

June 17, 1952

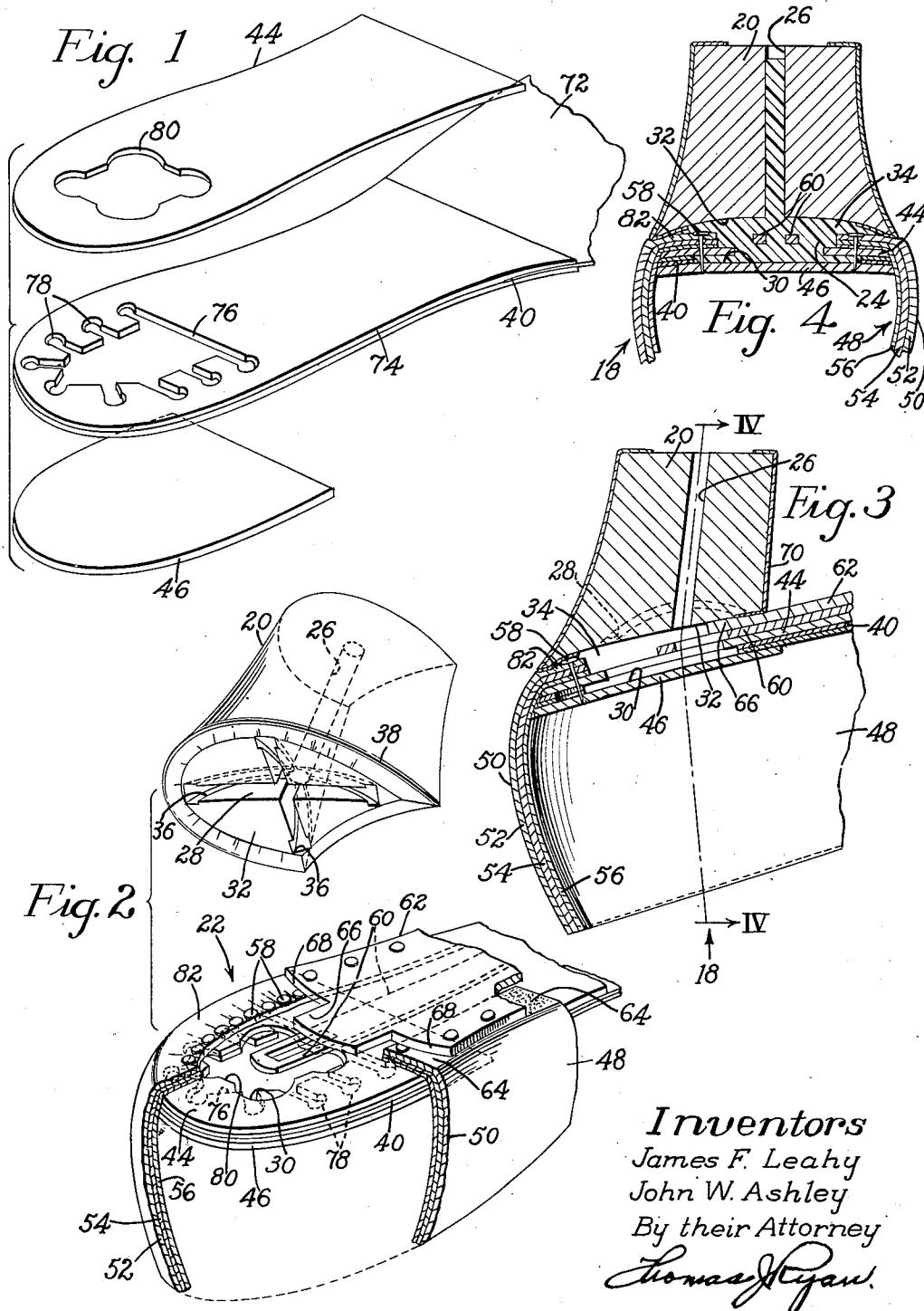
J. F. LEAHY ET AL

2,600,507

APPARATUS FOR USE IN THE ATTACHMENT OF HEELS TO SHOES

Filed Aug. 7, 1948

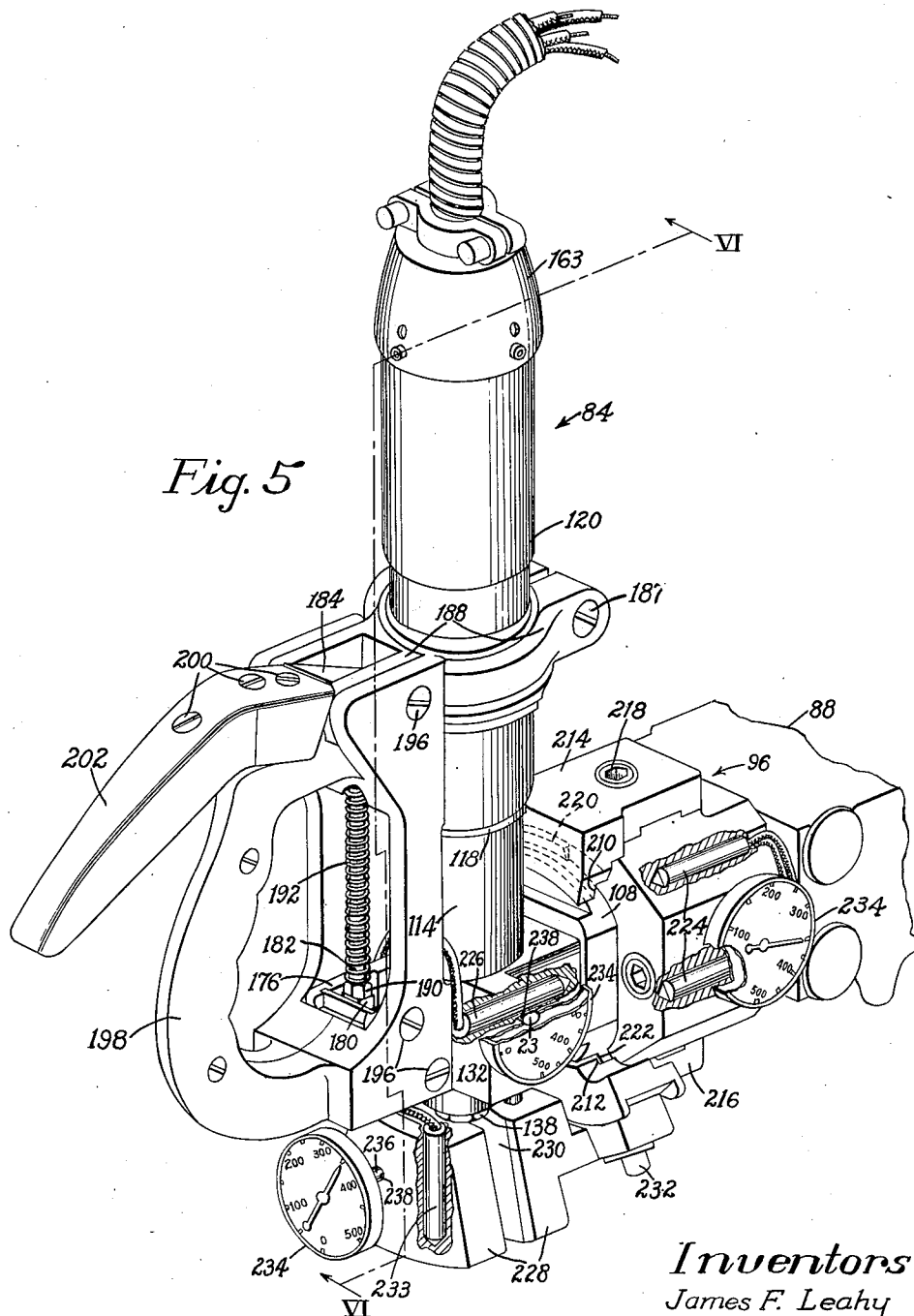
6 Sheets-Sheet 1



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6 Sheets-Sheet 2



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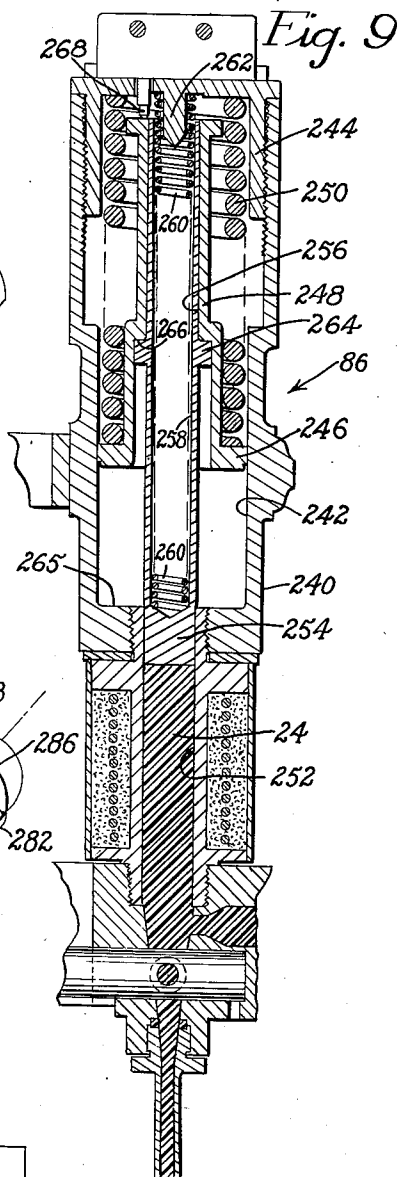
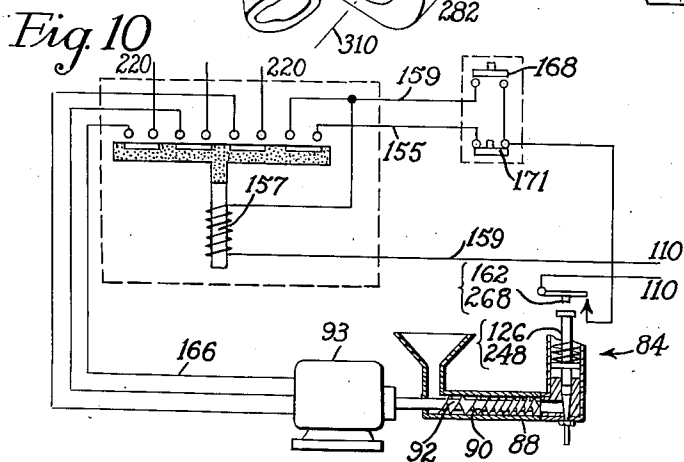
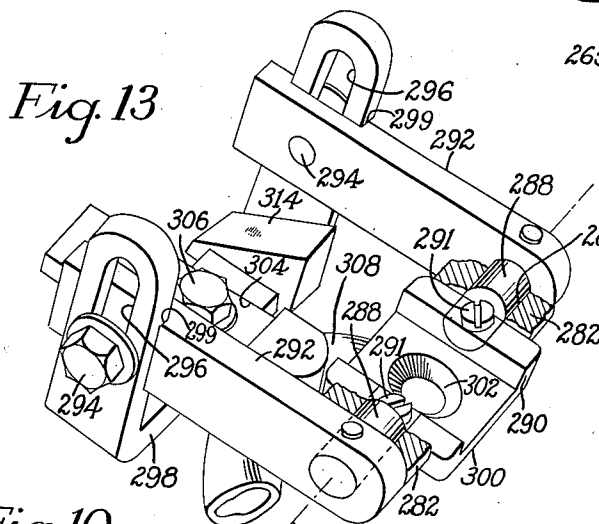
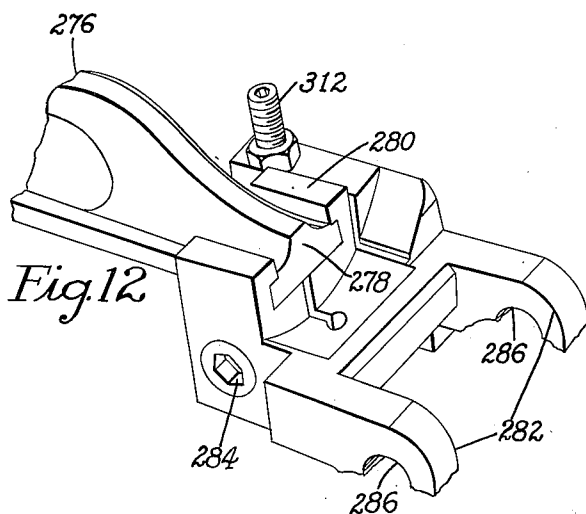
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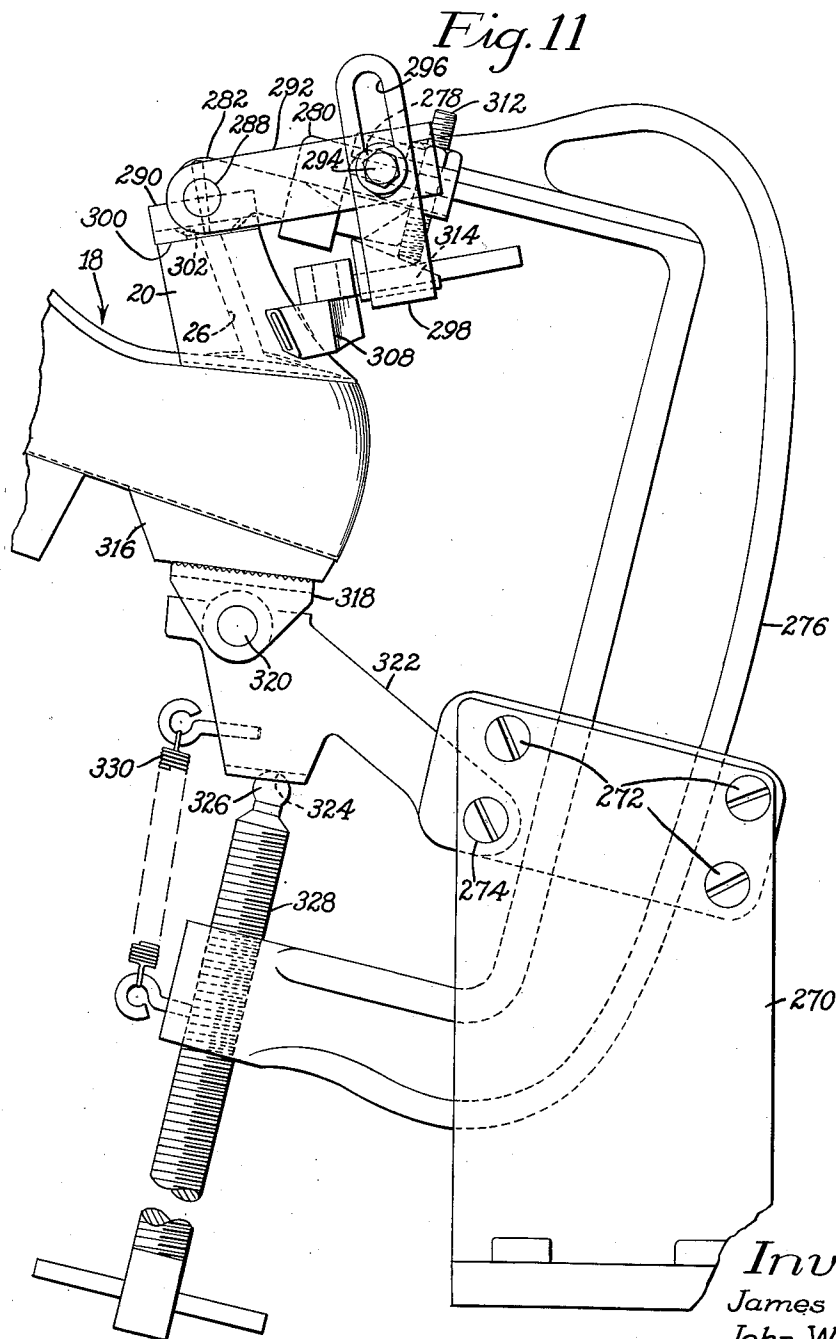
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APPARATUS FOR USE IN THE ATTACHMENT OF HEELS TO SHOES

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6 Sheets-Sheet 6



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UNITED STATES PATENT OFFICE

2,600,507

APPARATUS FOR USE IN THE ATTACHMENT
OF HEELS TO SHOES

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Application August 7, 1948, Serial No. 43,046

6 Claims. (Cl. 18—30)

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This invention relates to shoe machinery and is herein illustrated as embodied in an apparatus for use in the attachment of heels to shoes.

It has been proposed, as disclosed for example in United States Letters Patent No. 2,447,512, granted August 24, 1948, in the name of James F. Leahy, permanently to attach a heel to a shoe by thermoplastic resin which is injected into opposite undercut cavities in the heel seat of the shoe and the attaching face of the heel after the heel has been clamped against said heel seat and which, after filling said cavities and also filling all voids formed between the attaching face of the heel and the heel seat of the shoe and being allowed sufficient time to harden, serves as a rivet for securing the heel permanently to the shoe.

In the attachment of wood heels to shoes in accordance with the above practice the heel of the shoe is clamped with heavy molding pressure against the heel seat of the shoe and softened thermoplastic resin is thereafter injected under high substantially sustained pressure through a passage extending heightwise of the heel and terminating at the tread end of the heel into the above-mentioned undercut cavities and voids. It will be appreciated that the amount of pressure which in the attachment of the wood heel to the shoe may be applied to the heel without breaking it is limited and also that the pressure under which quick setting thermoplastic resin must be injected into the cavities and voids in order to be effective is substantial. It has been found that when a heel is attached to a shoe in accordance with the above practice there is a tendency for the thermoplastic resin to seep out from between the heel seat of the shoe and the rim or the breast edge of the attaching face of the heel with the result that the finish of the shoe is impaired. Such seepage is usually caused by the high pressure of the softened thermoplastic resin which is injected between the heel seat of the shoe and the attaching face of the heel opposing and thus rendering less effective the heavy molding pressure of the heel against the heel seat of the shoe. It will thus be apparent that when the pressure of the viscous or softened thermoplastic resin between the heel and the heel seat of the shoe reaches a certain point it reduces the heel attaching pressure sufficiently

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to cause the heel to move slightly away from its molding position upon the heel seat of the shoe in which position it is desirable that the heel remain during and after its attachment to the shoe.

Such movement of the heel from its molding position upon the heel seat of the shoe may or may not be accompanied by the above-mentioned seepage but impairs the general appearance of the shoe since the heel does not then merge attractively with the counter portion of the shoe.

It is an object of the present invention to provide an improved apparatus for quickly and effectively attaching heels to shoes by the use of thermoplastic resin. With the above considerations in view there is disclosed herein an improved method of permanently securing together two parts of an article, for example, a shoe and a heel, said method comprising providing the attaching face of the heel and the heel seat of the shoe with opposing anchoring cavities, forcing the heel with heavy pressure against the heel seat of the shoe, injecting under high pressures a mass of viscous thermoplastic material into said cavities and also into voids formed between the heel and the heel seat of the shoe until said cavities and voids are almost filled, reducing radically the pressure under which the thermoplastic material is injected into the cavities and voids as said cavities and voids become filled, and maintaining the heel forced with heavy pressure against the heel seat of the shoe until the material has set.

The heel and the shoe constructions herein- after illustrated are generally similar to those disclosed in said Patent No. 2,447,512. After the heel has been clamped against the heel seat of the shoe, softened thermoplastic material which is of the resinous type and will hereinafter be referred to as resin is forced through a passage in the heel corresponding to the above-mentioned passage by an injector or dispensing gun having a nozzle which fits in the tread end of said passage, the resin filling the undercut cavities in the heel and the heel seat of the shoe and also filling the voids between said heel seat and the attaching face of the heel. In order quickly and effectively to fill said cavities and voids with thermoplastic resin and also to avoid the above-mentioned drawbacks the illustrative injector is

adapted initially to force the softened thermoplastic resin into the cavities and voids under high nozzle pressure of approximately 1600 pounds per square inch which is thereafter reduced below 390 pounds per square inch, for example, so that when the cavities and voids are approximately filled and the resin pressure between the heel seat of the shoe and the heel begins to build up, the injecting nozzle pressure will be below 390 thereby insuring against moving the heel away from its proper molding position upon the heel seat of the shoe and also insuring against the above-mentioned seepage of the resin.

The injector or dispensing gun comprises a chamber for receiving softened thermoplastic resin, a plunger slidable in said chamber, a spring for constantly urging the plunger into the chamber, a passage for receiving the thermoplastic resin under heavy pressure and for delivering it to said chamber causing displacement of the plunger and compression of the spring, a nozzle constructed and arranged to fit the above-mentioned heel passage communicating with said cavities in the heel and the heel seat of the shoe, a passage for conducting the softened resin from the chamber to the nozzle, and a valve movable in one direction in said last-named passage to prevent flow of resin from the chamber to the nozzle and movable into another position to enable flow of resin under decreasing pressure of the spring-pressed plunger through said nozzle and through the passage in the heel into said cavities.

There is also disclosed herein a modified injector or gun similar to the above-described injector but comprising heavy and light springs, both of which operate upon the plunger causing a predetermined mass of softened thermoplastic resin quickly and effectively partially to fill the above-mentioned cavities and voids, the light spring alone thereafter operating upon the plunger to complete the filling of said cavities and voids.

Softened thermoplastic resin is supplied by a suitable electrically operated extruder. Each injector comprises a coupling and the extruder has secured to it an extruder head. By operatively connecting the coupling of the injector to the extruder head softened thermoplastic resin may be quickly and effectively supplied to the ejector from the extruder. When the resin receiving chamber of each of the injectors has received the proper amount of resin which amounts consists of a mass slightly greater than that required to fill the cavities and voids in the largest shoe to be operated upon, the extruder is automatically stopped and cannot again be started until a manually operated switch is actuated.

By causing under final expanding action of a strong spring as in the case of the first described injector, or by causing under the action of the weak spring in the case of the modified injector, thermoplastic resin to be forced into the above-mentioned cavities and voids in sufficient quantities to fill said cavities and voids then partially filled, there is little if any tendency to build up pressure between the heel and the heel seat of the shoe, to a point which will cause displacement of the heel from its proper clamped position against the heel seat of the shoe or which will cause the above-mentioned seepage of thermoplastic resin between the heel and the shoe.

The various features of the invention will be understood and appreciated from the following

detail description read in conjunction with the accompanying drawings in which

Fig. 1 is an exploded view showing in perspective a composite insole, partly broken away and heel seat and sock lining tucks prior to their assembly in the manufacture of a shoe to which a heel is to be attached by thermoplastic resin in accordance with our improved heel attaching method;

Fig. 2 shows in perspective a heel and the rear end of a shoe, partly broken away, which is ready to receive a heel;

Fig. 3 is a longitudinal median section through the rear end of the shoe and the heel shown in Fig. 2 after the heel has been clamped with molding pressure against a heel seat of the shoe preparatory to being permanently attached to the shoe;

Fig. 4 is a section on line IV—IV of Fig. 3 after the thermoplastic resin has been injected into the undercut cavities in the heel seat of the shoe and the heel and has been allowed to set to attach the heel permanently to the shoe;

Fig. 5 is an angular view of an injector or gun by the use of which the thermoplastic resin is injected into said cavities, coupled to an extruder from which the injector receives its supply of softened thermoplastic resin;

Fig. 6 is a section on line VI—VI of Fig. 5;

Fig. 7 is a section on line VII—VII of Fig. 6;

Fig. 8 is a side elevation, partly broken away and partly in section, showing a heel clamping machine and the injector shown in Figs. 5, 6 and 7 in the process of injecting the resin into the undercut cavities of the heel seat of the shoe and the attaching face of the heel clamped against the shoe;

Fig. 9 is a vertical section corresponding to Fig. 6 showing portions of a slightly modified injector or gun;

Fig. 10 is a wiring diagram showing electrically operated means for controlling the extruder and accordingly the filling of the injector;

Fig. 11 is an enlarged side view of the heel clamping machine shown in Fig. 8; and

Figs. 12 and 13 are angular views showing in detail portions of a heel engaging member of said heel clamping machine.

As explained in the above-mentioned Patent No. 2,447,512, in the manufacture of women's shoes 18 (Figs. 3, 4, 8 and 11) it has been proposed to attach a wood heel 20 of the Cuban type to the heel seat 22 (Fig. 2) of the shoe by thermoplastic resin, for example, while the heel is clamped under molding pressure to the heel seat of the shoe, said resin being injected into a passage or bore 26 (Figs. 2, 3, 4, 8 and 11) extending heightwise through the heel and filling undercut reentrant or anchoring cavities 28 (Figs. 2 and 3), 30 (Figs. 2, 3 and 4) in the attaching face 32 of the heel and the heel seat 22 respectively as well as all voids or spaces 34 (Figs. 3 and 4) formed between the attaching face of the heel and the heel seat. The cavity 28 in the attaching face 32 of the heel 20 comprises a pair of intersecting undercut slots 36 having the appearance of the letter X as viewed when looking down on said attaching face of the heel. The illustrated slots 36 extend into close proximity to the rim 38 (Fig. 2) of the attaching face 32 of the heel and have central intersecting portions which are in register and communicate with the passage 26 in the heel through which the resin 24 is injected.

The shoe 18 comprises the composite insole 40 (Figs. 1, 2, 3 and 4) reinforced by the heel seat

and sock lining tucks 44 and 46 which are made of fibre or other suitable material; an upper 48, the heel end or counter portion 50 of which consists of a layer of outer leather 52, a fibre counter 54 and a lining 56, all suitably sewed together, heel seat lasted and secured to the heel seat of the reinforced insole by tacks 58; a metal shank stiffener 60 which is secured at its forward end to the reinforced insole 40 by staples (not shown); and an outsole 62 (Figs. 2 and 3) which is adhesively secured to a roughened overlasted margin 64 (Fig. 2) of the shoe upper 48 and the heel seat of which has been reduced to provide a heel seat tab 66 and heel breast receiving shoulders 68 engaged in the finished shoe by the forward end of the attaching face 32 and the breast 70 (Fig. 3) respectively of the heel.

The composite insole 40 consists of a forepart 72 (Fig. 1) and a paper-board shank and heel seat portion 74 interfitted and cemented together. The undercut cavity in the heel seat 22 of the shoe 18 is formed by providing in the heel seat of the composite insole 40 an opening 76 (Figs. 1 and 2) having finger portions 78 extending close to the heel seat margin of the sole, and forming in the heel seat tuck 44 prior to its attachment to the insole, an opening 80 slightly smaller than the central part of the opening 76, the construction and arrangement being such that when the sock lining 46 and the heel seat tuck 44 are cemented to the composite insole 40 there are formed a plurality of undercut finger portions of the cavity 30. It will be noted that the rear end of the shank stiffener 60 extends into the void or space between the undercut cavities 28, 30 in the attaching face 32 of the heel and the heel seat 22 of the shoe 18 and that when viscous thermoplastic resin is forced under pressure through the passage 26 into the heel by the use of a gun of the type described in said Patent No. 2,447,512, the resin fills the undercut cavities 28, 30 and all voids 34 between the heel seat 22 of the shoe and the attaching face 32 of the heel and if desirable approximately all of the passage 26 as best shown in Fig. 4.

Preparatory to the permanent attachment of the heel 20 to the shoe 18 the rim 38 of the attaching face 32 of the heel is forced with heavy molding pressure against the outer edge of the overlasted margin 82 (Figs. 2, 3 and 4) of the counter portion 50 of the shoe and the breast 70 (Fig. 3) of the heel 20 is forced against the heel breast receiving shoulders 68 (Fig. 2), the forward end of the attaching face of the heel resting upon the heel seat tab 66. It is desirable that the overlasted heel seat margin 82 of the shoe shall be planar so that the entire rim 38 of the attaching face 32 of the heel shall exert uniformly distributed pressure against said margin, said rim usually molding or depressing the margin slightly as best shown in Figs. 3 and 4. The lasted margin 82 instead of being flat commonly has high and low spots and accordingly it is necessary to force the rim 38 of the heel 20 with heavy molding pressure against the heel seat of the shoe before and while the heel is being attached to the shoe in order to insure that the rim of the heel shall "hug" and merge attractively with the counter portion of the shoe. As previously explained the amount of pressure that can be applied against the wood heel without damaging it in forcing it against the heel seat of the shoe is limited, 500 pounds being about the maximum pressure commonly used in the attachment of the average Cuban heel to the shoe.

In the attachment of heels to shoes by the use of thermoplastic resin which sets fairly rapidly it has been the practice to inject the softened resin into the cavities 28, 30 in the attaching face 32 of the heel and the heel seat 22 of the shoe and into the voids 34 between the attaching face of the heel and said heel seat under a substantially uniformly high and sustained nozzle pressure, for example, of about 1600 lbs. per square inch in order to insure that the resin shall be effectively injected into and fill such cavities and voids before having a chance substantially to set. As above explained when heels are being attached to shoes by viscous thermoplastic resin injected into the cavities and voids under sustained heavy pressure there is a tendency for the heel to be raised slightly away from its proper molding position upon the heel seat of the shoe and also for the resin to seep out between the counter portion of the shoe 18 and the rim 38 of the attaching face 32 of the heel and/or between the forward edge of the attaching face of the heel and the shank portion of the outsole. Such conditions as above explained are due to the fact that when softened resin is injected into the cavities 28, 30 and the voids 34 after said cavities and voids are substantially full, a high pressure is built up beneath the attaching face of the heel, such pressure opposing and thus reducing the pressure which is forcing the heel against the heel seat of the shoe.

With the foregoing considerations in view we propose to force, as above explained, under high pressures a substantial quantity or mass of softened thermoplastic resin into the cavities 28, 30 and the voids 34, a remaining quantity or mass of softened resin necessary to fill the undecut cavities and voids being injected into said cavities and voids at low pressures, so that pressures imparted to the mass of resin substantially filling the cavities and voids shall not be great enough to oppose the heel clamping pressure sufficiently to cause the above-mentioned undesirable conditions.

There are disclosed herein two injectors or guns for use in practicing our method, Figs. 5, 6, 7 and 8 illustrating an injector or gun 84 which injects softened thermoplastic resin at initially high but gradually diminishing pressures into the cavities 28, 30 and the voids 34 and Fig. 9 illustrating an injector or gun 86 which is substantially like the above-mentioned injector but which injects a predetermined amount of softened thermoplastic resin into said cavities and voids under high diminishing pressures and then injects into the cavities and voids under low diminishing pressures an amount of softened thermoplastic resin necessary to fill said cavities and voids.

The injector 84 receives softened resin from an extruder 88 (Figs. 5 and 6) of any suitable commercial type in which said resin is electrically heated and has a bore 90 (Figs. 6 and 10) along which the resin is advanced under pressure by a screw 92 rotated by an electric motor 93 (Fig. 10). There is secured to the extruder 88 by screws 94 (Fig. 6) a head or coupling head 96 which has a stepped passage or conduit 98 forming an extension of the extruder bore 90, said passage having in its outer end a shoulder against which a fine mesh screen 100 is forced by the extruded resin. The screen 100 stops flow of the softened resin from the conduit 98 into a passage 102 in a cylindrical nozzle 104 of the

extruder head 96 when the screw 92 of the extruder 88 is at rest.

The injectors or dispensing guns 84, 86 when full hold a quantity or mass of resin slightly greater than that required to fill the cavities 28, 30 and the voids 34 in the attachment of a heel to the largest shoe operated upon, said guns having secured to them by screws 106 a locking plate or coupling 108 for quickly and effectively coupling the guns to the extruder 96, as will be explained later, preparatory to receiving a new charge of viscous thermoplastic resin.

The injector 84 has a steel barrel 110 (Figs. 6 and 8), the periphery of which is recessed for receiving an electric heater 112, there being secured to the barrel a casing 114 (Figs. 5, 6 and 8) for covering said heater. The barrel 110 is bored to provide a cylindrical resin receiving recess or chamber 116. Threaded onto the barrel 110 and insulated from portions of it by an insulating washer 118 is an aluminum spring housing 120 having at its lower end a cylindrical recess 122 and having threaded into its upper end a cap 124. Slidably mounted in the chamber 116 is a hollow plunger 126 which has an enlarged flanged portion 128 fitted for sliding movement in the recess 122 of the housing 120, a heavy spring 130 which is interposed between the flanged portion 128 of the plunger and the cap 124 of the housing 120 serving constantly to urge the plunger into the chamber.

Screwed onto the barrel is a valve block 132 having a two-part tapering recess or passage 134, an upper portion of which is in alinement with the lower end of the chamber 116 and into which opens an inlet passage or conduit 136 for receiving viscous thermoplastic resin. To the lower end of the valve block 132 is secured a nozzle 138 which has a shoulder 139 (Fig. 5) and is constructed and arranged to fit in the passage or bore 26 in the heel 20 and which has a passage 140 in communication with the lower portion of the tapered recess 134. Formed in the valve block 132 is a bore 142 serving as a bearing for a rotary valve 144 having a tapering recess 146 which may be moved into alinement with the upper and lower portions of the tapering recess 134 to permit resin in the chamber 116 to be forced by the spring actuated plunger 126 out through the passage 140 of the nozzle 138 or which may be moved into its position shown in Fig. 6 to cut off communication between the upper and lower portions of the recess 134 and accordingly ejection of thermoplastic resin from the nozzle. The rotary valve 144 may be described as being movable only transversely of the passage 134 from an open position to a closed position to close communication between the chamber 116 and the nozzle 138.

The coupling or locking plate 108 which is secured by the screws 106 to the valve block 132 and may be considered as part of the injector or gun has formed in it a cylindrical resin inlet passage or conduit 148, a valve guide 150 provided with arcuate slots 152 connecting the passage 148 to the passage 136, being clamped between opposing shoulders of the coupling 108 and the valve block 132. Freely sliding in a bore of the valve guide 150 is a valve 154 which has a frusto conical head 156 constructed and arranged to seat on a frusto conical port 158 of the coupling 108. The valve 154 slides to the left, as viewed in Fig. 6, in the guide 150 to an extent determined by the engagement of a collar 160 of the valve with the guide under the

action of the incoming softened thermoplastic resin forced from the extruder into the passage 148. After the thermoplastic resin has passed under extrusion pressure through the passage 148, the arcuate perforations 152 and the passages 136, 134 into the chamber 116 it raises the plunger 126 against the action of the spring 130, the chamber continuing to fill until the upper end of the plunger engages a normally closed microswitch 162 which is carried by the cap 124 of the spring housing 120 and is secured to the cap by a terminal housing 163 thereby breaking a holding circuit 155 and accordingly de-energizing a solenoid operated switch 157 to cause the opening of a circuit 166 for the extruder motor 93. In order to insure against starting the extruder 88 when the plunger 126 moves away from the microswitch 162 and until the actuation of a normally open switch 168 in a solenoid circuit 159, there is provided the above-mentioned holding circuit 155 which after the release of the switch 168 keeps the solenoid operated switch 157 energized until the opening of the microswitch 162. It will be apparent from the wiring diagram shown in Fig. 10 that once the microswitch 162 has been actuated to de-energize the solenoid operated switch 157 said switch cannot again be energized until the manually operated switch 168 is actuated. There is also provided in the holding circuit 155 a safety switch 171.

Various thermoplastic materials are suitable for use in the practicing of our method. An example of one composition which may be used successfully is as follows:

Parts by weight	
Ethyl cellulose (50 or 100 centipoise viscosity) ethoxy content, 45.0-46.5%-----	250
Diphenyl (O-xenyl) phosphate-----	50
Phenolic resin-----	30
Menthyl phenol-----	4.5
Calcium stearate-----	3.0

Injection of thermoplastic resin from the gun 84, the plunger 126 of which has been moved to a cocked position by the viscous thermoplastic resin entering the chamber 116, may be readily effected by rotating the valve 144 to a position in which the tapering recess 146 connects the upper and lower portions of the tapering recess 134, the recesses 134, 146 forming in effect a continuous tapered recess. The valve 144 is controlled by a rack 170 (Figs. 6 and 7) which meshes with a pinion 172 secured to the valve and which is slidably mounted in guideways 174 (Fig. 7) formed in spaced projecting ears 176 (Figs. 5, 6 and 7) of the valve block 132. The rack 170 carries a pivot pin 178 upon which is mounted a block 180 into which is threaded the lower end of a rod 182, the upper end of said rod being pivotally connected to a lever 184 journaled on a pivot pin 186 carried by a bracket 188 clamped by a screw 187 to the spring housing 120. The rack 170 may be initially adjusted with relation to the rod 182 to insure that the tapering recess 146 may be moved into its proper stop position in alinement with the tapering recess 134, after loosening a lock nut 190 which is threaded onto the rod and may be clamped against the block 180 to maintain the rod in its adjusted position with relation to the block. Surrounding the rod 182 and interposed between the nut 190 and the bracket 188 is a spring 192 for constantly urging the rack 170 downward until shoulders 194 (Fig. 7) of the valve 144 engage the ears

176 of the valve block 132. Secured by screws 196 (Figs. 5 and 8) to the ears 176 of the valve block 132 and to the bracket 188 is a wood handle 198 which is used by the operator in handling and operating the ejector or gun, said lever 184 having secured to it by screws 200 a wood hand piece 202 which when depressed raises the rack 170 into a position in which the tapering recess 146 is in alignment with the upper and lower portion of the tapered recess 134, such position being determined by the engagement of the shoulders 194 of the valve 144 with the ears 176 of the valve block 132.

The injector coupling 103 has a cylindrical throat or intake nozzle 206 which overrides and may be described as interfitting telescopically with the nozzle 104 of the extruder head 96 until a conical face or sealing portion 208 (Fig. 6) of the injector coupling is forced against an opposed complementary conical face or sealing portion 209 of said extruder head. The injector 84 may be forced into and held in its adhesive receiving position in the socket formed in the extruder head as shown in Figs. 5 and 6. This socket has a frusto conical face 209 at its inner end and, when the injector has been seated in the socket, the conical faces 208 and 209 of the coupling 103 and the extruder head 96 are in engagement. They are held in firm contact by upper and lower spiral cams 210, 212 which are formed on brackets 214, 216 respectively secured by screws 218 to the extruder head 96, said cams being constructed and arranged to be engaged by spiral faces 220, 222 of the coupling 103 as the injector is rotated clockwise as viewed in Fig. 5 into its proper position shown in Figs. 5 and 6 to receive softened thermoplastic resin from the extruder 88. It will be apparent that when the injector or gun 84 is rotated counterclockwise as viewed in Fig. 5 to permit it to be released from the extruder 96, the valve 154 is slid to the right as viewed in Fig. 6 by pressure of the thermoplastic resin within the injector, causing the head 156 of the valve 154 to close the port 158.

It is important that the temperature of the thermoplastic resin 24 in the various parts of the injectors or guns 84, 86 be retained sufficiently high to insure the proper flow of said resin into the undercut cavities 28, 30 in the attaching face 32 of the heel 20 and heel seat 22 of the shoe 18 and into the voids 34 between the attaching face of the heel and the heel seat of the shoe. Accordingly, the extruder head 96 has inserted in it four electric heaters 224 (only two shown) (Fig. 5) and the valve block has two electric heaters 226 (only one shown). Moreover, it is important that the nozzle 138 be kept hot while the gun is not in use. Accordingly, there is provided an electrically heated shroud or yoke 228 having a slot 230 in which the nozzle 138 of the gun 84 or 86 is moved when the gun is being moved to its resin receiving position shown in Figs. 5 and 6 in the extruder head 96. The heating yoke 228 is secured to the extruder head 96 by bolts 232 (only one shown) extending through recesses (not shown) in the yoke and threaded into the cam bracket 216. The yoke 228 is heated by a plurality of electric heaters 233 (only one shown). In presenting either of the injectors or guns 84, 86 to the extruder head 96 the cylindrical throat 206 of the locking plate 103 is slid onto the cylindrical nozzle 104 of the extruder head 96, the nozzle 138 of the gun being arranged to the right, as viewed in Fig. 5, of the notch 239 of the heated yoke 228 and the spiral faces 220,

222 of the coupling 103 being arranged rearward and at one side of the spiral cams 210, 212 of the brackets 214, 216 secured to the extruder head 96. The injector or gun 84 or 86 is then rotated clockwise as viewed in Fig. 5 causing the upper and lower spiral faces 220, 222 of the coupling 103 to override the spiral cams 210, 212 of the brackets 214, 216 thereby forcing the conical face 208 of the coupling 103 against the conical face 209 of the extruder head 96 and causing the nozzle 138 of the injector to be swung into the slot 230 of the yoke 228.

In order readily to determine the temperatures of the extruder head 96, the valve block 132 and the nozzle heating yoke 228 there are provided thermometers 234 (Fig. 5) having stems 236 fitting in recesses 238 of the various members.

As above explained the injector or gun 84 (Figs. 5, 6, 7 and 8) may be replaced by the injector or gun 86 illustrated in Fig. 9 in order quickly and effectively to inject under heavy pressure into the undercut cavities 28, 30 in the attaching face 32 of the heel and the heel seat 22 of the shoe and into voids 34 formed between the attaching face of the heel and the heel seat of the shoe a quantity or mass of softened thermoplastic resin which will fill a large percentage of said cavities and voids, and thereafter to inject into said cavities and voids under light pressure a quantity of softened thermoplastic resin sufficient to fill said cavities and voids. The injector or gun 86 which may be referred to as a modified injector, except for hereinafter described parts, is similar to the injector or gun 84 and comprises a spring housing 240 (Fig. 9) which corresponds to the spring housing 120 and has a cylindrical recess 242. Interposed between a cap 244 threaded into and forming part of the housing 240 and a flange 246 at the lower end of a drum 248 slidable in the recess 242 is a heavy or strong spring 250. Slidably movable in a cylindrical resin receiving recess or chamber 252 substantially like the recess or chamber 116 of the injector or gun 84 is a plunger 254, the upper end of which is slidable in a guideway 256 of the drum 248, said plunger having formed in it a bore 258 for receiving a relatively light or weak spring 260, the upper end of which engages a spring retaining projection 262 of the cap 244. The plunger 254 is constantly urged to its lowered position in the resin chamber 252 by the springs 250 and 260 the lower limit of travel of the plunger 254 in the chamber 252 being determined by the engagement of a flange 264 of the plunger with a stop or face 265 of the housing 240. Upward movement of the plunger 254 with relation to the drum 248 is limited by engagement of the flange 264 of the plunger with a stop or face 266 of the drum.

It will thus be clear that when viscous thermoplastic resin is forced under pressure into the cylindrical chamber 252 the plunger 254 is raised against the action of the relatively light spring 260 until the flange 264 of the plunger engages the face 265 of the drum 248, the plunger and the drum thereafter being moved upward together against the action of the heavy spring 250 and the light spring 260 under pressure applied to the plunger by the softened thermoplastic resin entering said chamber. As in the injector or gun 84, rotation of the extruder screw 92 and accordingly upward movement of the drum 248 under the action of the viscous resin forced into the gun by the extruder 88 is limited by the engagement of the upper end of the drum with a microswitch 268 corresponding to the micro-

switch 162. As above explained in connection with the injector or gun 84 once the extruder 88 has been stopped, the switch 168 has to be manually operated in order again to start the extruder.

The heel 20 may be quickly and effectively forced against the heel seat 22 of the shoe 18 by the use of the machine or clamp which is illustrated in Figs. 8, 11, 12 and 13 and which as will appear later is constructed and arranged to enable the nozzle 138 of the injector or gun 84 or 86 to be inserted into the passage or bore 26 of the heel clamped against the heel seat of the shoe.

The illustrative heel clamping machine comprises a frame 270 (Figs. 8 and 11) which is bolted to a bench (not shown) or other suitable support and has secured to it by screws 272 and a fulcrum screw 274 a yoke 276. Slidingly adjustable on a guide portion 278 (Figs. 11 and 12) at the upper end of the yoke 276 is a split supporting bracket 280 having a pair of forwardly extending bifurcations 282, the bracket being secured in different adjusted positions on said guide portions by a binding screw 284. Pivotal-ly supported in aligned bores 286 of the bifurcations 282 are pins 288 which are secured by screws 291 to a tread end abutment or plate 292 (Figs. 11 and 13) and which are pinned to a pair of rearwardly extending arms 292 into the rear ends of which are threaded screws 294 extending through slots 296 in a U-shaped gage supporting member 298 arranged in guideways 298 (Fig. 13) formed in said arms. The abutment 290 has a flat lower heel engaging surface 300 and a tapered opening 302 through which the nozzle 138 of the injector is inserted preparatory to injecting resin into the passage 26 of the heel 20 to be attached to the shoe 18.

Adjustable into different forward and rearward positions in a guideway 304 (Fig. 13) of the gage supporting member 298 after releasing the locking screw 306 is a V-shaped back gage 308 constructed and arranged to be engaged by the rear face of the heel, the abutment 290 and the back gage 308 being movable as a unit into a predetermined angular operating position about an axis 310 (Fig. 13) of the pins 288 against a screw 312 which is threaded into the split bracket 280 and is engaged by an abutment 314 forming part of the gage supporting member 298. It will be clear that the abutment 290 and the back gage 308 may be moved as a unit into different angular positions about the axis 310, the friction between the pins 288 and the forwardly extending bifurcations 282 of the bracket being sufficient to retain the abutment block 314 in its operating position against the stop screw 312.

The back gage 308 may be moved into different adjusted positions along the guideway 304 of the supporting member 298 and may be moved into different adjusted positions generally heightwise of the heel by raising or lowering the gage supporting member 298 along the guideways 298 of the arms 292. The various members which are supported by the bifurcations 282 and comprise the abutment 290 and the back gage 308 may be described as a holder.

The shoe 18 mounted upon a last or form 316 is supported in the illustrative heel clamping machine by a knurled support 318 fulcrumed on a pin 320 secured to a lever 322 which is pivoted upon the fulcrum screw 274, said lever having a cylindrical recess 324 for receiving an upper

ball end 326 of a manually operated thrust member or screw 328 threaded into the yoke 276. The lever 322 is constantly urged against the ball end 326 of the screw 328 by a spring 330, opposite ends of which are attached to hooks fixed to the lever 322 and to the yoke 276. The fulcrum screw 274 is so positioned with relation to the yoke 276 that when the lever 322 moves clockwise as viewed in Figs. 8 and 11 upon upward advancement of the screw 328 in the yoke, said lever moves the support 318, then in engagement with the cone of the last 316 upon which the shoe is mounted, heightwise and rearward of the shoe. The heightwise and rearward components of movement of the knurled support 318 carried by the lever 322 may be varied by moving the yoke 276 into different adjusted positions upon the frame 270 so as to change the location of the fulcrum screw 274 about which the lever 322 pivots with relation to the yoke 276.

In practicing our improved heel attaching method the operator places the heel 20 upon the fitted heel seat 22 of the shoe 18 and after moving the tread face of the heel assembled with the shoe into engagement with the lower face 300 of the abutment 290 and the rear face of the heel into engagement with the back gage 308, operates the screw 328 to force the knurled support 318 against the cone of the last 316 upon which the shoe is mounted.

Preparatory to assembling the heel and the shoe the pivotally mounted holder which comprises the abutment 290 and the heel gage 308 is moved to its frictionally held operative position against the screw 312. Clockwise rotation of the hand screw 328 as viewed from below causes the lever 322 to swing clockwise as viewed in Figs. 8 and 11 with the result that the knurled support 318 is moved upward and rearward causing the heel seat 22 of the shoe to be forced with considerable pressure against the attaching face of the heel held against movement by the abutment 290 and the back gage 308 and the heel breast receiving shoulders 68 of the sole 62 of the shoe to be forced against the breast of the heel with considerable pressure. The upward and rearward components of movement of the support 318 may be varied to increase or decrease the amount of pressure of the heel breast receiving shoulders 68 against the breast 70 of the heel by changing the position of the yoke 276 with relation to the axis of the fulcrum screw 274.

In order permanently to attach the heel 20 to the shoe 18 by thermoplastic resin 24 after clamping the heel against the heel seat 22 of the shoe in the heel clamping machine above described, the operator grips the handle 198 (Figs. 5, 6 and 8) of the injector 84 which is then in its position illustrated in Fig. 5 and the chamber 116 of which has been filled with thermoplastic resin, and rotates the injector counterclockwise to move the spiral faces 220, 222 of the coupling 108 from behind the spiral faces 210, 212 of the extruder head 96 and to swing the injector nozzle 138 out of the slot 230 of the heating yoke 222, the spring 130 (Fig. 6) of the injector then being compressed. The injector 84 is then bodily transferred to the heel clamp and the nozzle 138 of the injector is inserted through the opening 302 in the abutment 290 and into the passage or bore 26 of the heel, the flange 139 of the nozzle resting on the upper face of said abutment.

The handle 202 of the injector 84 is then depressed causing the thermoplastic resin in the chamber 116 to be forced with gradually decreas-

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ing pressure into the undercut cavities, 28, 30 in the attaching face 32 of the heel 20 and the heel seat 22 of the shoe as well as into the voids 34. When the cavities 28, 30 and the voids 34 have been filled with resin the passage 26 in the heel starts to fill and the injector is moved out of the passage under pressure of the resin which progressively fills said passage. As the end of the nozzle 138 approaches the top lift receiving face of the heel the operator releases the handle 202 of the injector and moves the injector away from the work, the injector again being placed in its thermoplastic receiving position shown in Fig. 5 on the extruder head 96 to receive, after the switch 168 has been manually closed another supply of thermoplastic resin preparatory to operating upon the next shoe. The screw 328 is then released and the shoe which has been operated upon is removed from said machine.

The practicing of the method by the use of the injector illustrated in Fig. 9 is substantially the same as that above described, the only difference being that the thermoplastic resin is ejected from the chamber 352 first under the action of the springs 250, 260 and thereafter under the action of spring 260.

The method practiced in securing two parts of an article together or in attaching a heel to a shoe by the use of the mechanism disclosed herein is claimed in an application for United States Letters Patent Serial No. 135,362, filed December 28, 1949, in our names and the machine or apparatus for use in clamping heels to shoes in practicing the above method is claimed in an application for United States Letters Patent Serial No. 250,902, filed October 11, 1951, in our names.

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

1. In an injector for use in the permanent attachment to the heel seat of a shoe of a heel which is temporarily clamped against said heel seat and which has in its attaching face an anchoring cavity in opposed relation to an anchoring cavity in the heel seat of the shoe, a chamber for receiving softened thermoplastic resin, a plunger slidable in the chamber, a resin receiving conduit which communicates with said chamber and through which softened resin under heavy pressure may be forced into the chamber with displacing action on the plunger, a valve for opening and closing said conduit, a nozzle fitting in a bore which is formed in the heel and through which the resin is injected into said cavities, an outlet passage between the chamber and the nozzle, a member which is movable relatively to the plunger and acts on the plunger, a stop, a heavy spring for moving said member in one direction, a predetermined distance limited by the stop against the plunger and accordingly for moving the plunger a predetermined distance into an inner end of the chamber to force under heavy pressure into the cavities of the heel and the heel seat of the shoe a mass of softened thermoplastic resin insufficient to fill the cavities, and a light spring operative to move the plunger relatively to said member after engagement of said member with the stop to force into said cavities under low pressure another mass of softened thermoplastic resin sufficient to complete the filling of said cavities.

2. The combination of a hollow dispensing gun provided with a displaceable plunger and an extruder for filling the gun, said extruder having an outlet and power operated means for

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delivering a softened plastic material to the gun through an opening therein, cooperating fitting surfaces on the gun adjacent to said opening and on the extruder adjacent to its outlet, means for holding said surfaces in firm engagement, a control device responsive to the movement of displacement of the plunger in the gun, and a connection between said control device and the power operated means for the extruder for stopping the extruding action on the completion of a predetermined displacement of said plunger.

3. In combination, a power driven extruder having an outlet opening, a socket associated with said outlet opening, a dispensing gun temporarily positioned in said socket in tight relation to the outlet opening, said gun being provided with a displaceable plunger moved by the advancing material pressed by the extruder into the gun, a switch actuated by the movement of the plunger at a predetermined point in its travel, a device for controlling the application of power to said extruder drive, and means operated by said switch for actuating said device.

4. In combination, an extruder provided with a screw mechanism for forcing a softened thermoplastic material out of the outlet of the extruder, a dispensing gun having a filling opening temporarily positioned to receive material from said outlet, said gun having a plunger which is physically displaced an appreciable amount by the thermoplastic material pushed into the gun by the extruder, a drive for the screw mechanism, electrically operated means for controlling said drive, a switch actuated by the displaced plunger as the gun is being filled, and electrical connections between said switch and the drive control for rendering the drive ineffective when the gun has been filled.

5. In combination, an extruder having an opening leading into a socket provided with a frusto conical surface at its inner end, a dispensing gun having a displaceable plunger, said gun being provided with a projecting portion terminating in a frusto conical surface fitting the corresponding surface of the socket of the extruder, coacting cam faces on the extruder and the gun rendered operative by a partial turning movement of one with respect to the other to lock the projecting portion of the gun in the socket of the extruder, and a controllable drive for the extruder rendered ineffective when the gun has been filled.

6. The combination of an extruder and an injector which has a chamber for receiving softened thermoplastic resin from the extruder and has a plunger constantly urged into said chamber and displaceable in said chamber under pressure of the resin entering said chamber, said injector and extruder having cooperating portions respectively for coupling the injector to the extruder preparatory to receiving softened thermoplastic resin from the extruder and for uncoupling the injector from the extruder preparatory to injecting said resin into a work piece, electrically powered means for operating the extruder, said means comprising a circuit, a solenoid operated switch movable into an active position to close said circuit and from said active position to open said circuit, a solenoid circuit comprising a manually operated normally open switch, a holding circuit for maintaining closed the solenoid circuit once it has been established even though the manually operated switch is open, and a micro-switch which is operative when the injector plunger has been moved to a predetermined position under the action of softened

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thermoplastic resin injected into the chamber to open said holding circuit thus causing movement of the solenoid operated switch away from its active position and accordingly the stopping of the extruder.

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REFERENCES CITED

The following references are of record in the 10
file of this patent:

16

UNITED STATES PATENTS

Number	Name	Date
2,118,373	Creveling -----	May 24, 1938
2,269,514	Brandt -----	Jan. 13, 1942
2,299,195	Ushakoff -----	Oct. 20, 1942
2,306,788	MacDonald -----	Dec. 29, 1942
2,431,843	Swager -----	Dec. 2, 1947
2,435,647	Engseth -----	Feb. 10, 1948
2,439,506	Christian -----	Apr. 13, 1948
2,447,512	Leahy -----	Aug. 24, 1948
2,449,625	Stuart -----	Sept. 21, 1948