F. L. MacKENZIE.

MACHINE FOR INSERTING FASTENINGS.

APPLICATION FILED FEB. 8, 1909.

1,045,717.

Patented Nov. 26, 1912.

5 SHEETS—SHEET 1.

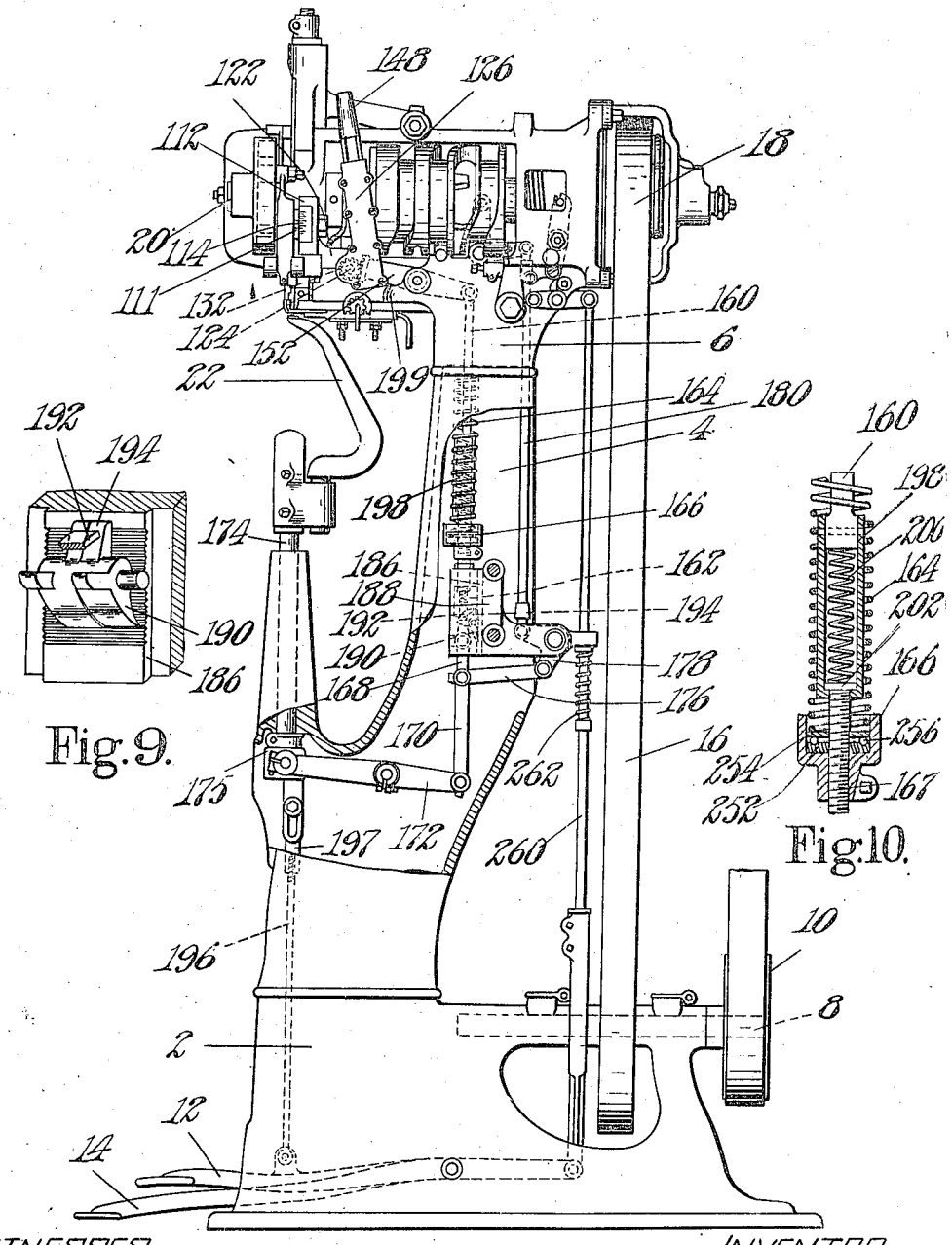

Fig. 1.

Fig. 9.

Fig. 10.

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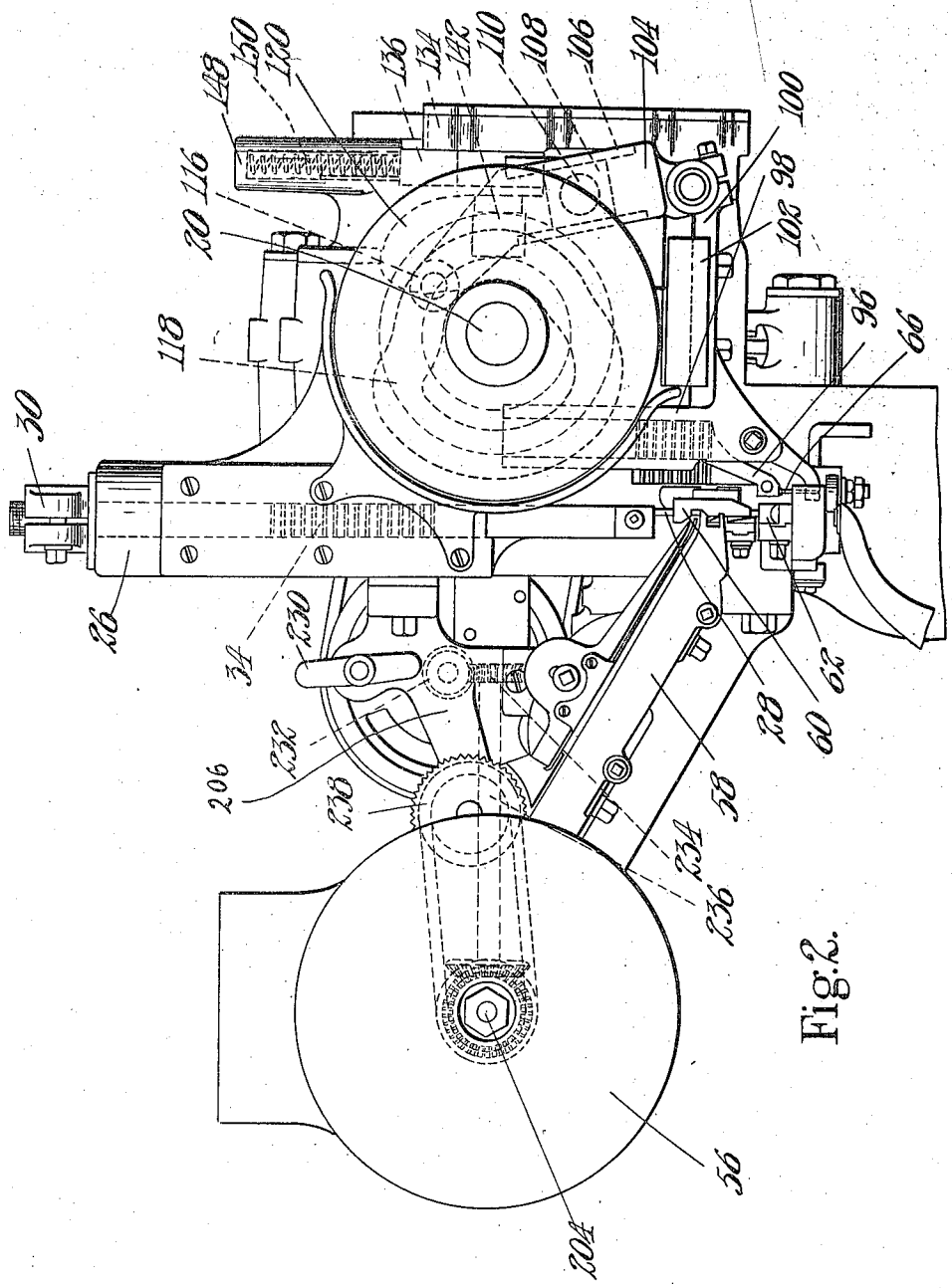

Fig. 2.

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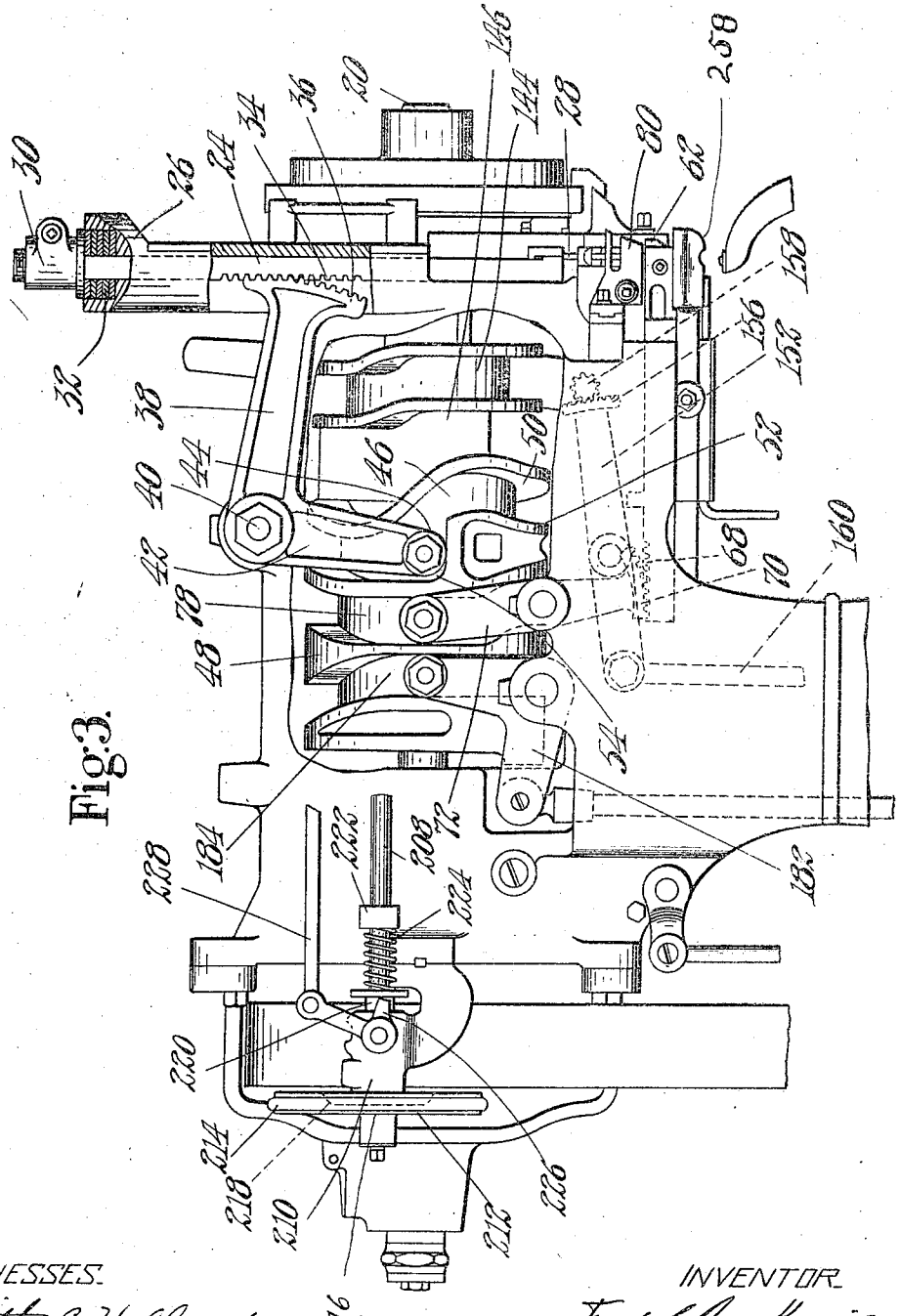

Fig. 3.

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5 SHEETS—SHEET 4.

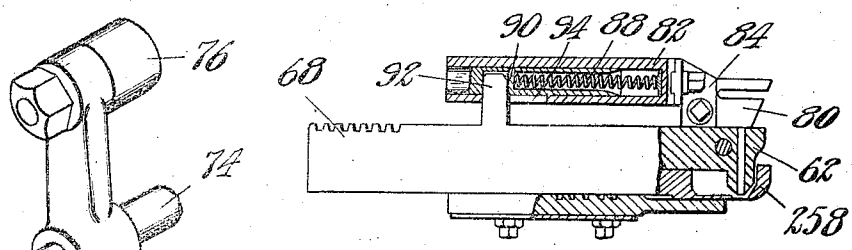

Fig. 5.

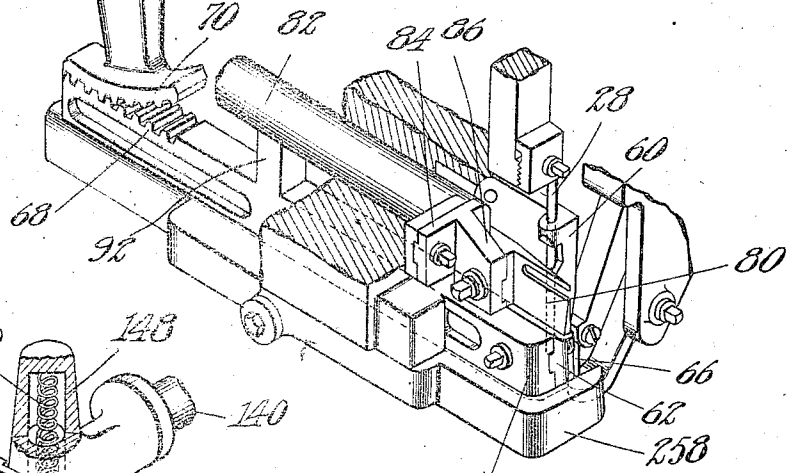

Fig. 4.

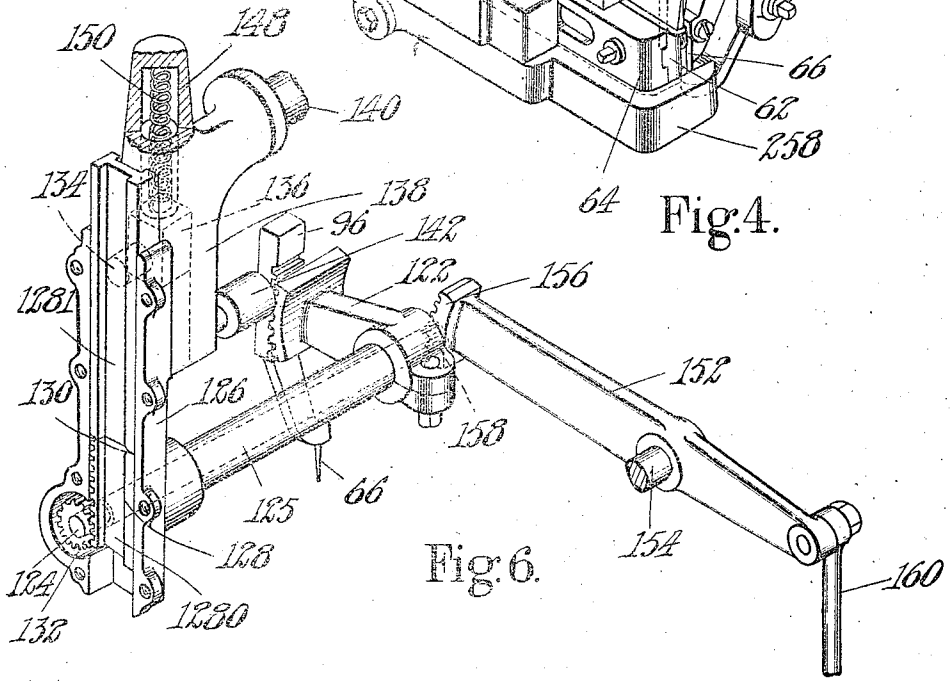

Fig. 6.

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5 SHEETS—SHEET 5.

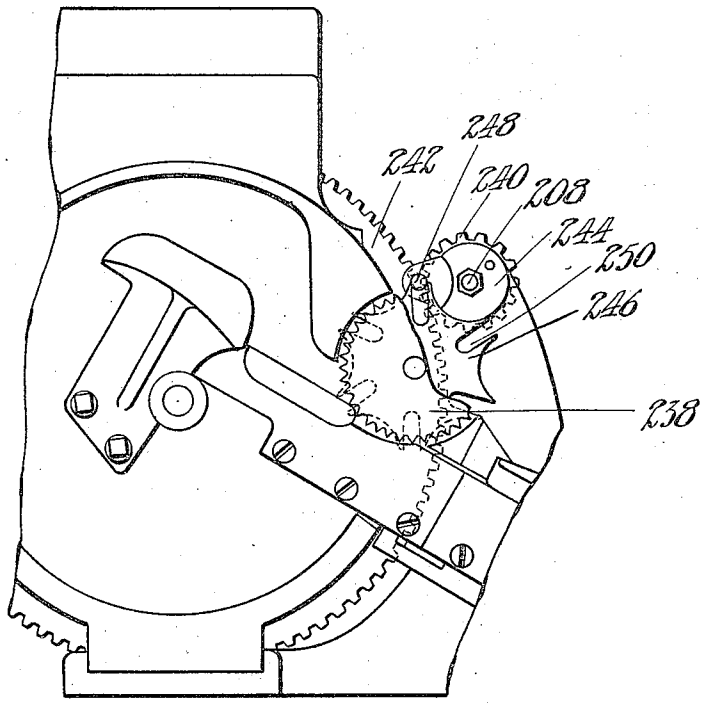

Fig: 8.

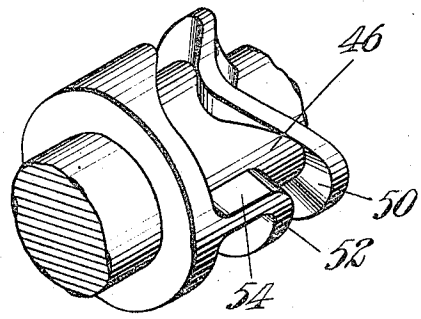

Fig: 7.

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UNITED STATES PATENT OFFICE.

FRED L. MacKENZIE, OF BEVERLY, MASSACHUSETTS, ASSIGNOR TO UNITED SHOE MACHINERY COMPANY, OF PATERSON, NEW JERSEY, A CORPORATION OF NEW JERSEY.

MACHINE FOR INSERTING FASTENINGS.

1,045,717. Specification of Letters Patent. Patented Nov. 26, 1912.

Application filed February 8, 1909. Serial No. 476,718.

To all whom it may concern:

Be it known that I, FRED L. MacKENZIE, a citizen of the United States, residing at Beverly, in the county of Essex and State of Massachusetts, have invented certain Improvements in Machines for Inserting Fastenings, of which the following description, in connection with the accompanying drawings, is a specification, like reference characters on the drawings indicating like parts in the several figures.

This invention relates to machines for inserting fastenings and particularly to machines for inserting previously formed fastenings. As herein used the term "fastening" is intended to include within the scope of its designation things having other than fastening functions, but which are adapted to be handled by machines of the type to which this invention particularly relates.

Efficient fastening inserting machines are in use in many arts, the machine herein illustrated being intended especially for use in the manufacture of boots and shoes, but the commercial success attending the use of such machines is dependent, to a great extent, upon two things, namely: the speed at which the machine performs its work and the rapidity with which the work may be presented to the machine. Of these two elements of commercial success the latter depends for the most part upon the skill and quickness of the operator. The speed of operation, however, is a resultant of the organization and construction of the machine as a whole and in this respect machines in commercial use are not entirely satisfactory, for the reason that, owing to the low speeds at which they must be run, their capacity for performing work is inferior to the demand made upon them by the average operator and seriously handicaps the best operators.

A general object of the present invention, therefore, is to provide a machine for handling previously formed fastenings which may be run at speeds higher than those attainable with machines of known construction.

A further object of the invention is so to improve the construction of machines of this type that they will be adapted for performing not only an increased quantity of work but also a superior quality of work.

Another object of the invention is to provide a machine which is adapted to be run at high speed and yet which is so constructed and arranged that there is a minimum of vibration and a minimum of wear.

Other objects of the invention relate especially to improvements in the construction and operation of the various elements which go to make up a machine of the type known as "loose nailing machines", that is, a machine adapted to handle previously formed nails in bulk and comprising usually a nail driving mechanism, a hopper, a raceway for conducting nails from the hopper to a point adjacent to the driving mechanism, a separator for separating the endmost nail from the others in the line in the raceway and delivering it to a nail receiving throat which constitutes, usually, a part of the driver passage, and an awl for forming a nail receiving opening in the work and having usually, and preferably, the further function of feeding the work between successive nail driving operations. It will be understood however that many of the objects of the invention hereinafter pointed out relate to improvements in fastening inserting machines in general.

An important object of the present invention is to provide means for actuating the fastening driver by which said driver may be operated at high speed in exact time relation to the other parts of the machine, and yet be caused to drive the fastening with a blow as distinguished from a shove. In fastening machines as ordinarily constructed the fastening driving movement of the driver is usually effected by a spring which has been put under tension by the upward movement of the driver. It is impracticable, however, to employ a spring in a machine designed to run at very high speed since the spring cannot be relied upon to bring the driver into proper coöperative relation to the other parts of the machine at the proper time.

In some fastening inserting machines, a cam has been employed to effect the reciprocation of the driver but it has been found in practice that the operation of cam controlled drivers is unsatisfactory, since the fastening is forced into the work by a shoving action rather than by a blow, and the depth to which it is inserted has varied with the nature and condition of the work.

The present invention aims therefore to provide the positive control advantages of a cam-actuated driver with the impact driving advantages of a spring-actuated driver. To this end a driver actuating mechanism has been provided which insures the arrival of the driver at a predetermined point at the proper time in the cycle of operations of the machine and yet which imparts to the driver a momentum drive similar to that which would be imparted to it by the usual driver spring.

The invention aims further to provide a driver actuating mechanism which will not only cause the fastening to be driven with a blow instead of a shove, but which will also cause a second or setting blow to be given to the fastening whereby proper and uniform insertion of the fastenings in the work may be insured.

In the illustrated embodiment of the invention the foregoing objects are attained by the provision of a driver actuating cam of novel design which may conveniently be described as a momentum cam and which is so constructed that it will cause the driver to travel at not less than a predetermined minimum velocity to an intermediate point in the driving direction, determine positively the location of that point and free the driver thereat to continue its driving movement by momentum, and which is further so constructed that it insures a movement of the driver to a predetermined limit in the driving direction. Said cam is preferably so constructed also that it controls positively the action of the driver during all parts of its movement except as hereinabove described when it releases said driver to travel under its acquired momentum and thereby drive the fastening with a blow.

An improved means for clearing the raceway which is herein shown will not be claimed in this case, this means having been made the subject-matter of a co-pending application Ser. No. 663,014 filed Nov. 29, 1911.

Still other objects of the invention will be apparent from a consideration of the disclosure in this application of the preferred embodiment of my invention.

In the accompanying drawings,—Figure 1 is a side elevation of a machine embodying the preferred form of this invention; Fig. 2 is a front elevation of the head of the machine; Fig. 3 is a side elevation of the machine head viewed on the left hand of an observer standing in front of the machine; Fig. 4 is a perspective view of the mechanism for moving the throat and separator in proper time relation to each other; Fig. 5 is a detail sectional view showing the connections between the throat and separator; Fig. 6 is a perspective view of the awl depth controlling mechanism; Fig. 7 is a detail perspective of the driver operating cam; Fig. 8 is a detail side elevation, partly broken away, of the improved raceway clearer actuating mechanism; Fig. 9 is a detail perspective of the locking mechanism constituting a part of the horn operating mechanism; Fig. 10 is a detail section of the yielding connection between the awl depth controlling mechanism and the horn release mechanism.

The illustrated machine has a supporting frame comprising a base 2, a standard or column 4 and a head 6. In the base are mounted a counter shaft 8 to which is attached a pulley 10 connected to any suitable source of power and the horn depressing and clutch operating treadles 12 and 14, respectively. The counter shaft 8 also carries a second pulley rigidly attached to it and connected by a belt 16 to a loose pulley 18 upon the main driving shaft 20 in the head 6. In the upright portion of the frame or standard 4 are mounted the work support or horn 22 and the horn release controlling mechanism, hereinafter more specifically described.

In the head 6 are mounted the various parts of the fastening inserting mechanism and the cams which control the timing of the operations of the various parts of the machine as a whole. Inasmuch as the illustrated machine is of the type known as loose nailing machine, for the purposes of this description the term "nail" will be used instead of fastening in describing the various parts of the fastening inserting mechanism and the various operations performed by the machine.

The fastening inserting or nail driving mechanism comprises a driver bar 24 mounted to reciprocate vertically in a guideway in an upright part 26 of the machine head and having clamped to its lower end a driver 28. At its upper end the driver bar 24 is provided with an adjustable stop 30 which impacts in the movement of the driver upon a cushion 32 surrounding the driver bar and contained in a countersunk opening in the upper end of the part 26. Upon its rear side the driver bar 24 is provided with rack teeth 34 which are engaged by the teeth of a segment rack 36 carried upon the substantially horizontal arm 38 of a bell-crank lever pivoted at 40 upon the machine head. The other arm 42 of the bell-crank driver operating lever carries a cam roll 44 which travels in a cam groove 46 formed in a cam wheel 48 mounted upon the driving shaft 20.

The driver operating cam is of peculiar construction, and as hereinabove suggested may conveniently be described as a momentum cam. The cam groove 46 is provided with opposed walls 50 and 52 which are parallel throughout the greater part of their extent so that both the upward and downward movements of the driver are substantially positively controlled throughout the

greater part of the reciprocatory movement of said driver. In order, however, to provide a momentum or blow-like driving of the nail the positive control of the movement of the driver by the cam is preferably relaxed during a predetermined part of the movement of said driver, and this relaxation of control or release of the driver will preferably take place during the latter part of its downward movement or its movement in the nail driving direction.

Preferably, however, the control of the cam over the movement of the driver will be maintained to the extent that the driver will be compelled to move at not less than a predetermined velocity throughout the whole of its driving movement and will be compelled to move to a predetermined limit in the driving direction. To this end the wall 50 of the groove 46 will be given a cam shape, such that it will compel the movement of the driver at not less than a predetermined speed in the event that the momentum of the driver is not sufficient to carry it at a greater speed. To permit the driver to travel at a greater speed than that at which it would be caused to travel by the compelling action of the side or wall 50 of the cam groove 46, the wall or side 52 is so shaped that there is a recess or pocket 54 in the groove 46 into which the cam roll 44 may be carried as the momentum of the driver bar and driver causes it to move away from the wall 50. It will be noted that the wall 50 of the cam groove 46 impels the driver in its downward direction and prevents too rapid movement of the driver in the upward direction, and that, on the other hand, the wall 52 serves to effect the upward movement of the driver but resists too rapid movement in the downward direction except as hereinabove described when the driver has reached a predetermined point in its downward movement, when the control of the wall 52 over the downward movement is interrupted by the provision of the recess or pocket 54.

It will be noted further that after the driver and driver bar have been permitted to descend under their acquired momentum, which may conveniently be referred to as the acquired momentum of the driver, the wall 50 of the cam groove again comes into contact with the cam roll 44 and causes the driver to deliver upon the head of the fastening a second or setting blow in the event that the driving blow has not sunk the head to the proper depth.

The nails to be driven are contained in a hopper 56 from which they are conducted by a raceway 58 to a point adjacent to the driver passage in the driver guide 60, said guide being broken away at the side adjacent to the raceway whereby the nails may be introduced one at a time from said raceway into said driver passage. Below the driver guide 60 is a nail receiving throat 62 mounted upon a slide 64 and movable with said slide transversely to the path of feed of the work and transversely to the raceway 58. Transverse movement of the throat 62 and slide 64 is provided to withdraw the throat from the path of feed movement of the awl 66, hereinafter to be described, in order to permit the awl to bring the nail receiving opening which it has formed in the work beneath the driver passage.

The slide 64 is guided in an opening in the machine frame and is provided at its rear end with rack teeth 68 with which engage the teeth upon a segment rack 70 upon the lower end of a slide actuating lever 72 pivoted at 74 on the machine head and carrying at its upper end a cam roll 76 entering a cam groove 78 in the cam wheel 48, said cam groove 78 being so shaped as to effect movement of the throat 62 into operative position and to withdraw it out of the path of the awl at the proper times in the cycle of operations of the machine.

The nail separator 80 is also mounted upon the slide 64 to move therewith and is yieldingly connected with said slide so that on the return movement of the slide 64 the separator may move relatively to said slide in the event that it meets an obstruction in the raceway. The connections between the separator and slide comprise a cylindrical slide 82 upon which is mounted a bracket 84 provided with a forwardly projecting portion 86 to which the separator blade 80 is attached. The bracket 84 is adjustable upon the slide 82 in a direction substantially parallel to the movement of the awl, so that the separator may be adapted to nails of varying dimensions. The cylindrical slide 82 is guided in a cylindrical opening in the machine head and has socketed within it a spring 88 which bears at one end against the end of a socket in the slide 82 and at its other end against the end of a socket in a second cylindrical slide 90 mounted within the slide 82.

The slide 90 is provided with a pocket in which is received a lug 92 extending up from the slide 64, a slot 94 being provided in the slide 82 whereby said slide may move relatively to said lug to permit the separator to yield when it meets an obstruction. The spring 88 tends normally to keep said slide 82 in such relation to the slide 64 that the lug 92 will be in the rear end of the slot 94.

The awl 66 is clamped in an awl bar 96 which has a straight vertical portion mounted to slide in a vertical guideway in an awl carrying frame 98, said frame 98 being provided with a horizontal dove-tail portion 100 arranged to slide in a similarly shaped slideway formed in a bracket 102 bolted to

the machine head. The awl bar 96 is arranged to reciprocate vertically in its carrying frame 98 and to be moved horizontally with said frame. The mechanism for effecting the horizontal movement of the frame 98 comprises a floating lever 104 provided with a guideway 106 in which is slidably mounted a fulcrum block 108 pivoted upon a stationary fulcrum pin 110 carried by a block 111 adjustably mounted in an upstanding portion 112 of the machine head.

Vertical adjustment of the fulcrum pin 110 varies the relative lengths of the two arms of the floating lever 104 and therefore varies the amount of horizontal movement of the frame 98 and the amount of feed movement of the awl. For convenience in adjusting the fulcrum pin 110, the upstanding portion of the frame 112 is provided with a nail-spacing scale 114 with which coöperates an indicator on the fulcrum pin carrying block 111. At its upper end the floating lever 104 is provided with a cam roll 116 traveling in a cam groove 118 formed in the rear face of the cam disk 120 mounted upon the forward end of the main driving shaft 20.

Upon the rear face of its vertical portion the awl bar 96 is provided with rack teeth with which engage the teeth upon a segment rack carried upon one arm 122 of an awl operating lever. The awl operating lever is fulcrumed upon a rock-shaft 124, being provided with a sleeve 125 which surrounds said rock-shaft. The arm 122 of the awl-operating lever is attached to the inner end of the sleeve 125 and the other arm 126 is attached to the other end of said sleeve.

The arm 126 of the awl operating lever comprises a casing in which is mounted a slide bar 128 broken at 130 into two separable sections, the lower section 1280 being provided with rack teeth which mesh with the teeth of a pinion 132 carried at the outer end of the rock-shaft 124 and the upper section 1281 receiving through an opening in the back of the casing which forms the arm 126 a pivot pin 134 upon a block 136 arranged to be moved vertically in a lever 138 pivoted at one end at 140 to the machine head and at its other end carrying a cam roll 142 which enters a cam groove 144 in a cam wheel 146 on the main shaft 20.

The lever 138 is provided with a spring socket 148 in which is contained a spring 150 which holds the block 136 yieldingly in its lowermost position. The power which operates the awl to cause it to penetrate the work being transmitted to the arm 126 of the awl operating lever through the lever 138, the effective length of the arm 126 is therefore varied by varying the vertical position of the fulcrum pin 134.

In order that the work penetrating movement of the awl may be proportioned to the thickness of the work, mechanism is provided for automatically varying the vertical position of the fulcrum pin 134 in accordance with the thickness of the work. This mechanism comprises a lever 152 attached to a rock-shaft 154 having bearings in the machine head, said lever carrying at its forward end a segment rack 156 which engages a pinion 158, see Fig. 3, upon the inner end of the rock-shaft 124. The rear end of the lever 152 is connected by a rod 160 to a slide 162 constituting a part of the work thickness compensating mechanism through which the releasing movement of the horn is controlled for the work feeding operation. Since the position of the slide 162 is determined by the thickness of the work in a manner hereinafter to be described, the vertical position of the fulcrum pin 134 will be controlled through the rod 160, lever 152, segment 156, pinion 158, rock-shaft 124, pinion 132 and slide 128.

The horn release mechanism herein shown is substantially the same in its construction and principle of operation as that shown in the co-pending application of George Goddu, Serial No. 409,352, filed Jan. 4, 1908, except that the mechanism herein shown is mounted in the column 4 to operate in the reverse direction from that in which the mechanism in the co-pending application operates. In the illustrated construction the slide 162 is normally depressed into its lowermost position by a horn raising and work clamping spring 164 bearing at its upper end against a cross-piece in the column 4 and at its lower end being received in an annular socket 166 surrounding and clamped upon a threaded rod 167 connected to the slide 162.

The pressure of the spring 164 is transmitted to the horn 122 through connections comprising toggle links 168, 170 and a lever 172 fulcrumed in the column 4 and connected at its rear end to the toggle link 170 and at its forward end connected by a block and slot connection to a member 175 into which the horn supporting rod 174 is threaded. The lever 172 is forked at its forward end. The straightening of the toggle is effected through a link 176 connected at one end to the knee joint of the toggle and at its other end to one arm of a bell-crank lever 178, the other arm of which is connected by a rod 180 to an arm of a second bell-crank lever 182. The other arm of the lever 182 carries a cam roll entering a cam slot 184 in the cam wheel 48. When the toggle is broken, the spring 164 is preferably locked against action upon the horn, as in the co-pending application above referred to, and said locking means comprises as in said application a ratchet plate 186 carried by a casing 188 in which the slide 162 is mounted to reciprocate vertically, pawls 190 being mounted upon said slide and arranged to engage the ratchet

when the toggle is broken, said pawls being held out of engagement with said ratchet when the toggle is straightened by the pressure of a finger 192 attached to the toggle link 168 upon the tails 194 of said pawls.

The horn may be depressed when the machine is at rest in order to place work upon it or remove work from it by suitable connections with the horn depressing treadle 12, said connections comprising, in the illustrated construction, a rod 196 threaded at its upper end into a piece 197 having a pin and slot connection with a forked extension of the member 175, said rod being pivotally connected at its lower end to the treadle 12.

The mechanism for automatically controlling the depth of penetration of the awl into the work has preferably only a limited range of movement, since when operating upon work which is very thick it is unnecessary to vary the depth of penetration of the awl and therefore when the thickness of the work exceeds a predetermined amount the awl depth controlling mechanism ceases to cause variations in the movement of the awl corresponding to variations in the thickness of the work. A stop 199 in the path of the segment carrying end of the lever 152 limits the movement of the awl depth controlling mechanism.

In order that the free movement of the horn may not be interfered with when the thickness of the work exceeds that for which automatic variation of the awl movements is provided, a yielding connection is provided between the rod 160 and the slide 162 whereby when the rod 160 has reached the upper limit of its movement, that is when it has set the awl operating mechanism to give the greatest amount of penetrative movement to the awl, the slide 162 may be moved relatively to the rod 160 to permit the horn 22 to accommodate itself to work of still greater thickness. This yielding connection comprises a socket 198 located within the spring 164 and connected to the rod 160 and having confined within it and bearing against the lower end of rod 160 a spring 200.

A second rod 167 passes through an opening in the bottom of the socket 198 and within said socket is provided with a piston 202 bearing upon the lower end of the spring 200. The spring 200 is strong enough so that the thickness of the work will be accurately gaged by the automatic controlling mechanism up to the maximum for which this mechanism is effective, and that beyond the said maximum it will be compressed to permit the relative movement of the slide 162 and the rod 160.

The downward movement of the slide 162 causes a positive downward movement of the rod 160 after the spring 200 has expanded sufficiently to bring the piston 202 into contact with the bottom of the socket 198 in the event that said spring has been compressed.

During the horn release operation of the horn controlling mechanism there will be no movement of the awl through the awl depth controlling mechanism since at this time the slide 162 will be locked against movement and therefore the rod 160 will be held stationary. It will be noted that when the awl operating lever is turned about the rock-shaft 124 by the action of the lever 138 upon it that the part 1280 of the slide bar 128, as it rolls about the pinion 132, will tend to move away slightly from the part 1281 and for this reason the slide bar 128 has been made in two separable sections in order that this slight downward pull may not affect the vertical position of the fulcrum pin 134. When the slideway for the block 136 in the lever 138 and the slideway for the slide bar 128 are substantially parallel, any movement of the bar 128 caused by variations in the thickness of the work will have no effect upon the awl since the parts are in what may be called neutral position, and no tendency to turn is imparted to the arm 126 of the awl operating lever by the movement of the slide 128 when the parts are in this neutral position, or in other words, when the angle between the slideway for the block 136 and the slideway for the slide bar 128 is zero.

Since the position of the awl will not be affected by any adjustment of the awl depth controlling mechanism when the two slideways are in the position just described, the parts are preferably so timed that the movement of the horn back into work gaging position will take place with the slideways in this position and that the machine will stop with the slideways in this position. It will therefore be seen that the horn may be depressed by the treadle 12 to permit work to be placed upon it or removed from it without any effect upon the awl.

The hopper 56 is attached to a counter shaft 204 mounted in a bracket 206 clamped to the machine head. Also mounted in this bracket is a second counter shaft 208 having a bearing 210 at the rear part of the machine head and having loosely mounted on its rear end a driving pulley 212 in a peripheral groove in which travels a belt 214. The belt 214 surrounds and travels in a peripheral groove in a hopper driving extension 216 of the loose pulley upon the shaft 20 to which the belt 18 transmits movement from the counter shaft 8. This loose belt pulley is constantly rotated and is arranged to be clutched to the shaft 20 by any suitable clutch mechanism, preferably that disclosed in the co-pending application of George Goddu, Serial No. 476,649, filed Feb. 8, 1909.

The loose pulley 212 may be clutched to the shaft 208 by any suitable clutch mechanism, such for example as that illustrated which comprises a cone 218 carried by a sleeve 220 surrounding the shaft 208 within the bearing 210, said sleeve being somewhat longer than the bearing 210 and having a flange upon its forward end between which and the collar 222 upon the shaft 208 is confined a spring 224 which tends normally to cause the sleeve 220 to move the cone 218 into clutching engagement with the loose pulley 212.

The sleeve 220 may be moved against the tension of spring 224 to move the cone to effect an unclutching of the pulley 212 from the shaft 208 by means of a forked bell-crank lever 226, one arm of which bears against the flange of the sleeve 220 and the other arm of which is connected to an operating rod 228 extended to the front of the machine and provided at its forward end with a finger hold 230. Between the fork members of the bell-crank lever is a downwardly extending lug which coöperates with stop members on the bearing 210 and limits the movement of said lever. When the bell-crank 226 is in the position shown in Fig. 3, the pulley 212 is unclutched from the shaft 208 and the hopper is at rest. It will be noted that by this arrangement the hopper may be kept in motion while the fastening inserting mechanism is at rest. This is frequently desirable in order to keep the raceway properly supplied with nails.

The counter shaft 208 is provided at its forward end with a worm 232 which drives a worm-wheel 234 upon a cross shaft 236 extending between the shaft 208 and the shaft 204, said shaft 236 having at its other end a bevel gear meshing with a bevel gear upon the rear end of the shaft 204. A rotary raceway clearer 238 is mounted upon a third counter shaft having bearing in the bracket 206 and is provided at its rear end with a belt pulley which is connected with a belt pulley upon the shaft 208.

In Fig. 8 is shown an improved raceway clearer operating mechanism. In this figure is shown also a different hopper actuating means, but it will be understood that the clearer actuating mechanism may be used equally with this hopper actuating means or with that shown in the other figures. Upon the shaft 208 is mounted a pinion 240 which meshes with an annular gear 242 formed upon the hopper. The shaft 208 has also attached to it a pin wheel 244 of a Geneva stop mechanism. The counter shaft upon which the raceway clearer 238 is mounted has attached to it the star wheel 246 of the Geneva stop mechanism. The pin 248 upon the pin wheel 244 entering successively the slots 250 in the star wheel 246 effects at each rotation of the shaft 208 one-sixth of a rotation of the raceway clearer 238. This intermittent movement of the raceway clearer 238 is very effective in removing the misplaced nail from the upper end of the raceway, since the blow which it gives the misplaced nail is very quick and much more effective than the continuous movement of a constantly rotating clearing wheel.

When it is desired to adjust the tension of the spring 164 which operates to move the horn 22 into clamping relation to the work, the socket 166 may be adjusted upon the threaded rod 167. It will be noted that the portion of this socket which is threaded upon the rod 167 is split and provided with a set screw by which it may be clamped in adjusted position. To permit the adjustment of the spring to be effected more easily, an anti-friction bearing is provided for the spring in the bottom of the socket 166. This anti-friction bearing comprises, as illustrated, a washer 252 in the bottom of the socket and a washer 254 upon which the spring 164 rests, anti-friction balls 256 being provided between the two washers.

The operation of the machine is as follows: The parts being in the position shown in Fig. 1, at which time the awl depth controlling mechanism is in neutral position, and the toggle 168, 170 is straightened so that the spring 164 may act upon the horn 22, the pawls 194 being held out of engagement with the ratchet plate 186, the operator depresses the treadle 12 to lower the horn to permit the work to be placed thereon, this depression of the treadle serving to compress the spring 164 so that when the operator again releases the treadle the work will be pressed into engagement with the work abutment 258 adjacent to the fastening inserting mechanism. This work clamping movement of the horn 22 operates through the connections 160, 152, 124, 132 and 128 to adjust the fulcrum pin 134 so that the awl operating mechanism will cause the awl to penetrate to the proper depth for the thickness of the work clamped between the horn and the work abutment. The work having thus been placed in position upon the horn, the operator removes his foot from the treadle 12 and depresses the starting treadle 14. This treadle is connected by a rod 260 to suitable clutch actuating mechanism not herein specifically illustrated nor described since it constitutes no part of the present invention, and is normally depressed by a spring 262 bearing at one end against the under side of the rearward extension of the casing or bracket 188 and at its other end upon a collar upon the rod 260.

Depression of the treadle 14 serves, through the rod 260, to effect a clutching of the constantly rotating loose pulley over which the belt 18 travels to the main driv-

ing shaft 20. The machine stops with the driver in substantially its lowermost position and with the cam roll 44 in the recess or pocket 54 of the driver cam groove 46, as shown in Fig. 3. As the main shaft 20 starts to rotate the driver is lifted until it clears the throat 62 and the throat 62 and separator 80 are then withdrawn simultaneously out of the path of the awl by the lever 72 operating upon the slide 64. While the driver is rising to clear the throat and the throat is being withdrawn out of the path of the awl, the awl enters the work to a depth determined by the awl depth controlling mechanism hereinabove described, and as it completes its work penetrating movement the horn is depressed by the breaking of the toggle 168, 170, the slide 162 being at this time locked to the ratchet plate 186 so that the spring 164 cannot act upon the horn during the horn release. The awl then feeds the work over the horn until the fastening receiving opening which it has formed in the work is brought beneath the driver passage.

As the awl returns to its initial position the throat and separator are moved back into their original positions and the separator acts to deliver a nail to the throat as the fastening receiving opening in the throat comes beneath the driver passage. The driver completes its upward movement after the separator has come into position to retain the nails behind that separated in the raceway and descends to drive the nail immediately after the throat has come into proper relation to the driver passage.

It will be noted that the spring 150 serves to keep the section 1281 of the slide 128 in engagement with the section 1280 when the slideways for the block 136 and the slide 128 are parallel, and that therefore the fulcrum pin 134 will be automatically adjusted for each thickness of the work clamped between the horn 22 and the work abutment 258, this gaging action of the horn taking place at the end of the work feed as the awl is withdrawn from the work and as the parts of the awl depth controlling mechanism are returned into neutral position so that it has no direct effect upon the position of the awl.

If the treadle 14 is kept depressed by the operator several nails will be driven in rapid succession. When the treadle 14 is released the machine will automatically complete the cycle of operations necessary to drive a nail and will stop with the parts in the relation above described and which is shown in Fig. 1.

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

1. In a machine of the class described, the combination with a driver, of means for operating said driver, said means being constructed to control positively the action of said driver during a part of its driving movement and to permit to said driver independent movement in the driving direction during another part of said driving movement.

2. In a machine of the class described, the combination with a reciprocating driver, of means for controlling positively the action of the driver during a portion of its reciprocating movement, said means being constructed to compel a predetermined driving movement of the driver while permitting free travel of the driver in the driving direction during another portion of the reciprocating movement of said driver.

3. In a machine of the class described, the combination with a driver, of means for imparting to said driver a predetermined amount of driving movement, said means being constructed to move said driver with a positively predetermined velocity during a portion of its movement and to permit to said driver a velocity in the driving direction greater than that of said means during another portion of its movement.

4. In a machine of the class described, the combination with a driver, of means for actuating said driver, said means being constructed to control positively the action of the driver during a part of its movement and then to permit the driver to travel under its acquired momentum and yet to compel its travel to a predetermined point during another part of its movement.

5. In a machine of the class described, the combination with a driver, of operating means connected with said driver including a cam roll and a cam wheel provided with a cam slot within which the cam roll is confined for the greater part of the rotation of said wheel, said slot having an enlarged portion in the region compelling extreme descent of the driver whereby the driver is free to move under its acquired momentum in completing its driving movement.

6. A machine of the class described, having in combination, a driver and means for actuating said driver constructed to cause it to travel at not less than a predetermined minimum velocity to an intermediate point in the driving direction, to determine positively the location of that point and to free the driver to continue its driving movement by momentum only when it has reached said point.

7. A machine of the class described, having in combination, a driver, means for actuating said driver constructed to control said driver positively throughout a part of its movement in the driving direction, to permit said driver to travel under its acquired momentum through the balance of its movement in the driving direction and then to act upon said driver in such manner that

it causes it to effect a setting action upon the head of the driven fastening.

8. A machine of the class described, having in combination, a driver and a single means for actuating said driver constructed to operate twice upon the driver during its driving movement, between which operations the driver is free to travel under its acquired momentum, the first of said operations imparting to the driver its momentum and the second of said operations imparting to the driver, in substantially its lowermost position, a fastening setting movement.

9. In a machine of the class described, a reciprocating driver, driver actuating means, and connections between said driver and said actuating means constructed to insure positive correlation of the movements of the actuating means and the driver throughout the greater part of the reciprocating movement of said driver, provision being made for free movement of the driver during the latter part of its movement in the driving direction.

10. In a machine of the class described, a driver and means for actuating said driver comprising a member connected with said driver and an angularly movable member, said two members being connected with provision for independent movement in such parts only of the angular movement of said angularly movable member that the driver will be caused to travel at a positively predetermined velocity to an intermediate point in the driving direction, and will then be freed at that point to continue its driving movement by momentum.

11. In a machine of the class described, a reciprocating driver and means for reciprocating said driver constructed to control positively the movements of said driver throughout the greater part of its reciprocating movement, said means having provision for free movement of said driver under the action of gravity and its acquired momentum during the latter part of its movement in the driving direction.

12. A machine of the class described, having in combination, mechanism for inserting fastenings, an awl, means for positively operating said awl comprising a lever having a segment rack engaging the awl bar, a second lever having an adjustable connection with said first lever whereby the effective throw of said first lever may be varied and mechanism for adjusting the said connection in accordance with the thickness of the work arranged to operate through the center of oscillation of said first lever.

13. A machine of the class described, having in combination, mechanism for inserting fastenings, an awl for forming fastening receiving openings in the work, means for operating said awl, and means for varying the effective throw of the awl operating means comprising a lever connected at one end with the work support, a rock shaft upon which a member of the awl operating means is sleeved provided with pinions at each of its ends, a segment gear at the other end of said lever meshing with one of said pinions and a fulcrum adjusting slide bar forming a part of said awl operating means and provided with a rack meshing with the other of said pinions.

14. A machine of the class described, having in combination, mechanism for inserting fastenings, an awl and an awl bar having rack teeth, mechanism for positively operating said awl comprising a lever carrying upon one arm a segment rack engaging the rack teeth upon the awl bar and carrying in its other arm a fulcrum adjusting slide and means for operating said slide having an axis coinciding with that of said lever.

15. A machine of the class described, having in combination, mechanism for inserting fastenings, an awl for forming a fastening receiving opening in the work, means for positively operating said awl comprising a lever having one arm pivotally connected with said awl and having in its other arm a slide formed of a plurality of separable sections, a cam operated lever having pivotal connection with one of the sections of said slide, and means operating through the center of oscillation of said first mentioned lever upon another section of said slide for varying the effective throw of said awl operating mechanism in accordance with the thickness of the work.

In testimony whereof I have signed my name to this specification in the presence of two subscribing witnesses.

FRED L. MacKENZIE.

Witnesses:
H. DORSEY SPENCER,
FREDERICK L. EDMANDS.