

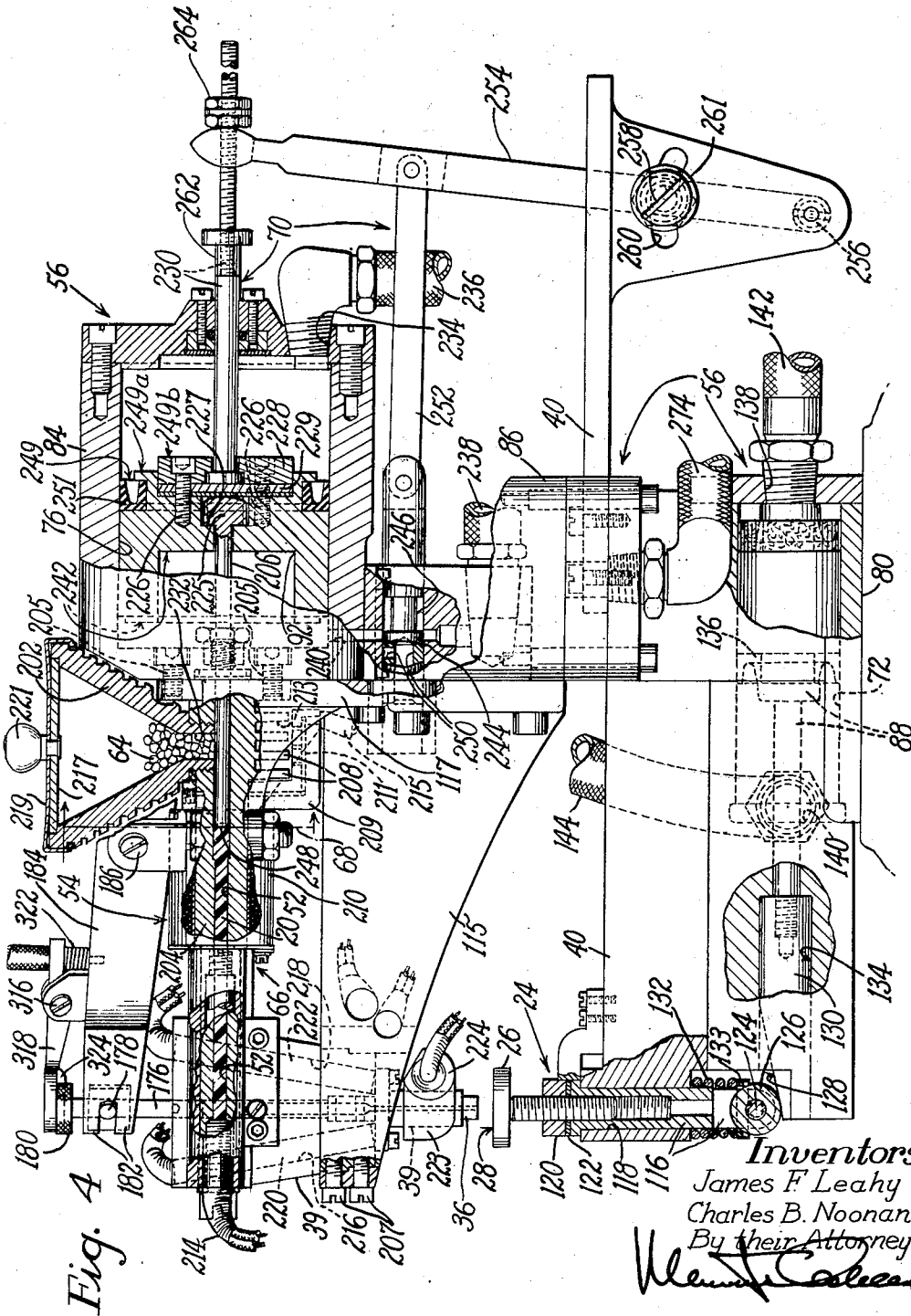
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FASTENING MACHINES

2,890,481

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Fig. 8

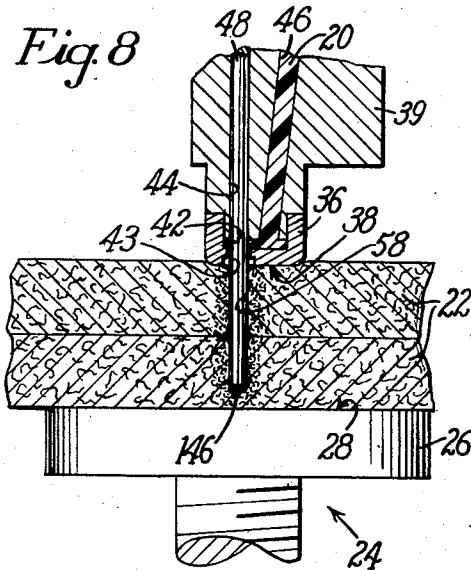


Fig. 7

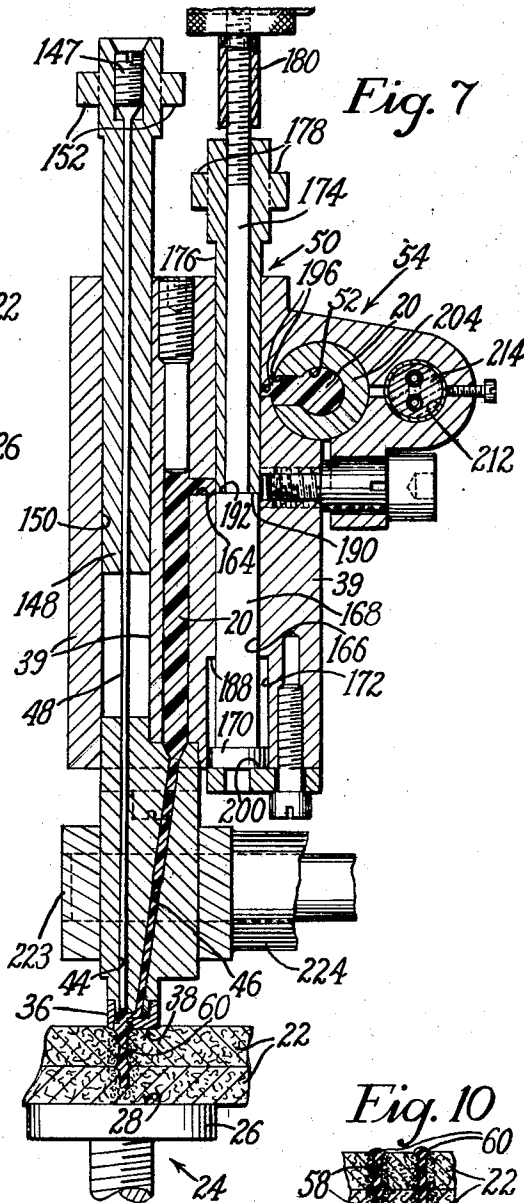


Fig. 9

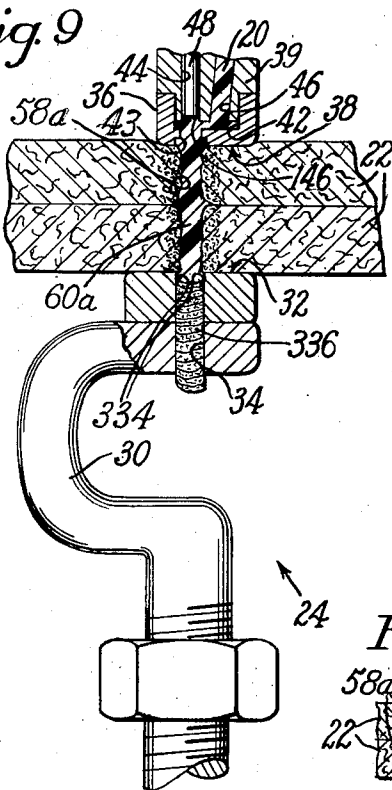


Fig. 10

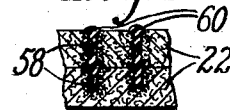


Fig. 11



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FASTENING MACHINES

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7 Claims. (Cl. 18—1)

This invention relates to machines for fastening two or more parts of an article together by the use of thermoplastic fastenings and is illustrated as embodied in a machine which is adapted to fasten together strips of leather and is in certain aspects advantageous in the manufacture of shoes. However, the present invention is not limited to fastening leather but may be practiced in fastening an almost limitless number of materials.

The present invention consists in the novel features hereinafter described, reference being had to the accompanying drawings, which illustrate one embodiment of the invention selected for purposes of illustration, said invention being fully disclosed in the following description and claims.

In the accompanying drawings,

Fig. 1 is a perspective view, partly broken away and partly in section, of the illustrative fastening machine in its idle or rest condition;

Fig. 2 is a section on the line II—II of Fig. 1 showing one of four valves which are of identical construction and are adapted to control the operation of various instrumentalities of the machine;

Fig. 3 is a plan view, partly broken away and partly in section, of the machine in its idle condition;

Fig. 4 is a side view, partly in section on the line IV—IV of Fig. 3, of a portion of the machine in its idle condition;

Fig. 4a is a rear view of the lower end portion of stoker control mechanism shown in Fig. 4;

Figs. 5, 6 and 7 show a section of the machine on the line V—V of Fig. 3 during three successive portions respectively of its cycle;

Fig. 8 is an enlarged view of a lower end portion of the section of the machine illustrated in Fig. 6;

Fig. 9 is a section similar to the lower end of the section shown in Fig. 7 but showing the machine equipped with a work supporting horn; and

Figs. 10 and 11 are sections through work or work pieces, parts of which have been fastened together by the use of the illustrative machine.

The illustrative machine will be described with reference to fastening together two or more pieces or strips 22 of leather or other penetrable material by inserting softened thermoplastic plastic or resin 20 and allowing it to harden in the form of fastening 60 (Fig. 10) or 60a (Fig. 11). The machine comprises a support or jack 24 which includes a table 26 having a work supporting or engaging surface 28 or which includes a "horn" 30 (Fig. 9) having a work supporting or engaging surface 32 and a bore or hole 34, an abutment 36 which functions as a mold and which has a work supporting or engaging face 38 and which forms, with a multi-part block, housing or casing 39 secured to a main frame 40 of the machine, an undercut or re-entrant recess 42 into which opens a guide 44 for slidably receiving a cylindrical awl 48 and a conduit 46 for receiving the resin 20 which has been softened. The recess 42 leads to a head forming cavity 43. The machine also comprises a resin measuring, transferring and injecting unit 50 (Figs. 5, 6 and 7) for receiving a predetermined quantity or amount of softened resin from a reservoir 52 of an extruder 54 and forcing it into the conduit 46, means for intermittently raising the jack 24

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to clamp said strips or pieces 22 of leather firmly between the abutment 36 and the table 26 or the horn 30, and fluid pressure means 56 for operating in timed relation with the jack 24, the awl 48 and the resin measuring, transferring and injecting unit 50 to form a hole or passageway 58 (Figs. 8 and 10) or 58a (Figs. 9 and 11) in the strips or pieces 22 of leather and to fill said hole with softened resin, said resin when it has hardened in said strips serving as the aforesaid fastenings 60, 60a for permanently securing said leather strips together. The jack 24 and the abutment 36 together with its associated multi-part block 39 may be referred to as jaws.

Resin 20 is supplied to the extruder 54 in the form of granules 64 (Fig. 4) and, after being softened in a softening unit or zone 66 of the extruder 54 at the left, as viewed in Fig. 4, of a vertical section line 68, is moved by stoking or feeding mechanism 70 and the measuring, transferring and injecting unit 50, into the conduit 46. The jack 24, the awl 48, the stoking mechanism 70 and the resin measuring, transferring and injecting unit 50 are operated in proper timed relation by the fluid pressure means 56 employing, for example, compressed air, supplied from an accumulator (not shown) to cylindrical chambers 72 (Fig. 4), 74 (Fig. 3), 76 (Fig. 4) and 78 (Fig. 1) formed in housings 80, 82, 84 and 86 respectively and having reciprocable in them multi-part pistons 88, 90, 92 and 94 the operation of which is controlled by associated valves 96, 98, 100, 102 (Fig. 1) operated by cams 106, 104, 108 and 110 secured to a cam shaft 112.

The cam shaft 112 is rotatable in bearings 113 secured to the main frame 40 and has loosely mounted on it a drive pulley 114 which rotates continuously when the machine is powered. Associated with the drive pulley 114 is a pin clutch 109 which so long as a treadle actuated rod 111 is held depressed causes the shaft 112 to be coupled to the drive pulley, thus actuating the machine continuously.

The housings 80, 82, and 86 are secured to the main frame 40, and the housing 84 is secured to the housings 82, 86. Screwed to the housings 82, 86 is a yoke-shaped bracket 115 and screwed to the housings 86 and 82 respectively are angle brackets 117, 119. As will be explained later, the bracket 115 serves as a support for the multi-part block 39 and the brackets 117, 119 respectively serve as bearing supports for portions of the resin measuring, transferring and injecting unit 50 and for mechanism for operating the awl 48.

The table 26 and the horn 30 are threaded into a post 116 (Figs. 1 and 4) slidable in a vertical bore 118 of the machine frame 40 and may be secured in different heightwise positions in said post by a nut 120 and a lock washer 122. Rotatably mounted upon a pin 124 secured to the post 116 is a roll 126 which is constantly urged against a face 128 of a cam 130 by a spring 132 interposed between the main frame 40 and a washer 133 secured to the jack post 116. The cam 130 is slidably mounted in a guideway 134 of the main frame 40 and has threaded into it the piston 88. In communication with the cylindrical chamber 72 at opposite sides of a head 136 of the piston 88 are ports 138, 140 into which are threaded air lines 142, 144 respectively.

When the machine is at rest the awl 48 is in a dwell or retracted position shown in Fig. 5, a leading or punching face 146 of said awl being drawn just into the guide 44. The awl 48 is secured by a screw 147 (Figs. 5, 6 and 7) to a holder 148 which is slidable in a guideway 150 formed in the multi-part block 39 and has a pair of trunnions 152 fitting in slots of bifurcations 154 (Figs. 1 and 3) of a lever 156 fulcrumed upon a bearing pin 158 supported by the bracket 119. The rear end of the lever 156 is operatively connected to the piston 90 which is

vertically reciprocable in the cylindrical chamber 74 which has formed in its lower and upper portions ports which are opened to lines 160, 162, respectively. The housing 82 and the piston 90 are substantially identical with the housing 86 and the piston 94 respectively which will be hereinafter described in detail.

The resin conduit 46 which supplies the resin 20 to the undercut recess 42 has an upper portion of increased diameter in communication with a port 164 which may be considered part of the conduit 46 and extends into a guideway 166 (Figs. 5, 6 and 7) which is formed in the multi-part block 39 and in which reciprocates a plunger or slide 168 a lower end of which has a flange 170 reciprocable in an enlarged guideway 172 of said block. The plunger 168 has a reduced shank 174 upon which is slidably mounted a sleeve or slide 176 having a pair of trunnions 178, a nut 180 being threaded onto the upper end of said shank. The trunnions 178 fit in slots of bifurcations 182 of a lever 184 (Figs. 1, 3 and 4) fulcrumed upon a pin 186 adjustably secured to the bracket 117. When the machine is at rest the plunger 168 is in its raised position, shown in Fig. 5, the flange 170 of the plunger being in engagement with a transverse shoulder 188 of the multi-part block 39 and the sleeve 176 being in engagement with the nut 180 which may be set in different adjusted positions, for reasons which will be explained later, upon the plunger. At this time there is formed by the guideway 166 of the multi-part block 39, the lower end or face of the sleeve 176 and the shank 174 and a shoulder 192 of the plunger 168 a ring-shaped recess or metering cavity 194 which is open to a port 196 leading to the reservoir 52 which forms part of the extruder 54 and in which is softened resin introduced in the form of the granules 64 through a funnel 202 (Figs. 1 and 4) hereinafter described.

When, as the sleeve 176 moves downward from its position shown in Fig. 6 in response to depression of the forward end of the lever 184, the plunger 168 through the provision of hereinafter described spring actuated mechanism, moves downward together with the sleeve, the ring-shaped recess 194 at this time being full of softened resin which is sealed against escape. When the plunger 168 engages a face or stop 200 of the multi-part block 39 its downward movement stops, continued downward movement of the sleeve 176 against the action of said spring actuated mechanism causing the resin in the ring-shaped recess 194, which at this time is arranged opposite the port 164 connecting the conduit 46 and the guideway 166, to be forced into said conduit and accordingly causing the same measured amount of resin to be ejected from the conduit into the undercut recess 42 and into the cylindrical hole 58 or 58a, which has been formed by the then retracted awl 48, in the leather strips or pieces 22 compressed between the face 38 of the abutment 36 and the table 26 or between the face 38 of the abutment 36 and the horn 30.

The funnel 202 is threaded into a cylinder or tube 204 which fits in a bore of the multi-part housing 39 and is secured to the housing 84 by screws 205 and which has formed in it the cylindrical reservoir 52 in which the resin is softened and in which a plunger or feeder 206 of the stoking mechanism 70 slides. It will be noted at this point that the multi-part block 39 is secured to the yoke-shaped bracket 115 by screws 207 said bracket together with the tube 204, which is secured to the housing 84, serving rigidly to support said block. The tube 204 may be described as a resin melting or softening tube or cylinder having a charging zone and a melting zone.

It is desirable that the granules 64 of resin 20 shall remain cool until they have been moved forward in the reservoir 52 by the plunger 206 into close proximity to a plane defined by the section line 68 which divides the melting zone from the charging zone. Accordingly, the tube 204 has formed integral with it a plurality of cooling fins 208 (Figs. 1, 3 and 4) surrounded by a jacket

209 which has a plurality of air passages 211 (Fig. 4) and is secured to the tube. Cool air under pressure is supplied by a conduit 215 to the passages 211 and circulates around the fins 208 and out through exit ends of passages 213 formed between the fins. In order to retain the granules 64 of resin in the funnel 202, said funnel has a cover 217 normally held in position by a leaf spring 219 secured to the cover by a knob 221.

In order to melt or soften the resin granules 64 forced into the melting or softening zone 66 of the extruder 54 by the plunger 206, the tube 204 has surrounding a portion of it a sleeve heater 210 (Figs. 1, 3 and 4) and the multi-part block 39 has formed in it a horizontal cylindrical recess 212 for receiving an electric heating unit 214. In order to insure that the resin passing from the reservoir 52 to and through the recess 42 shall remain soft and accordingly flowable the multi-part block 39 has formed in it vertical recesses 216, 218 (Fig. 3) for receiving electric heating units 220, 222 respectively and has secured to it a collar 223 into which extends a heating unit 224. The reservoir may be described as having a relatively cool section for receiving the granules 64 of resin 20 and a relatively hot section in which the resin is softened.

The plunger 206 has at its rear end a flange 225 (Fig. 4) which is held in a groove 227 of the piston 92 by a plate 229 secured to said piston by a pair of screws 226, said screws also serving to secure, by the use of a clamp plate 228, a rod 230 to the piston 92.

The amount of resin injected into the work during each cycle of the machine is usually somewhat less than the amount of resin in the form of granules 64 transferred along the reservoir 52 from below the funnel 202 to a position behind the column of softened resin in the reservoir. Accordingly, it will be apparent that should the plunger 206 operate through a cycle during each cycle of the machine, the resin in the reservoir 52 would eventually build up to the right of the plane 68, as viewed in Fig. 4, until it reached the rear end of an exit 232 of the funnel 202 and approximately the starting portion of the plunger. This condition is undesirable since, should the machine remain inactive for a substantial period when such condition exists, a portion of the resin which is included in the reservoir 52 between the plane 68 and the funnel exit 232 and is inclined to soften, especially in the vicinity of said plane, will tend to "freeze" or harden and cannot be readily restored to its softened condition.

With the foregoing in view the piston 92 and accordingly the plunger 206 is forced intermittently to the left, as viewed in Fig. 4, by air pressure entering a port 234 into which is threaded an air line 236, a line 238 at such time being closed off from a port 240 leading to the chamber 76 formed in part by faces 242 which are formed on the piston 92 and may be considered collectively as a single face, until a valve 244 operatively connected to the plunger 206 by mechanism hereinafter described has moved into a position in which an annular recess 246 thereof is in register with the port 240 and accordingly renders the line 238 accessible to the port 240, thereby making available high-pressure air for the face 242 of the piston 92. Such action takes place when a thrust face 248 of the plunger 206 has advanced in the vicinity of the plane of the section line 68. The right end of the piston 92, as viewed in Fig. 4, comprises a face 249 of a packing ring 251, a face 249a of the piston 92 and a face 249b of the clamp plate 228. The faces 249, 249a and 249b may be collectively regarded as a single face.

When the machine is idle and so long as a column of resin in the reservoir 52 extends an appreciable distance to the right of the plane of section line 68 (Fig. 4) the port 240 is open to an angular port 250 which is formed in the valve 244 and is open to the atmosphere. The valve 244 is operatively connected by a link 252 to a control arm 254 (Figs. 4 and 4a) which is journaled

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upon a shoulder screw 256 secured to the main frame 40 and has secured to it a screw 258 which passes through an arcuate guideway 260 formed in the main frame and is centered about the axis of the shoulder screw 256. The control arm 254 is frictionally forced against a flat face of the machine frame 40 by a spring-pressed washer 261. The upper end of the arm 254 is bifurcated and straddles a reduced portion of the rod 230 and is arranged between a pair of nuts 262, 264 threaded onto the rod, the nut 262 engaging the arm 254 to move said arm to a retracted position, and the nut 264 engaging the arm 254 as the stoker 206 moves to a projected position during one cycle of the machine or moves intermittently and progressively to said projected position during successive cycles of the machine. Since the valve 244 is operatively connected to the control arm 254 it will be apparent that the limit of movement of the plunger 206 to its projected position or to the left, as viewed in Fig. 4, and accordingly the volume of resin in the reservoir to the right of section line 68, may be varied by adjusting the nut 264 into different operative positions upon the rod 230, the adjustment of said nut usually being such that when the face 248 of the plunger 206 reaches the plane of the section line 68 the port 240 is open to the line 238 so that during the same cycle of the machine the plunger is retracted. The resin granules 64 which have fallen into the reservoir 52 during retraction of the plunger 206 are forced against the end of the packed resin by the plunger as said plunger moves to its projected position, the length of the initial stroke of said plunger depending upon the amount of resin at the right of the section line 68. During a following cycle or following cycles of the machine the plunger 206 advances step-by-step until it face 248 reaches the plane of the section line 68 whereupon it is moved back to its retracted position and again to its projected position to supply another "batch" of resin granules to the reservoir. If it is found that for a particular type of work not enough resin is being supplied to the reservoir 52, the nut 264 is adjusted forward, that is to the left as viewed in Fig. 4, on the rod 230 so that the plunger will return to its retracted position earlier and accordingly will operate through its complete stroke more frequently. If desirable the tube 204 may be changed for a tube having a reservoir 52 of a larger of smaller diameter and in effecting such a change a funnel 202 which is of a different size and has a different size exit or exit port 232 may be used.

It is desirable that when the ring-shaped recess 194 returns to its position shown in Fig. 5 the plunger 206 shall be exerting pressure on the resin in the reservoir 52 in order immediately to fill said recess. Moreover, it is desirable in order to assist in maintaining the resin in the reservoir 52 in the proper softened condition that when the machine is at rest the plunger 206 shall remain pressed against the resin in the reservoir. The plunger 206, when permitted to do so by reason of the annular recess 246 of the valve 244 connecting the port 240 to the line 238, moves to its retracted position to enable granules 64 to drop into the reservoir and then rams them against the resin in the reservoir during the time that the measured amount of resin in the ring-shaped recess 194 is being transferred to the port 164 and the recess is being moved back to its resin receiving position, said plunger when the machine is at rest being forced against the resin in said reservoir.

Each of the valves 96, 98, 100 and 102, which are identical and of the common four-way type, comprises a multipart housing 266 (Fig. 2) having a passage 268 in communication with an intake line 270, 270a, 270b or 270c from the above-mentioned accumulator (not shown) and passages 272 alternately in communication with lines 142, 144; 160, 162; 236, 238; and 274, 276 leading respectively to the jack, awl, plunger and injector housings 80, 82, 84 and 86. Mounted for reciprocation

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in a guideway 278 of each of the housings 266 is a piston 280 which is secured by a rod 282 to a slide 284 upon which is mounted a cam roll 286, the rolls of the valves 96, 98, 100 and 102 being constantly urged against the associated cams 106, 104, 108 or 110 by springs 288. Also formed in the valve casing 266 is a passage 290 which is in communication with an exhaust port 292. When the cams 104, 106, 108 and 110 are rotated the pistons 280 are moved into different operative positions in the guideways 278 causing corresponding lines 142, 144; 160, 162; 236, 238; and 274, 276 of the pairs of lines to be connected alternately to the accumulator and to the exhaust ports 292 to operate the pistons 88, 90, 92 and 94 and accordingly to operate the jack 24, the awl 48, the plunger 206 and the lever 184 in timed relation for purposes above explained. As above explained, the actuating means for the plunger 206 is so constructed and arranged that the port 234 is accessible to the exhaust port 292 only during the time that the shoulder 192 of the plunger 168 is out of communication with the port 196 thereby insuring that when the ring-shaped recess 194 is in communication with the reservoir 52 the plunger at all times exerts a follow up pressure on the resin in said reservoir. As above explained, the face 242 of the piston 92 is not ordinarily open to the accumulator until the face 248 of the plunger 206 reaches the plane of the section line 68 and this may occur during each cycle of the machine or only during a plurality of cycles depending upon the amount of resin injected into the work during each cycle.

It is desirable to insure against binding of the multipart piston 94 in the chamber 78 and also to insure against there being any strain on the measuring, injecting and transferring unit 50 as it is acted upon by said piston. Accordingly, the piston 94 is operatively connected to a rod 300 which is slidably mounted for reciprocation in a bushing 302 threaded into the housing 86 and is connected by an elongated slot and pin connection 304 to the lever 184. The rod 300 has at its lower end a head 306 mounted in a bore 308 of a sleeve portion of the piston 94, a spring 310 interposed between a shoulder of said sleeve portion and the head of the rod constantly forcing said rod toward a plug 312 which is secured to the sleeve by a pin 314. As heretofore explained, the piston 90 and the mechanism for operating it are substantially identical with the piston 94 and its associated mechanism and need not be shown and described herein in detail.

The bushing 302 is initially rotated into such an adjusted position in the housing 86 that during the resin injecting stroke of the plunger 168, the piston 94 engages said bushing just before the sleeve 176 engages the shoulder 192 of the plunger 168 the flange 170 of the plunger 168 at that time being in engagement with the face or stop 200 of the multi-part block 39. With such a construction it will be apparent that contact between the piston 94 and the bushing 302 will relieve strain on the resin measuring, transforming and injecting unit 50. Moreover, at the end of each cycle of the machine, the piston 94 is in engagement with the lower end of the cylindrical chamber 78, the spring 310 having been compressed after the flange 170 of the plunger 168 has engaged the shoulder 188 and the sleeve 176 has engaged the nut 180 threaded onto the plunger. By providing the spring connection between the sleeve portion of the piston 94 and the rod 300, strains between the plunger 168 and the multi-part block 39 on the one hand and between the sleeve 176 and the nut 180 on the other hand during retraction of the plunger are eliminated.

It will be noted that the upper end of the housing 82 has threaded into it a bushing 315 which is identical with the bushing 302 and adjustment of which in the housing regulates the projected position of the awl 48 beyond the work engaging face 38 of the abutment 36, in accordance with the thickness of the work. As above stated, it is desirable that the awl 48 in its retracted position shall have

its face 146 arranged adjacent to the undercut recess 42. The retracted position of the awl 48 may be initially varied by a stop screw 317 which during the retraction of the awl is engaged by the lever 156, the engagement between the lever and the screw being cushioned by a piston, spring and connecting rod construction such as that which operates the lever 184.

The nut 180 may be initially rotated into different adjusted positions upon the shank 174 of the plunger 168 in order to vary the size of the annular recess 194 and accordingly the amount of resin injected into the conduit 46 during each cycle of the machine. In order to maintain the initial adjustment of the nut 180 on the plunger 168 and to insure that the plunger 168 shall be constrained to slide as a unit with the sleeve 176 except when movement of the plunger is positively prevented by its engagement with the multi-part block 39, the lever 184 has mounted on it a bearing pin 316 upon which is mounted a locking lever 318 constantly urged counterclockwise, as viewed in Fig. 4, by the above-mentioned spring 322, the forward end of the locking lever having a lug 324 (Figs. 4 and 6) fitting in any one of a plurality of recesses 326 in the upper end of the nut.

In order to insure that the reservoir 52 shall be adequately filled with resin to the right of the plane of the vertical section 68, as viewed in Fig. 4, preparatory to operating upon work, there is pivoted upon a shoulder screw 328 threaded into the housing 86 an abutment 330 having an upstanding flange 332 which may be swung beneath the rear arm of the lever 184 when said lever has been rocked counterclockwise as viewed in Fig. 1. Such action causes the sleeve 176 to be held depressed below the port 196 and when the machine has completed a few cycles with the sleeve held depressed, resin if necessary will be forced by the plunger 206 in sufficient quantities into the reservoir 52, the setting of the nut 264 being such that the stoker comes to rest when the resin in the reservoir 52 has been built up to the right of the plane of the vertical section 68. The abutment 330 is then swung from beneath the lever 184.

In the operation of the illustrative machine the operator places the work, which may consist of the two strips or pieces 22 of leather, upon the surface 28 of the table 26 or upon the surface 32 of the horn 30 and then depresses the treadle rod 111 thereby effecting continuous rotation of the cam shaft 112 and accordingly operation of the machine through successive cycles so long as said rod remains depressed.

During each cycle of the machine the cam 130 is moved forward raising the table 26 and accordingly forcing the upper of the strips 22 of leather with considerable pressure against the face 38 of the abutment or mold 36 after which the awl 48 is forced downward, from its retracted position shown in Fig. 5, through the recess 42 and into the work to its projected position illustrated in Figs. 6 and 8. The awl 48 is then raised to its retracted position and while the work is held compressed between the table 26 and the abutment 36 the lever 184 is swung counterclockwise, as viewed in Figs. 1 and 4, causing depression of the plunger 168 and the sleeve 176 from their positions shown in Fig. 6 to their positions shown in Fig. 7, and accordingly the transferring under pressure of a measured amount of softened resin, which has been delivered to the annular recess 194 from the reservoir 52, into the conduit 46 thereby forcing substantially the same amount of softened resin through the recess 42 and into the hole or passageway 58 or 58a formed in the strips 22 of leather. The thermoplastic resin injected into these holes hardens almost immediately and after the table has been depressed by the action of the spring 132 upon rearward movement of the cam 130, the operator feeds the strips of leather transversely over the table 26 preparatory to clamping adjacent areas of the strips between the table 26 and the abutment during the first part of the next cycle of the machine. During the

time that the resin is being transferred to the conduit 46 the plunger 206 moves to its retracted position to permit the resin granules 64 to drop into the reservoir 52 and then forces said granules against the mass of resin in the reservoir.

When it is desired to form fastenings 58a which extend through both strips of leather the horn 30 (Fig. 9) is substituted for the table 26, the operation of the machine being similar to that above described except for the fact that the throw of the awl 48 is increased by adjusting the bushing 315 to the proper position so that said awl passes through the work and a slight distance into the bore or hole 34 formed in the horn.

It will be noted that the diameter of the bore or hole 34 is slightly greater than the diameter of the awl 48 and that in effect a mold cavity 334 is formed in the horn 30 by leather fibers 336 forced into the hole 34 by the action of the awl so that the horn 30 and the leather fibers 336 serve as a mold. By providing the cavity 43 with a diameter which is greater than the diameter of the awl and by providing the mold arrangement wherein the hole 34 has a diameter greater than the awl 48, heads are formed at opposite ends of the fastenings 58a, as shown in Fig. 11, the excess leather fibers 336 which have been forced into the hole 34 assisting in the forming of the lower heads. The holes or passageways 58, 58a formed by the awl 48 during its penetration of the strips 22 of leather are somewhat ragged so that when the thermoplastic resin is forced under pressure into said holes, the fastenings are sufficiently roughened so that they anchor themselves into the work.

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

1. In a fastening machine, a support for work two or more parts of which are to be secured together, an abutment having a face in which is formed a cavity, means for moving the support toward the abutment to clamp said parts between the support and the abutment, an awl guide and a resin conduit opening into said cavity, an awl movable from a retracted position in said guide through said cavity beyond said face of the abutment and into said parts of the work to form a hole in said parts, a housing having a guideway, a plunger which is slidably mounted in said guideway and has a reduced shank and a shoulder, a sleeve which is slidable upon said shank and in said guideway and which forms a metering cavity with said guideway, said shank and said shoulder, means for forcing softened resin into said metering cavity, a stop, mechanism for moving as a unit in said guideway the sleeve and the plunger to transfer resin in said metering cavity to a position available for said conduit and for thereafter moving the sleeve in said guideway relatively to the plunger to move said sleeve toward said shoulder of the plunger to force a measured amount of resin from the metering cavity and into said conduit to cause resin to be forced into the cavity and the hole formed in said parts of the work, and means for moving said support, said awl, the resin forcing means and said mechanism in timed relation.

2. In a fastening machine, a support for work comprising two or more parts which are to be secured together, an abutment having a face in which is formed a cavity, said support being movable relatively to the abutment to clamp the work against said face of the abutment, an awl guide and a resin conduit opening into the cavity, an awl movable from a retracted position in said guide through the cavity to a projected position into said parts of the work to form a hole in said parts, a housing having a guideway, a plunger slidably mounted in said guideway and having a reduced shank and a shoulder, a sleeve which is slidable upon said shank and in said guideway and which forms a metering cavity with said shank, said shoulder and said guideway, an extruder having a port through which softened resin is supplied under pres-

sure to the metering cavity, a stop, a power operated actuating lever for operating the sleeve, a nut threaded onto the plunger, spring operated mechanism carried by said lever for constantly urging said nut against the sleeve to insure the formation and maintenance of said metering cavity during a predetermined portion of the cycle of the machine, and means comprising said lever and said spring operated mechanism for moving as a unit the sleeve and the plunger to transfer resin introduced into said metering cavity by the extruder to a position in which it is available for the resin conduit and for thereafter moving said sleeve against the action of said spring operated mechanism relatively to the plunger after the engagement of the plunger with said stop to force the resin in said metering cavity into the conduit to cause resin to be forced into the cavity and the hole formed in said parts of the work, and means for moving the support, the awl and the last-named means in timed relation.

3. In a fastening machine, a support for work comprising two or more parts, an abutment having a face in which is formed a cavity, means for effecting relative movement between the support and the abutment to clamp said parts of the work between the support and said face of the abutment, a reciprocable awl movable from a retracted position, through said cavity to a projected position beyond said face of the abutment to form a hole in said parts of the work, a resin conduit opening into said recess, an extruder comprising a reservoir having a relatively cool entry section for receiving resin granules and a relatively hot section in which the resin is softened and comprising a stoker reciprocable in said reservoir, mechanism associated with said extruder for effecting transfer under pressure from the reservoir of measured amounts of resin to said conduit and for forcing resin into said cavity and the hole formed in said parts of the work, said transfer mechanism being operated in timed relation with the awl, the first named means and the stoker, fluid pressure means for forcing said stoker step-by-step in one direction to cause said stoker to move through said entry section of the reservoir to advance granulated resin to the hot section of the extruder and to supply softened resin to said mechanism, and fluid pressure means for returning the stoker to a retracted position out of said entry section only when said stoker has forced the softened resin well into the hot section of the reservoir preparatory to forcing step-by-step from the entry section of the reservoir another charge of resin into said hot section of the reservoir.

4. In a fastening machine, a housing comprising a guideway and an abutment having a cavity, a support, mechanism for operating the support to force work which comprises two or more parts and is mounted upon the support intermittently against said abutment, an awl guide and a resin conduit which form parts of said housing and open into said cavity, an awl which is movable in said guide, mechanism for actuating said awl to form a hole in said parts of the work, resin receiving means comprising a pair of slides which are movable in said guideway of the housing and form together with said guideway a metering chamber of a predetermined size, an extruder comprising a stoker for forcing softened resin into said chamber, and means for moving in the guideway of the housing said slides together as a unit to transfer a predetermined amount of resin in said chamber from communication with the extruder to communication with said resin conduit in timed relation with the support operating mechanism, the awl actuating mechanism and the stoker and for thereafter moving one of the slides relatively to the other to force said resin from the metering chamber into said resin conduit to cause an equal amount of resin to be forced under pressure into the cavity and into the hole formed in the parts of the work.

5. In a machine for injecting plastic, a member having formed therein a bore which communicates with an intake

port and a discharge port, the discharge port being offset longitudinally of the bore from the intake port, two members mounted in the bore, and an actuator for effecting mutual separation of the members to provide a measured chamber which is charged with fluid through the intake port, for effecting a movement of translation of the members, with the chamber charged with fluid, into a position in which the chamber is in registration with the discharge port, and for effecting mutual approach of the members thereby to cause total expulsion of the fluid in the chamber through the discharge port.

6. In a machine for injecting plastic fastenings, an awl for forming openings in work pieces for receiving plastic to form rivets, a head having a bore in which the awl operates, a work support having an opening for receiving punchings from the awl, means for actuating the awl to form a hole through work pieces on the work support and to drive the punchings from the work into the opening in the work support and part way through the opening into a position in the work support such that the exposed surface of the leading punching provides one face of a mold for forming a head at one end of a fastening means, the awl in its retracted position providing one surface of a cavity in which is received plastic for use in forming a head at the other end of the fastening means, the head in which the awl is mounted having a second bore which communicates with an intake port and a discharge port, the discharge port being offset longitudinally of the second bore from the intake port, two plungers mounted in the second bore, and an actuator for effecting mutual separation of the plungers to provide a measured chamber which is charged with fluid through the intake port, and for effecting mutual approach of the plungers thereby to cause total expulsion of the fluid in the chamber through the discharge port and through a conduit connecting the discharge port to the bore in which the awl is mounted.

7. In a fastening machine, an abutment having a face provided with an awl passage, means for pressing work pieces against the face of the abutment, an awl, means for actuating the awl to form holes in the work pieces, a member having formed therein a bore which communicates with an intake port and a discharge port, the discharge port being offset longitudinally of the bore from the intake port, two members mounted in the bore for movement toward and from each other, an actuator for effecting mutual separation of the members to provide a measured chamber which is charged with fluid through the intake port, for effecting a movement of translation of the members, with the chamber charged with fluid, into a position in which the chamber is in registration with the discharge port and for effecting mutual approach of the members thereby to cause expulsion of the fluid contained in the chamber through the discharge port, and means providing a passage from the discharge port to the awl passage in the abutment.

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