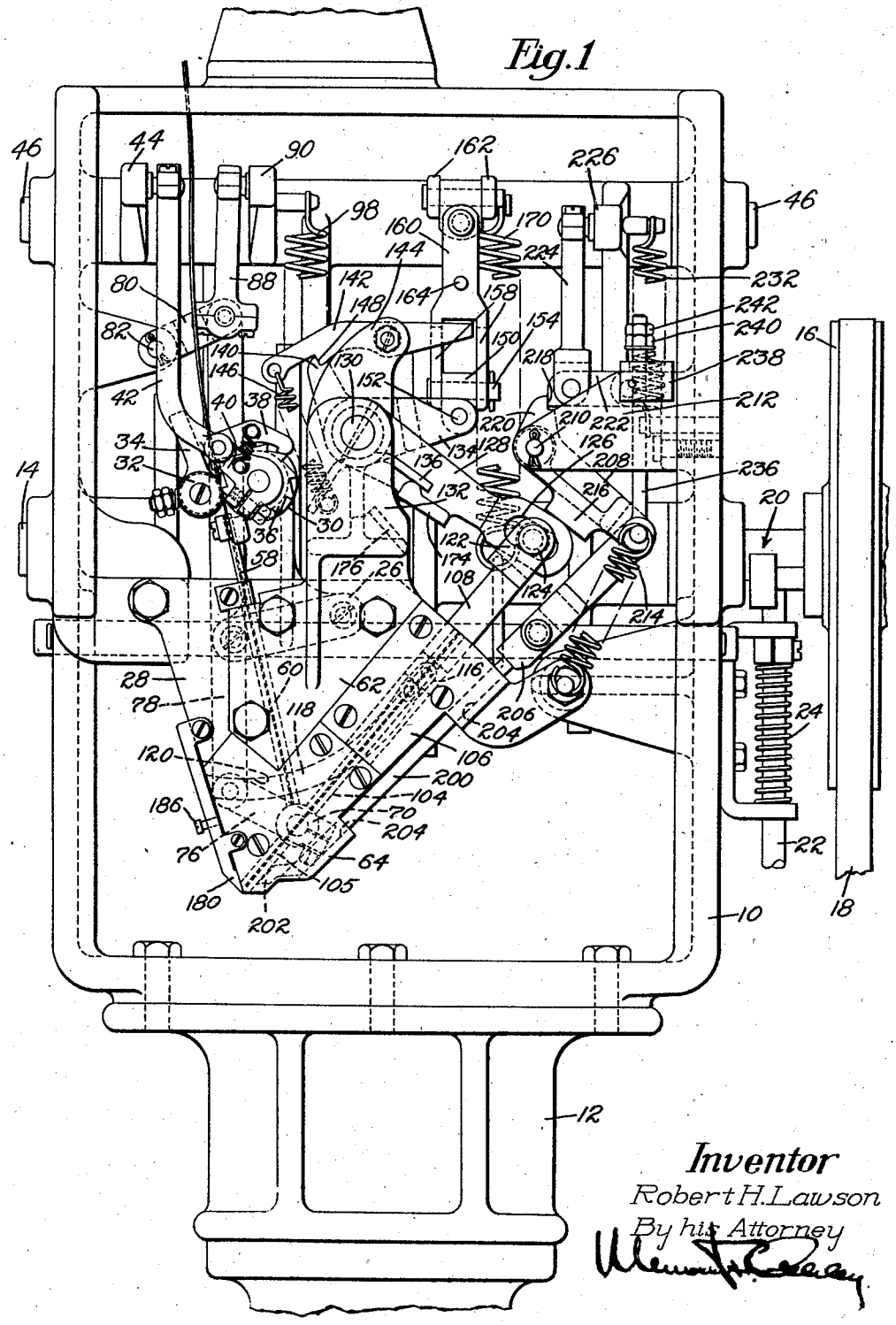
Nov. 11, 1947. R. H. LAWSON 2,430,515

MACHINE FOR INSERTING FASTENINGS

Filed Jan. 23, 1945 4 Sheets-Sheet 1

Fig. 1



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MACHINE FOR INSERTING FASTENINGS

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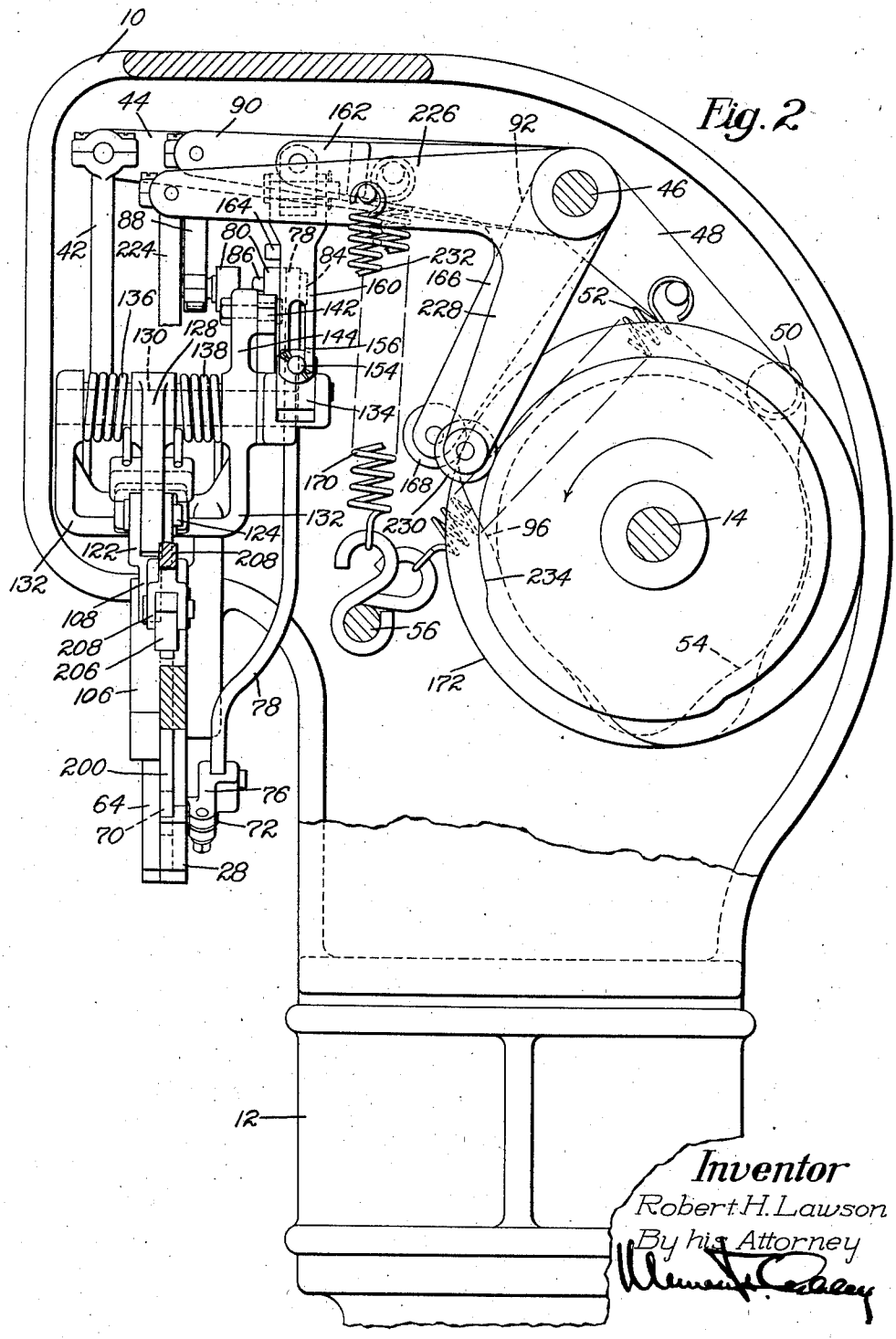

Fig. 2

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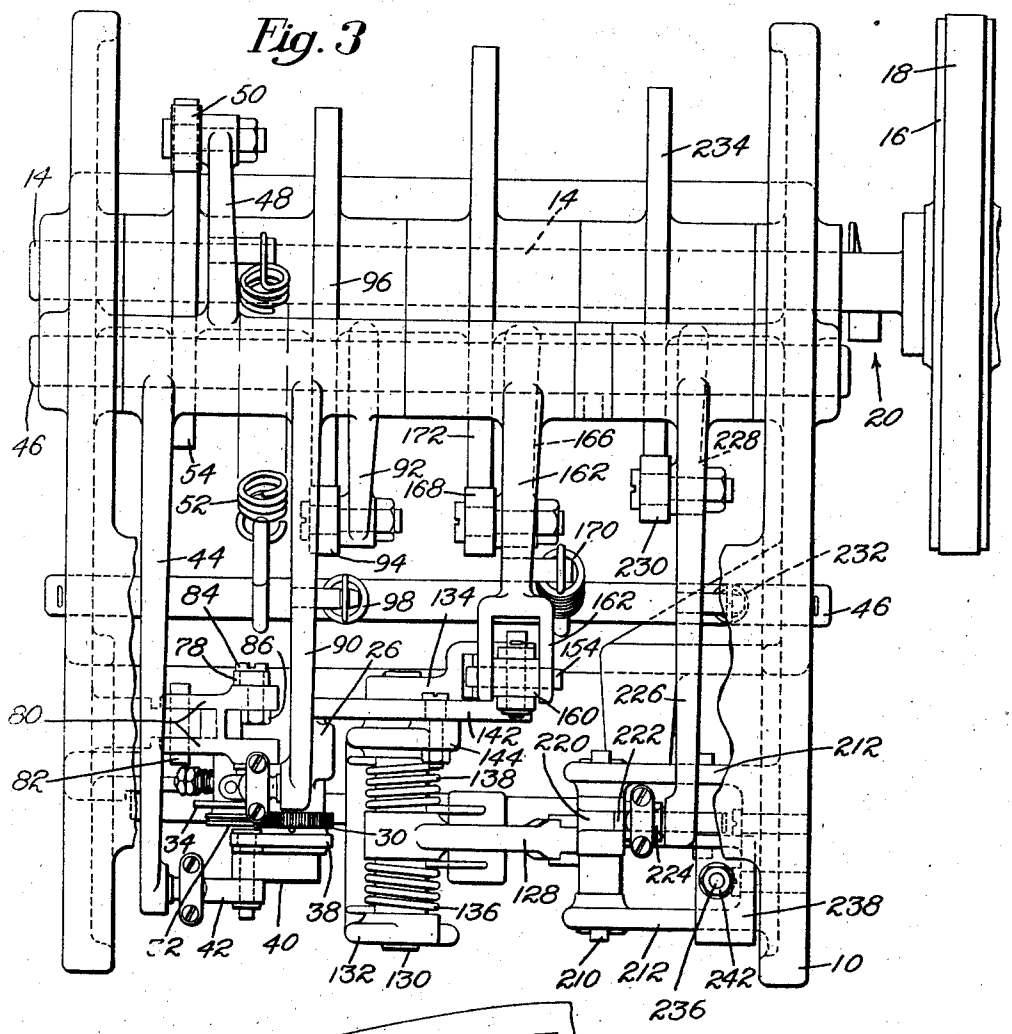
Fig. 3



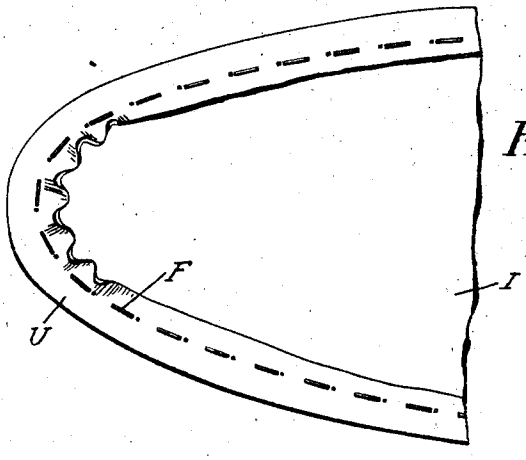


Fig. 6

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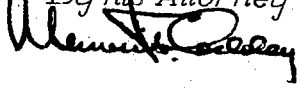

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MACHINE FOR INSERTING FASTENINGS

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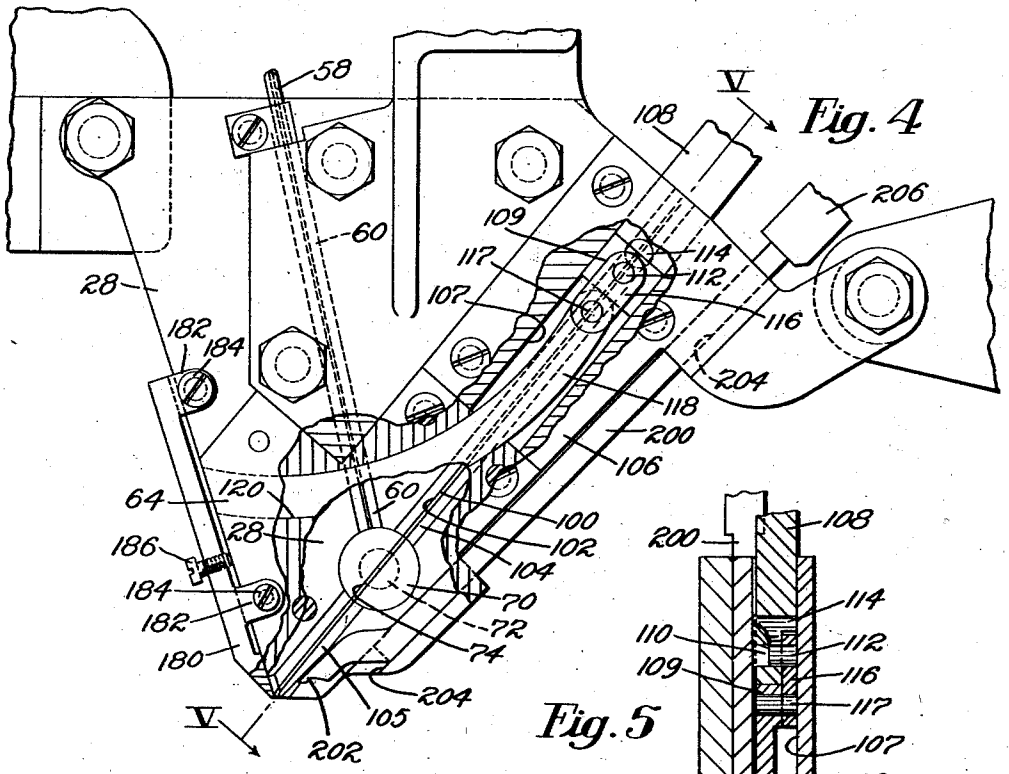

Fig. 4

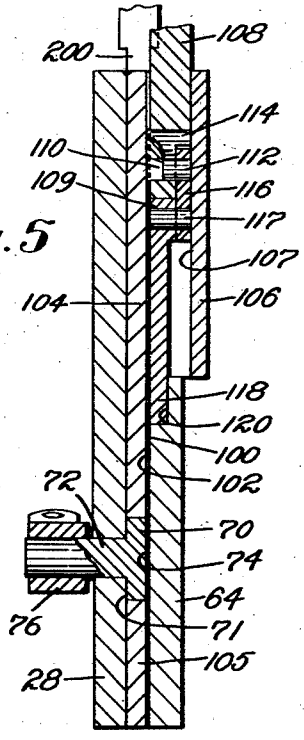

Fig. 5

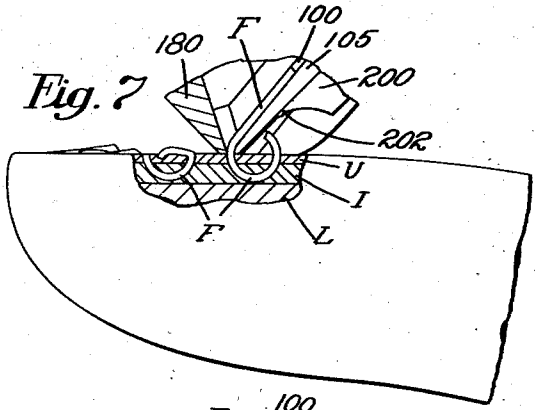

Fig. 7

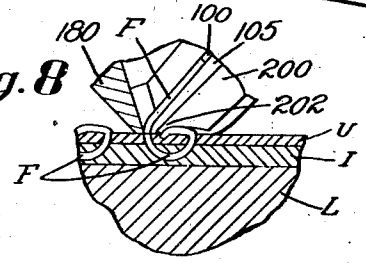

Fig. 8

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Patented Nov. 11, 1947

2,430,515

UNITED STATES PATENT OFFICE

2,430,515

MACHINE FOR INSERTING FASTENINGS

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Application January 23, 1945, Serial No. 574,086

22 Claims. (Cl. 1—25)

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This invention relates to an improved machine for inserting fastenings into work pieces, such as shoe parts, and is herein illustrated as applied to the fastening of shoe uppers to sole members after the upper of each shoe has been worked into lasted relation to the sole member.

In the manufacture of shoes of that type in which the margin of the upper is secured in lasted position in substantially parallel relation to the outer or bottom face of the insole preparatory to the attachment of an outsole directly to the margin of the upper by suitable means, it is well known to employ fastenings such as staples to secure the upper to the insole, successive portions of each staple being progressively bent during the driving operation, but before entering the work, by a deflector, thereby causing the staple to follow a curved path in the work without penetrating the entire thickness thereof.

It is an object of the present invention to improve upon fastening inserting machines of the type just referred to and particularly to insure that fastenings, such as staples, are fully driven home or countersunk in the work surface, thus mitigating or entirely removing the danger that in the continuing processing of the shoe some of the inserted staples will be pulled out, this being due to the fact that by inadvertence that particular staple was not fully driven home.

It is another object of the invention to provide a fastening-inserting machine of very simple and compact construction having nevertheless accurate and dependable control over the formation and insertion of each fastening.

In one important aspect the invention accordingly provides a novel and improved machine for inserting fastenings according to which each fastening is inserted by means of another fastening of the same type, the first mentioned fastening being bent while it is being inserted by the other fastening and this insertion being continued until the trailing end portion of the fastening which is being inserted is embedded or countersunk in the surface of the work. This has the particular advantage of insuring that in each instance the inserted fastening is fully driven home and is accomplished by causing the other fastening to be the immediate and direct driving element in contact with the fastening being inserted rather than relying on the driver to be the direct driving element. The driver often can not be moved down sufficiently to countersink the driven fastening, and this is due to the fact that the driver is apt to interfere with the deflector which is mounted adjacent to the point of entry of the fastening into the work.

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The illustrated fastening forming and inserting machine has a supply of a continuous strand of fastening material such as staple wire which is intermittently fed by suitable feeding mechanism. The leading end portions of the wire are successively received by wire severing mechanism where they are severed from the strand of wire to form single-legged fastenings and whence they are transferred to a position to be engaged by a driver. Moreover, the illustrated machine is provided with a deflector adapted to engage successive portions of each fastening during its insertion thereby bending said portions and causing the fastening to follow a curved path through the work without penetrating the entire thickness thereof. In causing the single-legged fastening to curve through the work its leading end portion is permitted, in accordance with the invention, to emerge again from the side of the work from where it was inserted, additional means being provided for clinching the emerged end portion of the driven fastening and inserting the extremity of that clinched end portion into the surface of the work.

While the invention is thus disclosed herein in its application to the attachment of shoe uppers to sole members, it will be recognized that in a more general aspect the invention provides a novel machine for inserting fastenings not limited in utility to the fastening of uppers nor to shoe manufacture. Such utility is especially evident where conditions are such that it is inconvenient, impracticable or undesirable to anchor the fastening by clinching it against the rear surface of the work as, for example, where the rear surface of the work is not conveniently accessible, where the work is thicker than the length of the fastening, or where it is undesirable to have the fastening penetrate, as it might, entirely through the work.

These and other features of the invention will now be described in detail in connection with the appended drawings and will be pointed out in the claims.

In the drawings:

Fig. 1 is a view in front elevation of the head of a fastening-inserting machine in which the invention is embodied;

Fig. 2 is a view in right-hand side elevation of the machine head, with certain parts broken away;

Fig. 3 is a plan view of the machine head, with certain parts broken away;

Fig. 4 is a detail view in front elevation of the fastening-forming and -inserting mechanism of the machine illustrated in Fig. 1;

Fig. 5 is a sectional view, the section being taken along the line V—V of Fig. 4;

Fig. 6 is a plan view of a portion of a lasted shoe bottom after the insertion therein of fastenings which secure the marginal portion of the upper in lasted position upon the shoe bottom;

Fig. 7 is a view in side elevation of a portion of the forepart of a lasted shoe, partly in section, and illustrating the insertion of a fastening therein prior to the clinching of one end portion of the fastening;

Fig. 8 is a view similar to Fig. 7 after the clinching of the fastening.

As has been stated, the invention is concerned with the insertion of fastenings into work parts primarily for the purpose of securing together such work parts in juxtaposition. In the illustrated example the work is a shoe comprising an insole I (Figs. 6 to 8) on a last L and an upper U which has been tensioned over the last and the marginal portion of which has been worked over the bottom face of the insole and is secured in lasted position by fastenings F inserted through the marginal portion of the upper and into the insole I. As illustrated in Figs. 7 and 8, the inserted fastening is curved and is so inserted that it does not penetrate the entire thickness of the work parts, with the result that the side of the combined work parts opposite the side of entry of the fastening is not penetrated by the fastening and, therefore, remains smooth and unmutilated. The fastenings, which are single-legged in the sense that they comprise a substantially straight piece, are formed from a continuous strand of fastening material, such as wire. The above-described inserted fastening is produced by progressively bending the straight fastening during its insertion thereby causing the fastening to follow a curved path through the combined work parts without penetrating the entire thickness thereof. In the usual practice, this is accomplished by providing a deflecting means, such as a baffle plate, which acts on successive portions of the fastening before these portions enter the work. However, the provision of such deflecting means at the point of entry of the fastening into the work makes it impossible for the usual fastening-inserting means, such as a driver, to remain in contact with the trailing end portion of the fastening until that end portion is countersunk in the surface of the work, this by reason of the interference of the driver with the deflecting means. It is therefore contemplated to insert each fastening into the work by means of another similar fastening which is in direct contact with the trailing end portion of the fastening to be inserted. The fastening which causes the other fastening to be inserted and which may be termed the inserting fastening may itself be engaged by the driver. This avoids any interference between the driver and the baffle plate by which the driver either would become bent or be broken and enables the inserting

fastening to countersink or embed the fastening to be inserted into the work, since the interference of the inserting fastening with the baffle plate and any bending of that fastening is of no consequence owing to the fact that the inserting fastening, after having inserted a fastening, itself becomes a fastening to be bent and inserted. As illustrated, the fastening, which, as stated, is a straight piece of wire before its insertion, is inserted endwise and is caused to follow a curved path through the work, the insertion of the fastening being continued until its trailing end portion is embedded in the surface of the work and its leading end portion has emerged from the side of entry of the work and protrudes therefrom. Thereafter this leading end portion is clinched, that is to say, bent and caused to reenter the surface of the work.

The illustrated fastening-inserting machine is adapted to insert fastenings of the above-mentioned type in the manner just described. The utility of the machine is not limited to any particular fastening-inserting operation on any particular type of work. In the illustrated example, the machine is shown as adapted for use in securing the tensioned marginal portion of the shoe upper U in lasted relation to the insole I. Although no lasting mechanism proper is shown in the drawings, it is to be understood that such lasting mechanism may be provided in connection with the machine and may comprise the conventional pair of power-operated pincer jaws for progressively tensioning the upper over the last and for drawing its marginal portion inwardly over the insole. After a portion of the margin of the upper has been drawn inwardly over the insole and been laid upon it, a fastening is inserted through it while it is still held tensioned, and into the insole to secure that portion of the upper margin to the insole. The fastenings which are successively inserted into successive portions of the manually presented and fed work are formed in the machine from a continuous strand of fastening material, such as wire, which is usually wound up on a reel (not shown) and is fed into the machine by mechanism to be described.

The illustrated machine comprises a box-shaped frame or head 10 (Figs. 1, 2 and 3) which houses or supports the operating instrumentalities of the machine and their actuating mechanisms. The head 10 is secured to a suitable support, such as a column 12.

The principal mechanisms of the illustrated machine are a wire-feeding mechanism, a wire-severing and fastening-transferring mechanism, a fastening-driving mechanism, a fastening-deflecting mechanism and a fastening-clinching mechanism. The movable elements of these mechanisms are actuated from one source of power including a cam shaft 14 (Figs. 1, 2 and 3) which is rotatably mounted in bearings provided in the head 10. The shaft 14 carries on one end a pulley 16 which is rotated by a belt 18 from a suitable source of power, such as an electric motor (not shown). Driving connection between the pulley 16 and the shaft 14 is established or interrupted by a pin clutch 20, of conventional type, which is controlled by a treadle rod 22 connected to a treadle (not shown) and provided with a spring 24 tending to elevate the treadle rod 22 and to disengage the clutch. Downward movement of the rod 22 by the treadle serves to engage the clutch which is kept engaged as long as the treadle rod is maintained in its downward

position so that the machine may be operated continuously through a series of cycles. As will be described, the cam shaft 14 carries a series of cams for actuating the operating elements of the above-mentioned mechanisms in a predetermined sequence.

The above-mentioned wire-feeding mechanism serves to advance a strand of wire in the machine and to feed the leading end portion of the wire strand intermittently into the wire-severing mechanism where a fastening is formed. The wire is preferably wound up on a reel (not shown) which conveniently is supported on top of the head 16. The illustrated wire-feeding mechanism is similar in construction and operation to the wire-feeding mechanism disclosed in United States Letters Patent No. 2,334,715, granted on November 23, 1943, on an application filed in my name. The support for this mechanism is a bracket 26 (Figs. 1 and 3) which is bolted to a plate-like bracket or support 28 of somewhat triangular shape. The support 26 is bolted at opposite sides to the machine frame and serves to carry various of the above-mentioned mechanisms, as will be described. In brief, the wire-feeding mechanism comprises a wire feed roll 30 which is intermittently rotated in one direction to advance the wire in a downward direction and which to this end cooperates with a pressure roll 32 provided with a groove in its periphery in which the wire is received, the wire passing between the two rolls 30 and 32. The roll 32 is spring pressed toward the roll 30 and is rotatable in a pivotally mounted bearing piece. A pivotally mounted and manually operated throw-out lever 34 having a cam portion at its hub is adapted to move the roll 32 out of contact with the roll 30 so as to interrupt the feeding of the wire. Normally, the throw-out lever 34 is so positioned that it permits the spring pressed roll 32 to contact the roll 30 thus to enable the latter to advance the wire step by step. To this end the roll 30 is mounted to rotate freely about the axis of a stub shaft secured in the bracket 26 and has integral with one face of it a ratchet wheel 36 which is adapted to be rotated intermittently by a spring-biased pawl 38 pivoted on an arm 40 secured on the said stub-shaft carrying the roll 30. The arm 40 is rocked by pivotal engagement with a link 42 extending upwardly therefrom and pivotally connected at its upper end to a cam lever 44 rotatably mounted on a shaft 46 secured in suitable bearings in the machine frame. The cam lever 44 is in the form of a bell crank lever and has a rearwardly and downwardly extending arm 48 (Fig. 2) which carries a cam roll 50 held by a spring 52 against the periphery of a cam disk 54 secured on the cam shaft 14. The spring 52 is tensioned between the arm 48 and a transverse bar 56 secured in the machine frame. The cam disk 54 is so shaped that the cam lever 44 is swung downward at a predetermined point in each cycle of operation with the result that the pawl 38, which is held by its spring in engagement with a tooth in the ratchet wheel 36, causes the latter as well as the feed roll 30 to be rotated a predetermined distance. As a result of the succeeding upward movement of the cam lever 44 the pawl 38 is caused to ride idly back over the teeth of the now stationary ratchet wheel 36 into its initial position where it again engages a tooth of the ratchet wheel 36 in readiness to rotate the latter when the cam lever 44 is next operated.

The wire which passes from the reel through

suitable wire guides between the rolls 30 and 32 is fed into and through a tube 58 which is clamped to the brackets 26 and 28 and is in alinement with a grooved wire guiding member 60 of rectangular cross-section closely fitting into a channel provided in the front face of the bracket 28 and covered partly by a bracket 62 and partly by a plate 64, both being detachably secured to the bracket 28. The groove in the guiding member 60 extends longitudinally thereof and is in alinement with the wire passage of the tube 58 so that the wire is fed into and through the guiding member 60 the groove of which, since it is covered by the bracket 62 and the plate 64, represents a wire guiding passage or guideway enclosed on all sides but, nevertheless, readily accessible.

After a length of wire has been fed by the above-described mechanism through the wire guiding member 60 a piece is severed from the leading end portion of the wire strand to become a fastening. Thereupon the fastening is transferred to a position from which it can be driven by the fastening driving mechanism. The wire-severing and fastening-transferring mechanism comprises a roll 70 (Figs. 1 and 4) which is seated in a circular recess 71 provided in the front face of the bracket 28 and is covered by the plate 64. The roll 70 is integral with a stem 72 which is rotatably mounted in a horizontal bore provided in the bracket 28 through which bore it extends rearwardly. The front face of the roll 70 is provided with a diagonally extending groove 74 the open side of which is covered by the plate 64, and which is adapted to receive the wire when fed by the above-described feeding mechanism. The above-mentioned wire guiding member 60 is rounded at its bottom end in conformity with the curvature of the periphery of the roll 70 and terminates in close proximity to that periphery. The roll 70 is rotated between two predetermined positions one of which may be called the wire receiving position and the other the fastening inserting position. In the wire receiving position the groove 74 of the roll is in alinement with the groove of the wire guiding member 60, and in the fastening inserting position the groove 74 is in alinement with the path of movement of a driver, to be described, the axis of rotation of the roll 70 lying in the intersection of the line of wire feed and the path of movement of the driver.

To rotate the roll 70 back and forth between its two predetermined positions, the stem 72 has clamped to it an arm 76 extending laterally therefrom and pivotally connected to a long link 78 extending upwardly in the machine. The uper end of the link 78 is pivotally connected to one of two parallel arms provided at one end of an H-shaped member 80 (Fig. 3) the other end of which is pivotally secured by a pin 82 to a bracket on the machine frame. The pivotal connection between the link 78 and the member 80 is made by a screw 84 the stem of which is offset from or eccentric to the head and extends through the above-mentioned arm of the H-shaped member 80. It is secured in place by a nut 86. After loosening the nut 86 the screw 84 may be rotated so as to adjust the position of the link 78 heightwise of the machine thus to adjust the predetermined positions of the roll 70 to be in exact alinement with the wire passage of the guiding member 60 or with the path of travel of the driver. To rotate the roll 70 the H-shaped member 80 is rocked about the axis of the pin 82 and to this end the other free arm of the member 80 is pivotally connected by a link 88 (Fig. 1) to a

cam lever 90 pivotally secured to the shaft 46. The cam lever 90 is in the form of a bell crank lever and has a depending arm 92 (Fig. 3) carrying a roll 94 which is held against the periphery of a cam disk 96 on the cam shaft 14 by means of a spring 98 extended between the cam lever 90 and the bar 56. The cam 96 is so designed that the train of elements actuated by it will rotate the roll 70 into one or the other of its above-described positions, the roll being initially in its wire receiving position. Consequently, when a length of wire is fed downwardly the leading end portion of the wire is passed into and along the groove 74 which, as stated, supports the wire all around. After the leading end portion of the wire has been fed into the groove 74 the roll 70 is rotated thereby shearing the piece of wire contained in the groove 74 from the strand of wire and then locating that piece in the line of drive. As will be noted, the fastening thus formed is a straight piece of wire.

The principal element of the fastening driving mechanism is, of course, the driver 100 (Figs. 4, 7 and 8), mentioned above, which is of very small cross-section, and as a matter of fact in the illustrated example, it is as thin as the wire from which the fastenings are formed. As will be described the driver 100 is so mounted that it is supported at all of its sides and over its entire extent in any position of its reciprocatory movement. The driver is reciprocated in a guideway 102 (Figs. 4 and 5) provided in and along the front face of a guiding member 104 of rectangular cross-section which is seated in a recess provided in the front face of the plate-like bracket 28 with the front face of the guiding member 104 flush with that of the bracket 28. The guiding member 104 is covered in part by the above-mentioned plate 64 and in part by a plate 106 abutting the upper right hand end of the plate 64 and secured to the front face of the bracket 28. As illustrated best in Fig. 4, the lower end of the guiding member 104 is rounded and located in the immediate vicinity of the periphery of the wire severing roll 70 so that in the fastening driving position of the roll 70 the groove 74 provided therein is in alinement with the driver guideway 102. Below the roll 70, as seen in the direction of drive, there is provided in a recess in the front face of the bracket 28 a guidepiece 105 arranged and grooved in the same manner as the guiding member 104 and covered by the plate 64. The severed fastening, when being driven downwardly by the driver 100, is pushed out of the groove 74 of the roll 70 into the groove in the guidepiece 105, the two grooves being alined. The lower end of the guidepiece 105 terminates with the lower end of the bracket 28 and the plate 64 against which the work is held and thus constitutes a nozzle through which the fastenings are inserted into the work. The above-mentioned plate 106 is provided over the entire length of its rear face with a recess 107 in which is movable a driver bar 108. The driver bar 108 to which the driver 100 is attached, as will be presently described, is reciprocated and is in sliding contact with the front face of the bracket 28. The driver bar 108 is rabbeted at its lower end to form a shouldered portion 109 of reduced thickness. To secure the driver 100 to the driver bar 108 the former is provided at its upper end with a fin 110 (Fig. 5) which extends into a slot provided in one end of a pin 112 inserted through the portion 109 of the driver bar, the inner end of the pin being flush with the inside face of the portion 109 and the outer end of the pin 112 projecting from the front face of the portion 109. Driven through part of the driver bar 108 and part of the portion 109 and located in tangential relation to the pin 112 is a hardened pin 114 the inner end of which is provided with a small ridge extending into the guideway 102 and engaging the upper end of the driver 100 and its fin 110. Thus, on reciprocation of the driver bar 108 by mechanism to be described, the driver 100 is reciprocated along the guideway 102. The driver 100 is of sufficient length to engage, when on its driving stroke, a fastening held by the roll 70 and to drive it downwardly into the guidepiece 105 from which it is inserted into the work.

In view of the above-mentioned provision of the recess 107 in the plate 106 serving to accommodate the driver bar 108, the guideway 102 for the driver 100 is not covered over its entire extent. To insure, nevertheless, that the driver is supported all around over its entire length and in any position of its travel, the following is provided. Pivotally mounted on the projecting portion of the pin 112 and lying against the front face of the portion 109 of the driver bar 108 is a small link 116 (Figs. 4 and 5) the lower end of which is pivotally connected by a pin 117 to a curved driver guiding member 118 which serves to cover the driver 100 throughout the entire extent of its travel. The guiding member 118 is slidable in a curved slot 120 provided in the rear face of the cover plate 64. As the driver bar 108 descends from its uppermost position to lower the driver 100, the guiding member 118 is moved downwardly and to the left of Fig. 4, the direction of movement being determined by the slot 120, and thus it continuously covers the driver. Reversely, on retraction of the driver bar 108 and the driver 100, the guiding member 118 is retracted to cover the driver in the upper portion of its travel.

To reciprocate the driver bar 108 and the driver 100 the following mechanism is provided. The driver bar 108 has a fork-shaped upper end 122 (Figs. 1 and 2) carrying a transverse pin 124 which extends through a slot 126 provided in one end of an arm 128. The arm 128 is secured on a shaft 130 rotatably mounted in bearings provided in a U-shaped bracket 132 which is integral with the bracket 62. Another arm 134 is secured to the shaft 130 and is actuated by mechanism, to be described, to load two heavy torsion springs 136 and 138 (Figs. 2 and 3) coiled about the shaft 130 on opposite sides of the hub of the arm 128. One end of each torsion spring engages the top face of a lug provided on the arm 128 and the other end rests against a pin secured in the bracket 132 (see Fig. 1). As will be noted, on upward rotation of the arm 134, the arm 128 is moved upwardly in a counterclockwise direction, as viewed in Fig. 1, thereby loading the springs 136 and 138. Mechanism is provided for holding the springs 136 and 138 loaded and thus holding the arm 128 cocked. This mechanism comprises a latch arm 140 (Fig. 1) secured to the shaft 130 and cooperating with a pawl 142 pivoted substantially midway between its ends on an upward extension 144 of the bracket 132. The left-hand end of the pawl 142 (as viewed in Fig. 1) is connected by a spring 146 to the bracket 132. The spring 146 thus tends to rotate the pawl 142 in a counterclockwise direction, as viewed in Fig. 1. During the cocking of the arm 128 the latch arm 140, which is rotated with the arm 128 since it is secured to the same shaft 130, rides along the under surface of the pawl 142 until it snaps be-

hind a shoulder 148 of the pawl 142, thus holding the arm 128 cocked.

The above-mentioned mechanism for actuating the arm 134 to load the springs 136 and 138 and to cock the arm 128 is constructed and arranged as follows: The end of the arm 134 remote from the shaft 130 is fork-shaped and carries a block 150 (Fig. 1) pivotally secured thereto by a transverse pin 152 extending through the forked end of the arm 134. The block 150 has extending through it, above and at right angles to the pin 152, another pin 154 the opposite ends of which extend outwardly from the block 150 through vertical slots 156 (Fig. 2) provided in the two prongs of the fork-shaped lower end 158 of a link 160, the upper end of which is pivotally connected to a cam lever 162, to be described. The end faces of the block 150 are in sliding engagement with the inner faces of the prongs of the link 160. Elevation of the link 160 thus causes upward rotation of the arm 134, with the results described.

To release the pawl 142 with the result that the loaded springs 136 and 138 swing the arm 128 downward in a clockwise direction (as viewed in Fig. 1) to actuate the driver 100, there is provided a pin 164 extending from the link 160 substantially midway between the upper and lower ends thereof. As will be noted, on downward movement of the link 160 and assuming that the arm 128 is held in its upper cocked position, there is a lost motion between the then stationary pin 154 and the link 160 in view of the provision of the vertical slots 156. Upon engagement of the downward moving pin 164 with the right-hand arm of the pawl 142 (as viewed in Fig. 1) extending into the path of movement of the pin 164, the pawl 142 is tripped to release the latch arm 140 and to free the springs 136 and 138 to actuate the arm 128. On upward movement of the link 160, after an operating movement has been imparted to the arm 128 and thus to the driver 100, the arm 134 is again rotated upward to load the springs 136 and 138, there being then no lost motion between the link 160 and the pin 154 carried by the arm 134 since, as a result of the downward movement of the arm 128 by the springs 136 and 138, the arm 134 also was moved downward and located the pin 154 in the lower ends of the slots 156.

The above-mentioned cam lever 162, which moves the link 160 up and down at predetermined points in each cycle of the machine, is pivotally mounted on the shaft 46 and is in the form of a bell crank lever having a downwardly extending arm 166 (Fig. 2) carrying a roll 168 which is held by a spring 170 against the periphery of a cam disk 172 secured on the cam shaft 14.

As illustrated in Fig. 1, the driver actuating arm 128 is provided at its lower face with an abutment 174 which, during downward movement of the arm 128, is caused to strike upon a bumper 176 secured to the bracket 132 to cushion the blow of the arm 128 and to limit the extent of its operative downward movement as well as that of the driver.

As has been stated, the driver 100, on its driving stroke, moves downwardly along the guideway 102 into engagement with the fastening contained in the groove 74 of the roll 70 and, as a result of its continued downward movement, causes the fastening to be driven into the lower guiding piece or nozzle 105. However, the

lower end of the driver 100, at the termination of its driving stroke, is located a considerable distance from the surface of the work presented against the lower end of the guiding piece 105 (see Figs. 7 and 8). This distance corresponds substantially to the length of one fastening. Hence, it is impossible for the driver to insert the fastening F engaged by it into the work and drive its trailing end portion home as would be desirable. To cause each fastening to be nevertheless fully inserted into the work and to have its trailing end portion countersunk into the surface of the work the arrangement in the illustrated machine is such that each fastening is inserted through the agency of the succeeding fastening with which the driver 100 is in contact. This arrangement is of considerable advantage in view of the provision of fastening deflecting means which, as illustrated, is a baffle plate 180 (Figs. 1, 4, 7 and 8). The baffle plate is located opposite the point of emergence of the fastening from the nozzle 105 and is in contact with the work. Its purpose is to bend successive portions of the fastening, as the latter is being driven, before these portions enter the work so as to cause the fastening to follow a curved path in the work without penetrating the entire thickness thereof. If the arrangement were such that the driver 100 would insert each fastening into the work by direct contact with the fastening, the stroke of the driver, of course, would of necessity be much longer but in no case can its stroke be so lengthened that the driver could countersink the trailing end portion of the fastening into the surface of the work in view of the unavoidable interference of the driver with the baffle plate. If such an attempt were made, the driver would either become bent or its lower end would break off. This disadvantage is completely avoided by utilizing the fastening succeeding the one to be inserted as the direct driving means, since a slight bending of the forward end of the inserting fastening by the baffle plate at the end of the inserting operation (see Fig. 8) is immaterial, to say the least, and may be considered to be of advantage because that fastening, which becomes the next fastening to be inserted, is to be bent anyhow when being inserted into the work so as to cause it to follow a curved path therethrough.

To obtain different degrees of curvatures of the inserted fastenings to accommodate various work thicknesses, the baffle plate 180 is adjustable with relation to the guiding piece or nozzle 105. To this end it is provided with lugs 182 having slots (not shown) through which extend screws 184 adjustably securing the baffle plate 180 to the plate 94 and the bracket 28, a set screw 186 being provided in the baffle plate 180 for making fine adjustments.

As illustrated in Fig. 7 the fastening F in being inserted into the work and following a curved path therethrough reemerges with its leading end portion from that surface of the work from which it was caused to enter the work. This protruding reemerged leading end portion of the fastening is then clinched by being turned back into the work.

For clinching the reemerged leading end portion of the inserted fastening the above-mentioned clinching mechanism is provided which comprises a bar-shaped clinching member 200 (Figs. 1 and 4) having a laterally bent lower end provided with a concave clinching face terminating at one edge in a projection 202. The

clinching member 200 is reciprocated in the direction of its longitudinal axis and, when being moved downwardly, it is caused to engage the protruding end portion of the inserted fastening to bend it back against the surface of the work and to reinsert the extremity thereof into the surface of the work, as illustrated in Fig. 8. This reinsertion of the extremity of the fastening into the work is made possible by the provision of the projection 202 at the clinching end of the clinching member 200. The clinching member is movable in spaced guideways 204 provided in the bracket 28 and is connected at its upper end to a bar 206 (Fig. 1) the upper end of which is pivotally secured to an arm 208 secured to a shaft 210 rotatable in bearings provided in a bracket 212 (Fig. 3). A spring 214, which is stretched out between the machine frame and the outer end of the arm 208, tends so to rotate the arm 208 that the clinching member 200 is caused to clinch the reemerged end portion of the fastening F in the above-described manner. The spring 214 in order to perform this operation is loaded and to this end the retracting movement of the driver bar 108 which has been described is utilized to impart an upward movement to the arm 208 into a cocked position by the engagement of the outer end of the arm 128 with a projection 216 provided at the lower surface of the arm 208. The arm 208 is held cocked by the engagement of a shoulder 218 (Fig. 1) provided on a tail piece 220 of the arm 208 with a latch 222 pivoted at one end to the machine frame and engaging with its other end the shoulder 218. To withdraw the latch 222 and to release the arm 208 to the action of the loaded spring 214, the latch 222 is pivotally connected to the lower end of a bar 224 the upper end of which is pivoted to a cam lever 226 secured on the shaft 46. The cam lever 226 is in the form of a bell crank lever and has a depending arm 228 (Fig. 2) carrying a roll 230 held by a spring 232 against the periphery of a cam disk 234 secured on the cam shaft 14. The cam disk 234 is so shaped that at the proper time during each cycle of operations of the machine the bar 224 is raised to permit the actuation of the clinching member 200 by the spring 214.

To limit and adjustably to determine the extent of downward movement of the clinching member 200, there is pivotally secured to the outer end of the arm 208 a vertical rod 236 (Fig. 1) extending through a hole in a lug 238 provided on the bracket 212. The rod 236 has threaded on its upper end a nut 240 carrying a washer and a lock nut 242. Upon downward movement of the arm 208 by the spring 214 the washer of the nut 240 is caused to strike the top face of the lug 238, thus terminating the downward movement of the clinching member 200.

The operation of the machine is apparent from the foregoing description but may be summarized as follows: Assuming the machine parts to be in their initial inoperative positions, with both the driver 100 and the clinching member 200 retracted and cocked, the operation of the machine is started by the lowering of the treadle rod 22, thus tripping the clutch 20 and initiating the rotation of the cam shaft 14. As a result the cam 54 of the wire-feeding mechanism imparts a swinging movement to the cam lever 44, moving the link 42 downwardly to rotate the wire feed roll 30 a predetermined distance to advance the leading end portion of the wire strand through the guiding member 60 into the roll 70 which, at that time, assumes its wire receiving position with the groove 74 in alinement with the groove of the guiding member 60. This having been completed, the cam 96 of the wire-severing mechanism imparts motion to the cam lever 90, elevating the link 78 with the result that the roll 70 is rotated into its fastening inserting position in which the groove 74 is in alinement with the grooves in the guiding members 104 and 105. The leading end portion of the wire, which previously has been fed into the roll 70, is thus severed from its strand to form a fastening due to the shearing action between the roll 70 and the guide member 60, and this fastening is then located in the path of travel of the driver 100. Then the cam 172 imparts motion to the cam lever 162, moving the link 160 downward to release the pawl 142, freeing the arm 128 to the action of the loaded springs 136 and 138 to actuate the driver 100. The driver in descending engages the fastening F located in the roll 70 and drives it into the nozzle 105 in which the preceding fastening already is located in a position to be driven into the work presented to the lower end of the nozzle 105. The just mentioned fastening, already located in the nozzle 105, is thus inserted into the work and by reason of the provision of the baffle plate 180 it is caused to follow a curved path through the work with its leading end portion reemerging from the side of entry of the work. Then the cam 234 renders the cam lever 226 active to elevate the latch 222 and to trip the arm 208, thus enabling the loaded spring 214 to actuate the clinching member 200 to engage the reemerged leading end portion of the inserted fastening and to clinch it against and reinsert it into the surface of the work while the trailing end portion of this fastening is held by the succeeding fastening and the driver. Thereafter the cam 96 actuates the cam lever 90 in the opposite direction to turn the roll 70 back into its wire receiving position after the cam 172 of the driving mechanism has caused the driver 100 to be retracted at which time the arm 128 of the driver-operating mechanism, by engagement with the projection 216 on the arm 208 of the mechanism for operating the clinching member, retracts the clinching member 200, both the arms 128 and 208 then being held in their elevated cocked positions by their respective locking mechanisms with their actuating springs loaded in readiness for the next fastening inserting operation.

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 fastening-inserting machine, the combination with means for feeding a continuous strand of fastening material, and means for severing pieces from said strand successively to form fastenings for insertion into a work piece, of means for inserting each fastening into the work piece by engagement with a succeeding fastening.

2. In a fastening-inserting machine, the combination with means for feeding a continuous strand of fastening material, and means adapted to receive the leading end portion of said strand and to sever from said strand a piece to form a single-legged fastening, of a passageway for receiving a plurality of fastenings, and means movable in said passageway and arranged by engagement with the uppermost fastening in said passageway to cause the lowermost fastening to be inserted into the work.

3. In a fastening-inserting machine, the com-

bination with means for feeding a continuous strand of fastening material, and means for severing pieces from said strand successively to form fastenings for insertion into a work piece, of means for inserting each fastening into the work piece by engagement with a succeeding fastening, and a deflector adapted to engage successive portions of each fastening during its insertion and to bend said portions thereby causing the fastening to follow a curved path through the work without penetrating the entire thickness thereof.

4. In a fastening-inserting machine, the combination with means for feeding a continuous strand of fastening material, and means for successively severing pieces from said strand to be successively inserted into a work piece as fastenings, of means for inserting each fastening into the work piece and countersinking it therein by engagement with a succeeding fastening, and a deflector adapted to engage successive portions of each fastening while it is being driven and to bend said portions thereby causing the fastening to follow a curved path through the work without penetrating the entire thickness thereof.

5. A fastening-inserting machine having, in combination, means for feeding a continuous strand of fastening material and means adapted to receive the leading end portion of said strand and to sever it so as to form a single-legged fastening, said severing means being arranged to transfer the fastening from its severing position into a driving position, a driver for inserting the fastening into a work piece, a deflector adapted to bend successive portions of the fastening before they enter the work piece, thereby causing the fastening to curve through the work piece during the insertion thereof without penetrating the entire thickness of the work piece and causing the leading end portion of the fastening to emerge from the side of the work piece from where it was inserted, and means for clinching said leading end portion of the fastening.

6. A fastening-inserting machine having, in combination, means for feeding a continuous strand of fastening material and means adapted succesively to receive the leading end portion of said strand and to sever it so as to form successively single-legged fastenings, said severing means being arranged successively to transfer each fastening from its severing position into a driving position, means for inserting each fastening into a work piece by engagement with a succeeding fastening, a deflector adapted to bend successive portions of each fastening before they enter the work piece thereby causing the fastening to curve through the work piece during the insertion thereof without penetrating the entire thickness of the work piece and causing the leading end portion of the fastening to emerge from the side of the work piece from where it was inserted, and means for clinching said leading end portion of the fastening.

7. In a fastening-inserting machine, the combination with means for step-by-step feeding a continuous strand of stapling wire, of wire receiving means adapted successively to sever the received end portions of the wire and to transfer the severed end portions as fastenings into a position from which they are inserted into a work piece, a driver acting on a plurality of fastenings positioned in the line of drive thereby inserting the lowermost of said fastenings through the agency of the other fastenings and moving the succeeding fastening into position to

be inserted during the succeeding fastening inserting operation of the driver.

8. In a fastening-inserting machine, the combination with means for step-by-step feeding a continuous strand of stapling wire, of wire receiving means adapted successively to sever the received end portions of the wire and to transfer the severed end portions as fastenings into a position from which they are inserted into a work piece, a driver acting on a plurality of fastenings positioned in the line of drive thereby inserting the lowermost of said fastenings into the work piece through the agency of the other fastenings and moving the succeeding fastening into position to be inserted during the succeeding fastening inserting operation of the driver, and a deflector for successively bending portions of each fastening as it is being inserted thereby causing the fastening to follow a curved path through the work piece without penetrating the entire thickness thereof.

9. In a fastening-inserting machine, the combination with means for step-by-step feeding a continuous strand of stapling wire, of wire receiving means adapted successively to sever the received end portions of the wire and to transfer the severed end portions as fastenings into a position from which they are inserted into a work piece, a driver acting on a plurality of fastenings positioned in the line of drive thereby inserting the lowermost of said fastenings into the work piece through the agency of the other fastenings and moving the succeeding fastening into position to be inserted during the succeeding fastening inserting operation of the driver, a deflector for successively bending portions of each fastening as it is being inserted thereby causing the fastening to follow a curved path through the work piece without penetrating the entire thickness thereof and causing the leading end portion of the driven fastening to protrude from the work, and a member for clinching said protruding end portion of the fastening.

10. In a fastening-inserting machine, the combination with means for feeding a continuous strand of fastening material and means for successively severing pieces from the leading end portion of said strand to be successively inserted into a work piece as fastenings, of means for inserting each fastening into the work piece and countersinking it therein by engagement with a succeeding fastening, a deflector adapted to engage successive portions of each fastening while it is being driven and to bend said portions thereby causing the fastening to follow a curved path through the work without penetrating the entire thickness thereof and causing the leading end portion of the fastening to emerge and protrude from the side of the work piece from where it was inserted, and means for clinching said leading end portion of the fastening.

11. In a fastening-inserting machine having fastening inserting means including a thin, reciprocable driver and a stationary guideway for the driver, the provision of movable means for covering the driver in said guideway to insure support of the driver on all sides, over its entire length and in any position of its reciprocation.

12. In a fastening-inserting machine having fastening inserting means including a thin, reciprocable driver and a stationary driver guiding member provided with a guideway open on one side, stationary means for covering part of said guideway, a driver bar, a recess in said covering means to accommodate the driver bar, said re-

cess exposing part of said guideway, and means movable with the driver to cover the latter during the entire extent of its travel in those portions of the guideway which are exposed by said recess.

13. In a fastening-inserting machine, the combination with wire feeding means and fastening inserting means including a driver, of rotary means adapted to receive the leading end portion of the wire, means for rotating said rotary means at the end of the wire feeding operation to cause said rotary means to sever the fed-in portion of wire to form a fastening and to transfer said fastening to a position in which it will be engaged by the driver during the driving stroke of the latter, and driver guiding and supporting means adapted to support the driver at all sides thereof and over its entire extent in any position of its travel.

14. In a fastening-inserting machine, the combination with wire feeding means and fastening inserting means including a driver, of rotary means adapted to receive the leading end portion of the wire, means for rotating said rotary means after it has received the end portion of the wire thereby causing said rotary means to sever the end portion of the wire to form a fastening and to transfer said fastening to a position in which it will be engaged by the driver during the driving stroke of the latter, driver guiding and supporting means provided with a guideway in which the driver is adapted to move and which is open on one side, and a movable driver guard covering the open side of said guideway.

15. In a fastening-inserting machine, the combination with wire feeding means and fastening inserting means including a driver, of rotary means adapted to receive the leading end portion of the wire, means for rotating said rotary means after it has received the end portion of the wire thereby causing said rotary means to sever the end portion of the wire to form a fastening and to transfer said fastening to a position in which it will be engaged by the driver during the driving stroke of the latter, driver guiding and supporting means provided with a guideway in which the driver is adapted to move and which is open on one side, and a driver guard movable with the driver to cover the open side of said guideway.

16. In a fastening-inserting machine, the combination with wire feeding means and fastening inserting means including a driver and a driver bar, of rotary means adapted to receive the leading end portion of the wire, means for rotating said rotary means after it has received the end portion of the wire thereby causing said rotary means to sever the end portion of the wire to form a fastening and to transfer said fastening to a position in which it will be engaged by the driver during the driving stroke of the latter, driver guiding and supporting means provided with a guideway in which the driver is adapted to move and which is open on one side, and a movable driver guard pivotally secured to the driver bar and adapted to cover the open side of said guideway.

17. A fastening-inserting machine having, in combination, a work engaging nozzle through which fastenings are inserted into a work piece, a driver movable in the nozzle, means for so controlling the movement of the driver that the driver terminates its operative stroke a substantial distance from the work presented to the nozzle, means for successively transferring fastenings into the path of driving movement of the driver, and means for actuating the driver to insert the lowermost fastening positioned in the nozzle by means of a fastening interposed between the driver and said lowermost fastening.

18. A fastening-inserting machine having, in combination, a work engaging nozzle, means for positioning a plurality of fastenings for insertion successively into a work piece, a reciprocating driver adapted to insert the lowermost of the fastenings and thereafter to return to its initial retracted position, means for so actuating the driver that its fastening inserting movement is terminated with the driver spaced from the work a distance corresponding substantially to the length of a fastening to be inserted and with a fastening located between the end of the nozzle and the driver, and means for transferring a fastening into the path of operative movement of the driver after the latter has been retracted into its inoperative position so that the last mentioned fastening is located between the driver and the fastening already contained in the nozzle.

19. A fastening-inserting machine having, in combination, a work engaging nozzle, means for positioning a plurality of fastenings for insertion successively into a work piece, a reciprocating driver, means for reciprocating the driver between a fastening inserting position and a retracted position, means for so determining the fastening inserting position of the driver that the latter is spaced a substantial distance from the work and a fastening is located in the nozzle between the lower end of the nozzle and the driver, means for transferring a fastening into the path of operative movement of the driver on movement of the latter into its retracted position so that during the succeeding operative movement of the driver the fastening contained in the nozzle is inserted into the work piece by means of the fastening succeeding it, the latter fastening being engaged by the driver.

20. A fastening-inserting machine having, in combination, a driver, means for presenting fastenings to the driver to be so inserted into a work piece by the driver that one end portion of each fastening protrudes from the work, a clinching member adapted to clinch said protruding end portion of the fastening, means for retracting the driver and the clinching member against the action of spring means, means for holding the driver and the clinching member in their retracted positions, and separate means for successively releasing the driver and the clinching member to the forces of their respective spring means.

21. A fastening-inserting machine having, in combination, a work engaging nozzle, means for positioning a plurality of separate, alined fastenings for insertion successively into a work piece, a fastening inserting driver, means for imparting a fastening inserting movement to the driver while in engagement with the uppermost of the alined fastenings as a result of which the lowermost of the fastenings is driven out of the nozzle into the work and the succeeding fastening is moved into the nozzle to be inserted during the next fastening inserting movement of the driver.

22. A fastening-inserting machine having, in combination, a work engaging nozzle, means for positioning two alined fastenings for insertion successively into a work piece, a fastening inserting driver, means for imparting a fastening inserting movement to the driver while in engagement with the uppermost of the alined fastenings

to drive the lowermost fastening out of the nozzle into the work piece and to countersink said lowermost fastening in the work piece by causing the uppermost fastening to move into and along the nozzle until the leading end of that fastening is positioned flush with the lower end of the nozzle.

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