the last. One pair of gages 20 pivoted at 22 engage the sides of the last near its toe end, whereas the other pair 24 pivoted at 26 engage the sides of the last at substantial and approximately equal distances from the toe gage and also have extensions providing horizontal surfaces 27 to engage the bottom of the last as shown in Figs. 2 and 5. These side gages are normally spring pressed inwardly to predetermined positions where their ends are at distances apart slightly less than the corresponding widths of the last to be operated upon, so that as the last is pushed downwardly and inwardly into engagement with the toe gage it is automatically brought by the side gages into a predetermined position angularly and transversely. For thus moving the two gases 20, each is provided with a lateral extension 28 carrying a roll 30 acted upon by a cam surface or wedge 32 forming a part of a slide 34. A tension spring 36 connecting this slide 34 with a pin projecting from the table 12 continually tends to force the last engaging ends of gages 20 toward each other. However, the extent of this movement of the slide and gages is limited by a bell crank lever 38 (Fig. 2), one arm of which engages the slide and the other arm of which engages the lower end of an adjusting screw 40 mounted in table 12.

The gages 24 are moved through a similar mechanism including rearward extensions 46 (Fig. 5), rolls 48, wedge surfaces 50 on a slide 52, tension spring 54 (Fig. 4), bell crank lever 56 and adjusting screw 58.

Thus, by preliminary adjustment of the two screws 40 and 58, the innermost positions of the ends of each pair of side gages 20, 24 will preferably be so adjusted that the ends of each pair will be less than the width of the last L at the corresponding distance from the toe end and so that when the last is inserted between them it will be engaged by all four of the side gages before its toe end reaches the surface 18 of the toe gage 14. In so positioning the last, the operator insures that all four side gages shall contact with the opposite sides of the last, thus centralizing the last and locating it in a predetermined position angularly, longitudinally and laterally in the general plane of the bottom of the last. At the same time, the operator also presses the bottom of the last downwardly and firmly against the three gaging surfaces so as to predetermine the position of the last accurately in all planes normal to the bottom of the last.

To prevent any displacement of the last from this predetermined position while it is being clamped and while it is being operated upon, mechanism is provided for clamping or locking the slides 34, 52 and thereby locking the movable side gages against outward movement. This mechanism may be of the character disclosed particularly in Figs. 8 and 9 of said prior Patent No. 1,723,301. However, in order to secure still more effective clamping of the gages, the clamping mechanism employed in the illustrative machine includes for each slide two sets of spring plates, one set being fixed to the slide and the other set being mounted on a stationary part of the machine, the plates for slide 34 being indicated at 60 (Fig. 2) and those for slide 52 at 62 (Fig. 4). The alternate plates are normally just out of contact so that the slides and, therefore, the gages connected thereto may move freely but, when pressure is exerted vertically, adjacent plates are brought into firm frictional contact so that the slides and gages are securely locked. The means for exerting such vertical pressure will be further described below.

Two members are provided for engaging the upper surface of the last and for clamping the last, through suitable operating mechanism, in the position determined by the gages already described. One of these members is a block 68 (Fig. 2) having a stab point 70 adapted to penetrate the upper surface of the toe portion of the last. This block is mounted at the lower end of a threaded rod 72 which is secured against rotation but is movable axially in a bracket 74 bolted to the table 12 of the machine. This rod is moved axially by mechanism similar to that shown in said prior Patent No. 1,723,301 including two bevel gears 76, 78, a shaft 80, a pinion 82 (Figs. 1 and 4) meshing with a rack 84 to the lower end of which is pivotally secured a rod 86 which may be raised to clamp the last by a treadle 88 pivoted to its lower end. The rod 86 may be depressed to unclamp the last by a treadle 90 connected by a link 92 to a bell crank lever 94 also pivoted to the rod 86. Furthermore, the upward movement of rod 86 is effective through a spring 96 (Fig. 2), a lever 98 (Fig. 4) and plates 62 to clamp one pair of side gages 24 and similarly through a parallel and connected rod 100, a spring 102 (Fig. 2), a lever 104 and plates 60 to clamp the other pair of side gages 20 as above described. Details of the clamping

mechanism for plates 62 and side gages 24 are shown particularly in Fig. 13.

A second member for clamping the last is a block 112 (Figs. 1 and 2) which has an inclined lower face to engage the cone or upper surface of the last and which is dovetailed to slide horizontally forwardly and backwardly in a supporting block 114, a pin-and-slot connection between them limiting such movement. The block 114 is secured at the lower end of a vertically slidable rod 116 which is mounted on the bracket 74, its rotation being prevented by a key. A coil spring 118 acts normally to raise the rod to its highest position. One side of the rod is provided with ratchet teeth 120 (Fig. 4) normally engaged by a pawl 122 forming a part of a bell crank lever 124 and normally pressed into engagement with the teeth 120 by a spring 126. The rear end of the lever is provided with an adjustable stop screw 128.

After the last has been clamped by the block 68 as above described, the operator depresses rod 116 with one hand until the lower face of block 112 comes into engagement with the cone of the last and the rod 116 is then held in that position by the pawl 122. However, since, because of lost motion due to the space between adjacent teeth 120, the block 112 may rise slightly from the last, the operator may then slide this block forward with relation to its supporting block 114 and again bring the inclined lower face of block 112 into firm clamping engagement with the last. When the treadle 90 is depressed to lift the rod 72 and the block 68, the upper end of the rod engages the lower end of the screw 126 (Fig. 4) and thereby releases pawl 122 so that the spring 118 raises the block 112 out of engagement with the last.

The mounting of the three drills 136 and the three plug-inserting tools in the form of plungers 138 (Figs. 1, 2 and 3) and the mechanism by which these two sets of tools are actuated will now be described. The drills are rotated rapidly to bore three parallel holes H (Figs. 5 and 12) extending from the bottom face of the last L at a predetermined angle, i. e. substantially a right angle, to the general plane of the forepart of the bottom of the last and then three plugs P are forced to the bottoms of the holes so bored. Preferably these plugs are of slightly larger diameter than the holes so that they will be effectively retained in the last by friction after they have been forced into the holes.

As will be further explained shortly, the drills and the plug-inserting tools are mounted in a carriage which is automatically moved transversely of the last to bring the drills and the tools alternately into operating position directly beneath the forepart of the last after it has been clamped. The drills 136 are supported, rotated, moved axially and guided by mechanisms (Figs. 2, 3 and 6) which, except as hereinafter pointed out, may be similar to those described in said prior Letters Patent No. 1,723,301, each drill being removably secured to a short vertical shaft 140. To provide for independent adjustment of each drill relative to its support and thereby to vary the depth of the hole drilled in the last, each shaft 140 is provided with shoulders 142, 144 and between the shoulders is surrounded and supported by a threaded sleeve 146 to which is fixed a worm gear 150, the sleeve and gear being rotatable in a block 148 by means of a worm 152 on a short shaft 153 mounted in bearings in the block 148 and having a square end 154 which may be engaged by a hand wrench. Each shaft 140 is connected at its lower end through universal joints and an extensible member 156 to another vertical shaft 158 journaled in a crosshead 160, a pinion 162 being secured to each shaft 158. Crosshead 160 is integral with crosshead 148 or rigidly connected thereto by one or more webs, as indicated at 163 (Fig. 3). The three pinions 162 are all driven by a single vertically stationary gear 164 having a relatively wide face to provide for the proper driving of the pinions 162 during their vertical movement with the drills. The gear 164 is mounted on a vertical shaft 165 carrying a spiral gear 166 meshing with a similar spiral gear 167 pinned to a horizontal shaft 168 (also Fig. 4) splined within a sleeve 169 which is held against axial movement and to which is fixed a sprocket 170 driven by a sprocket chain 172 (also Fig. 4) from a sprocket wheel 174 fixed to the rotor shaft 176 of an electric motor 178 adjustably bolted to the frame of the machine.

The horizontally slidable carriage, previously referred to, in which the drills are mounted is shown particularly in Figs. 1 and 6, being designated 190. This carriage has horizontal bearing surfaces 192 sliding on ways or tracks 194 forming a part of the frame of the machine. Stationary guide bushings 196 (Fig. 2) are provided in a removable plate 198 forming a part of the table 12. The drills are laterally supported and guided during their vertical movement by three guide bushings 200 (Fig. 6) which are moved yieldingly vertically into bushings 196 and brought close to the bottom of the last.

The mechanism for operating the drills and these movable bushings will now be described. The bushings are screwed into a removable plate 202 (Fig. 6) in turn removably secured by a locking bolt 203 in a crosshead 204 which is slidable vertically in ways in the carriage 190. Pivoted at 206 to lugs extending laterally from either side of the crosshead 160 above mentioned are links 208 pivotally connected to the forward arms 210 of a lever fulcrumed on a rock shaft 212. Another arm 214 of this lever 210 is adjustably connected to another lever 216 also fulcrumed on the shaft 212. In order to adjust preliminarily the upper limit of movement of the crosshead 160 and of the drills carried thereby, and thus to compensate for wear of the drills, the relation between the arm 214 and the lever 216 may be changed by means of a threaded rod 218 (also Fig. 7) having two enlargements 219, 220 on the respective sides of a block 221 rotatable in lever 216 and having a hand knob 222. This rod 218 is threaded into another block 223 rotatable in the arm 214 and is freely rotatable in the block 221. After arm 214 has been adjusted by the operator to the desired distance from lever 216, the two are clamped in that relation by a clamping bolt 224. Lever 216 carries a cam roll 225 running in a cam groove 226 of a cam 227 fixed to a shaft 228. This shaft is driven from the motor 178 through gearing including a train of reduction gears indicated as a group at 230 (Figs. 2 and 5) from a shaft 232 on which is loosely mounted a sprocket wheel 234 (Fig. 4) driven by a sprocket chain 236 from a sprocket wheel 238 fixed to the rotor shaft 176 of the motor 178.

To connect the sprocket wheel 234 operatively with the shaft 232 and to release it therefrom, the machine includes a double cone friction clutch and brake of known type indicated at 244 (Fig. 5) the clutch being thrown into operation

by a heavy coiled spring 246 when released by a hand lever 248 (also Fig. 4) through suitable connections including rod 250, bell crank lever 252 and forked lever 254. The clutch is thrown out of operation and the hand lever 248 is reset automatically at the end of each cycle of operations in a well-known manner.

An exhaust pipe for withdrawing from the machine the chips produced by the drills is indicated at 256 while 258 and 259 (Fig. 2) respectively, indicate rheostat and switch boxes and appropriate electrical connections for controlling the motor 178.

As will be further explained below, the carriage 190, the drills and the plug-inserting tools 138 are each given one complete to-and-fro reciprocation during each cycle of the machine but, in order that the same cam 226 may be used for vertically reciprocating both the drills and the said tools at different times, the cam makes two complete rotations during each cycle of the machine.

The guide bushings 200 and the cross head 204 are supported by the carriage 190 through coiled springs 260 (Fig. 2) and are so operated from cam 227 that as the crosshead 160 and drills are raised the guide bushings 200 are also raised into stationary bushings 196, these bushings 200 coming to rest just below the bottom of the last, while the drills continue upward. To secure this result, a lost motion connection is provided between crosshead 204 and cam 227 comprising a pin 262 (Figs. 4 and 14) on each side of the crosshead 204 on which is supported a hook 264 having a slot 266 in which is movable a pin 268 at the forward end of a lever 270 pivoted on a rock shaft 272 on the carriage 190. A link 274 operatively connects this lever to a forward extension of lever 216 previously described. Hence, after the bushings 200 and their crosshead 204 come to a stop, the drills may continue their movement because the pins 268 may move vertically in the slots 266.

For reciprocating the carriage 190 along the ways 194 a link 276 (Fig. 2) is pivotally connected at one end to the carriage and at the other to the upper end of an arm 278 which oscillates about a fulcrum 280. A second arm 282 (Fig. 4) rigidly connected to arm 278 carries a cam roll 284 (Fig. 2) engaging a cam groove 286 in a cam 288 loose on shaft 228. Cam 288 is driven half as fast as shaft 228 by gearing (Fig. 4) comprising an internal gear 289, idler gear 290 and pinion 291 fixed to shaft 228.

An adjustable spring buffer or stop 292 (Figs. 1 and 5) may be provided to engage the carriage at or just before the end of its reciprocation toward the left and thus ensure the correct alignment of the plug-inserting tools 138 with the stationary bushings 196, thus compensating for lost motion after wear of parts.

Each of the plug-inserting tools 138 has secured to it a sleeve 294 (Fig. 2) and its lower end extends through a crosshead 296 movable vertically in bearings in the carriage 190. A heavy coiled spring 298 interposed between the crosshead and the lower end of each sleeve 294 permits the yielding of the tool 138 with respect to the crosshead 296, when the plugs P are bottomed in the holes H as explained above in connection with Fig. 12. Surrounding each tool 138 is a relatively movable guide bushing 300 acted upon at its lower end by a spring 302 which tends to move the bushing to its highest position where it extends above the tool 138 but which permits the tool to move further upward to complete the insertion of the plug P after the upper end of the bushing 300 has passed through its guideway 196 and come into engagement with the bottom of the last. Crosshead 296 is reciprocated vertically by two links 304 pivoted thereto and to the forward ends of two arms 306 of a bell crank lever loosely fulcrumed on shaft 212. Another arm 308 of this lever (also Fig. 6) carries at its lower end a cam roll 310 constructed and arranged to run in a cam groove 312 at the rear side, as shown in Fig. 6, of the cam 227. It will be understood that the cam rolls 225 and 310 are in engagement with their respective grooves in the cam 227 for only a portion of each cycle of operation and that when the carriage 190 is at the limit of its reciprocation and the drills are in alignment with the said bushings 196, the cam roll 225 is within the groove 226, as shown in Fig. 6, and that when the carriage moves to the other limit of its reciprocation, the cam roll 225 moves laterally out of its groove 226 and just before the plug-inserting tools 138 come into such alignment the cam roll 310 will enter its groove 312 in the cam 227. Hence, as above stated, the cam 227 makes two complete rotations for each cycle of the machine. Suitable springs and stops are provided to insure that cam rolls 225 and 310, notwithstanding wear or lost motion between parts, will be held in alignment with their respective grooves 226 and 312.

The mechanism for delivering plugs P automatically to the tools 138 will now be described. A mass of the plugs may be dumped into the open top hopper 320 (Figs. 1, 5, 8 and 9) supported with its bottom 322 at an inclination to the horizontal. To facilitate the passage of the plugs through the three exit ports 324 and between vertical guide flanges 326 of the hopper, two ribs or wires 328, 330 are fixed on its bottom and two partitions 332, 334 are arranged in the lower corners and a stationary bar 336 has an end 337 extending downwardly not quite to the tops of the ribs into position to engage the plugs. The ports 324 are of such shape that the plugs P can pass through them only when they are upright, i. e. when their frusto conical ends are uppermost, as shown in Figs. 10 and 11. The particular illustrated arrangement of the ribs 332, 334 and end 337 of bar 336 has been found by experiment to be very effective for arranging the plugs in such upright position and for ensuring the delivery of an adequate number of plugs through the ports.

The hopper 320 is supported directly on a frame or open box 338 (Fig. 8) but preferably adjusting means, such as screws 340, one of which is shown in Fig. 9, is provided for varying the height of the front end of the hopper, thus varying the angle of the inclination of its bottom 322. The hopper is secured to the frame 338 in any suitable manner as by screws, such as 342. The frame 338 is supported on and slidable over a flat surface 344 formed on a part of a bracket 346 extending from the main frame of the machine. A rapid circular motion, approximately in a horizontal plane, is imparted to the frame 338, and the hopper 320 carried thereby, by mechanism which includes a crank pin 348 rotatable in a journal 350 in the frame 338, the crank pin being formed on a disk 352 at the upper end of a vertical shaft 354. The frame 338 is provided also with bearing surfaces 356 along which may slide a block 358 having a hole 360 (Fig. 9) therein fitting an-

other crank pin 361 on a disk 362 forming a part of a second vertical shaft 364. The drawings show various devices such as boss 366 and pipe 368 (Fig. 8) having passages for conducting oil to parts to be lubricated. The block 358 fitting between surfaces 356 is provided to ensure a smooth and quiet operation of the hopper agitating mechanism and to make it unnecessary, in manufacturing the parts, to have the two crank pins 348, 360 a precise distance apart. The two vertical shafts 354, 364 carry spur gears 370, 372, respectively, between which is an intermediate gear 374 (Fig. 9). The shaft 354 to which the gear 370 is secured carries near its lower end (Fig. 2) a spiral gear 376 which is driven by a similar gear 377 on the shaft 232.

The plugs P which pass through the ports 324 and between flanges 326 enter three raceways formed in part by a bottom plate 378 (Figs. 8 and 9), the upper end of which bears at its upper side against the under side of the bottom 322 of the hopper and is supported by an adjustable post 380 which is secured by a set screw 382 in adjusted position in the bracket 346, the lower end of the plate 378 resting upon the table 12. Inasmuch as this plate 378 is stationary while the hopper 320 moves, a flexible connection is provided between the two including a coiled spring 384 at each side of each port 324, one end of each spring being connected to the hopper and the other to the plate close to the entrance to one of three slots 386 which provide raceways to guide the plugs to the table 12 upon which, at the exit end of these slots, are stops in the form of ribs 388 which position the lowermost of the plugs, coming from the three slots, on the table in the relation shown particularly in Fig. 10.

For controlling automatically the delivery of the plugs through the ports 324 there is provided for each raceway and slot 386 a mechanism including a finger or feeler 390 adjustably mounted at the lower end of a lever 392 pivoted on the raceway plate 378 at 394 and carrying at its upper end a block 396 which is constructed for limited lateral movement relative to the forward part of the lever 392 being connected to said forward part by a vertical pivot 398. Extending rearwardly from the block 396 and rigid therewith is a sleeve 400 and within this sleeve is slidably mounted a rod 402 carrying at its rear end a cross pin 404 slidable in a slot 406 in the block. To the rod at its rear end is pivoted another block 408 having a gate at its rear end in the form of a plate 410 of a size to close the corresponding port 324. A coiled spring 412 tends constantly to maintain the block 408 at its maximum distance from block 396, the movement of the block 408 about its pivot being limited by the flanges 326 at the sides of ports 324.

Normally the three plug-controlling devices just described occupy the positions shown in Fig. 9 so that the plugs P may travel freely down the raceways and as any one plug encounters a feeler 390 it passes thereunder tilting the lever 392 about its pivot and moving the plate 410 into position to close the corresponding port 324. However, if the raceway below a particular feeler has not been filled that feeler will return to its normal position shown in Fig. 9 as soon as the plug has passed. If, however, the raceway below the feeler has been filled the next plug will remain beneath the feeler and prevent it and its connected parts from returning to its normal position, and therefore, the plate 410 will close the corresponding port and keep it closed until the plug then under the feeler has been permitted, by the downward movement of the preceding plugs, to move further down the raceway after which the feeler will resume its normal position allowing more plugs to pass through the port.

The mechanism for transferring the plugs from the position indicated in Fig. 10 to the inserting tools 138 comprises three pickers or plungers in the form of rods 420 slotted at their lower ends at 421 (Fig. 1) to clear ribs 388, each rod being cut away to form a flat surface, as indicated at 422 (Figs. 9 and 11), and having two spring fingers 424 so mounted on the rod that the area between the lower ends of the fingers and the surface 422 of each rod is somewhat less than the area of a plug in cross section and the lower ends of the fingers are outturned so that, when a rod is moved vertically down from a position immediately above a plug, the fingers yield and the end of the rod passes over the plug, the fingers retaining the plug clamped against each surface 422 but the plugs may be ejected from the picker by an ejector rod 426. The three rods 420 are adjustably and removably secured to the rear end of a swinging arm 428 (Figs. 1, 4 and 5) rigidly secured to a vertical rod 430 supported in the frame for both axial and rotary movement. A spring 431 normally holds this rod and its connected parts in a position in which the lower ends of the rods 420 will be at a height above the table somewhat exceeding the height of the plugs P. For depressing the rod against the resistance of this spring, a collar 432 is secured to the rod and is provided with a groove 434 which receives a pair of studs 436 (Fig. 2) at the forward end of a bifurcated lever 438 (Fig. 4) pivoted in the frame and carrying a cam roll 440 bearing against a cam 442 fixed to the cam 288 (Fig. 2). For oscillating the rod 430, an arm 444 is secured at its lower end and has secured at its outer end a vertical pin 446 which has a sliding fit in the outer end of a lever 448 (also Fig. 5) which at its opposite end carries a cam roll 449 running in a cam groove 450 in cam 288 loose on shaft 228. Lever 448 is pivoted at 451 on a bracket 457 secured to the machine frame. As shown in Figs. 2 and 5 the walls forming cam groove 286 are so nearly parallel to the walls forming cam groove 450 that groove 450 is formed at the bottom of groove 286, i. e. nearer the axis of cam 288.

The three ejector rods 426 are connected at their upper ends to a horizontal plate 452 (Fig. 4) connected by a link 453 pivoted to a block 454 slidable in a slot in the rear end of a lever 455 pivoted at 456 to lugs extending upward from the arm 428. This lever 455 is raised to retract the ejectors 426 by a rod 458 pivoted thereto at 460 which in turn is lifted when the lower end of the rod comes into contact with the table 12. A coiled tension spring 462 (Fig. 1) tends constantly to move the rear end of lever 455 downwardly but, when it has been moved in the opposite direction against the resistance of this spring, it is held so as to leave the ejectors withdrawn, i. e. at their highest position, by latch lever 464 to which is connected a rod 465 with an enlarged lower end 466. A coiled spring 468 tends normally to hold the latch in operative position but, when the lower end 466 comes into contact with the table 12, the latch is released and spring 462 becomes effective to move the ejectors 426 to their lowermost position.

The cams and the other parts just described are so constructed and arranged that the pickers 420, through the rotation of rod 430 are moved into

a position immediately above the plugs P, as shown in Figs. 9 and 10, and then the rod 430 is depressed and the plugs P are clamped, as shown in Fig. 11, after which the pickers are raised and the rod 430 is rotated to carry the pickers and the plugs carried thereby to position immediately over the inserting tools 138. The rod 430 is again depressed to place the plugs close to and axially in alignment with the tools 138, the lower end of rod 458 at that time passing through a clearance hole 470 (Fig. 5) in table 12, and the latch 464 is released so that the ejectors 426 push the plugs out of the pickers and deposit them within the sleeves 300 and on the inserting tools 138 after which the pickers are again raised and turned to inoperative position ready for a repetition of the series of movements just described.

It will be understood that the mechanism for transferring plugs, just described, is adapted, either with or without obvious changes in form, for use in transferring other articles.

The manner in which different parts of the machine operate has been explained in connection with the foregoing description of them but the operation of the machine as a whole will now be summarized. When the machine is at rest its parts will occupy the relative positions illustrated in the drawings and more particularly in Figs. 1, 2 and 4. A last L is placed by the operator with its bottom against the horizontal surfaces 27 of the side gages 24 and with the respective side portions of the last against the ends of both pairs of side gages 20, 24 and then the last is pushed inwardly forcing the gages apart against the resistance of springs 36, 54 until the toe portion of the last has been brought firmly into engagement also with both surfaces 16, 18 of the toe gage 14. While the last is thus held by the operator in this position, the treadle 88 is depressed and the movable side gages are thereby first locked and then, through the continued movement of the treadle, the block 68 is pressed against the upper portion of the toe of the last, the stab point 70 entering the last. Then the operator depresses rod 116 with his hand and the block 112 is locked through pawl 122 in contact with or close to the cone of the last, the operator sliding the block 112 forward, if necessary, to take up any space between the block and the last.

The last being now firmly clamped in predetermined position, the motor 178 is started and the clutch 244 is thrown into operation by the hand lever 248 so that the drills 136 are rotated at high speed and the plug assorting and transferring mechanism operates. At this time the carriage 190 is at its extreme position to the right, as shown in Fig. 2, with the drills 136 and the movable bushings 200 in alignment with the stationary bushings 196. Therefore, the cam roll 225 is in operative position in the cam groove 226 of the cam 227, as shown in Fig. 6, and through the action of this cam the movable bushings and the drills rise together into and through the bushings 196 until the bushings 200 come to a stop in a position just below the bottom of the last. Then, because of the yielding connections, including springs 260, pins 262 and slots 266 above described, the drills continue upward and form the holes H to a depth in the bottom of the last predetermined by the adjustment of the sleeves 146 and rod 218.

Meanwhile, three plugs P have been delivered into the position shown in Fig. 10 and the pickers 420 have each clamped a plug P, as shown in Fig. 11, and then deposited the plugs within the sleeves 300. Cam 227 causes the drills and movable bushings to descend and the carriage 190 moves to the left, as shown in Fig. 2, bringing the plug-inserting tools 138 and their sleeves 300 into alignment with the bushings 196 and with the holes H already formed in the last. The cam roll 310 being now in operative position in its cam groove 312 in cam 227, the tools 138 and their sleeves 300 are raised through the bushings 196 until the sleeves contact with the bottom of the last after which the tools 138 continue to move upward carrying the plugs P into the holes H. After any particular plug has been forced fully to the bottom of its hole the corresponding heavy spring 298 will yield as the cross head 296 completes its movement. Thereafter the cam 227 causes the descent of the tools 138 and sleeves 300 to their lowermost position, the carriage 190 is shifted to the right and the machine comes automatically to rest in its initial position.

Having thus described my invention what I claim as new and desire to secure by Letters Patent of the United States is:

1. In a machine for operating upon lasts, the combination of a plurality of gages to engage the bottom and the side edges of a last to determine its position in all directions, clamping means for securing the last in the position thus determined, a plurality of drills, power means for rotating the drills and for moving them axially to form holes in the bottom of the last, a plurality of plug inserting tools, a hopper, a plurality of raceways and transferring mechanism for picking up plugs delivered by the raceways and depositing them on said tools, power means for operating said tools to force the plugs into the drilled holes, and automatic means for presenting said drills and said tools alternately in operative relation to the bottom of the last at predetermined times in the cycle of the machine.

2. In a machine for operating upon lasts, the combination of means for supporting and positioning a last in predetermined position with its bottom down and for clamping it in such position, a drill, power means for rotating the drill and for moving it axially to form a hole in the last bottom, an upwardly movable, plug inserting plunger, a guide sleeve surrounding the plunger and movable axially relatively thereto, transferring mechanism for picking up a plug and depositing it on the upper end of the plunger and within the sleeve, power means for raising said plunger and said sleeve together until the sleeve engages the bottom of the last and then for continuing the movement of the plunger to force the plug into a drilled hole, and automatic means for presenting said drill and said plunger alternately in operative relation to the last.

3. In a machine for operating upon lasts, the combination of means for positioning a last in predetermined position with its bottom down and clamping it in such position, a drill, power means for rotating the drill and for moving it axially to form a hole in the last bottom, an upwardly movable, plug inserting plunger, a guide sleeve surrounding the plunger and movable axially relatively thereto, means for depositing a plug on the upper end of the plunger and within the sleeve, power means for raising said plunger to force a plug into a drilled hole, and automatic means for presenting said drill and said plunger alternately in operative relation to the last.

4. In a machine for operating upon lasts, the combination of means for supporting a last, a

drill for forming a hole in the last, a tool for inserting a plug in a drilled hole, a support for said drill and tool, a single actuator, separate connections between said actuator and the drill and the tool respectively for operating them alternately, and means for relatively moving the support and the actuator to bring them into positions where the drill and the tool are alternately operatively connected to and disconnected from said actuator.

5. In a machine for operating on lasts, the combination of means for supporting a last, a drill, means for operating the drill to form a hole in the last, a tool for inserting a plug in a drilled hole, a support for said drill and tool, a single cam with two cam paths, connections between said two paths and the drill and the tool respectively for operating them alternately, and means for relatively moving the cam and the support to bring them into relative positions where the drill and the tool are alternately operatively connected to said cam.

6. In a machine for operating on lasts, the combination of means for supporting a last, a drill, a plug inserting tool, a cam shaft, a cam immovable axially on the shaft and having cam grooves in its opposite sides, a carriage movable in a line parallel to said shaft and supporting said drill and tool, and means for reciprocating said carriage to bring said drill and tool alternately into operative relation to said cam.

7. In an organized machine, the combination of a rotary cam immovable axially and having cam grooves in its opposite sides, a carriage movable in a line parallel to the axis of said cam, two tools supported by said carriage, two sets of connecting devices between said tools and the respective cam grooves, and means for reciprocating said carriage to bring said two sets of devices alternately into operative relation to the respective cam grooves.

8. In an organized machine, the combination of a cam having a cam path, a tool, a support for said tool operating means for said tool including connections to said cam path, and means for relatively moving the cam and the support to bring them alternately into and out of a position where the cam is operatively connected to said tool.

9. In a machine for operating on lasts, the combination of gages to determine the position of the last, clamping means for securing the last in the position thus determined including a last-engaging member and a support therefor, and means including a pawl and a ratchet for locking said support in position above the cone of the last, said member being movable relatively to its support to compensate for lost motion between the pawl and the ratchet and thus ensure clamping engagement between said member and the last.

10. In a machine for operating on lasts, the combination of means for positioning and clamping a last, a drill, power means for rotating the drill and for moving it axially to form a hole in the last, and means for adjusting the drill including a threaded sleeve movable axially but not rotatively with the drill, a support for the sleeve and means whereby the sleeve may be adjusted axially in the support.

11. In a machine for operating on lasts, the combination of means for positioning and clamping a last, a drill, power means for rotating the drill and for moving it axially to form a hole in the last, a carriage movable transversely of the last and supporting the drill and a portion of its said means, said means including a gear movable with the carriage and a driver mounted independently of the carriage, and connections between the gear and said driver to permit relative movement between them.

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