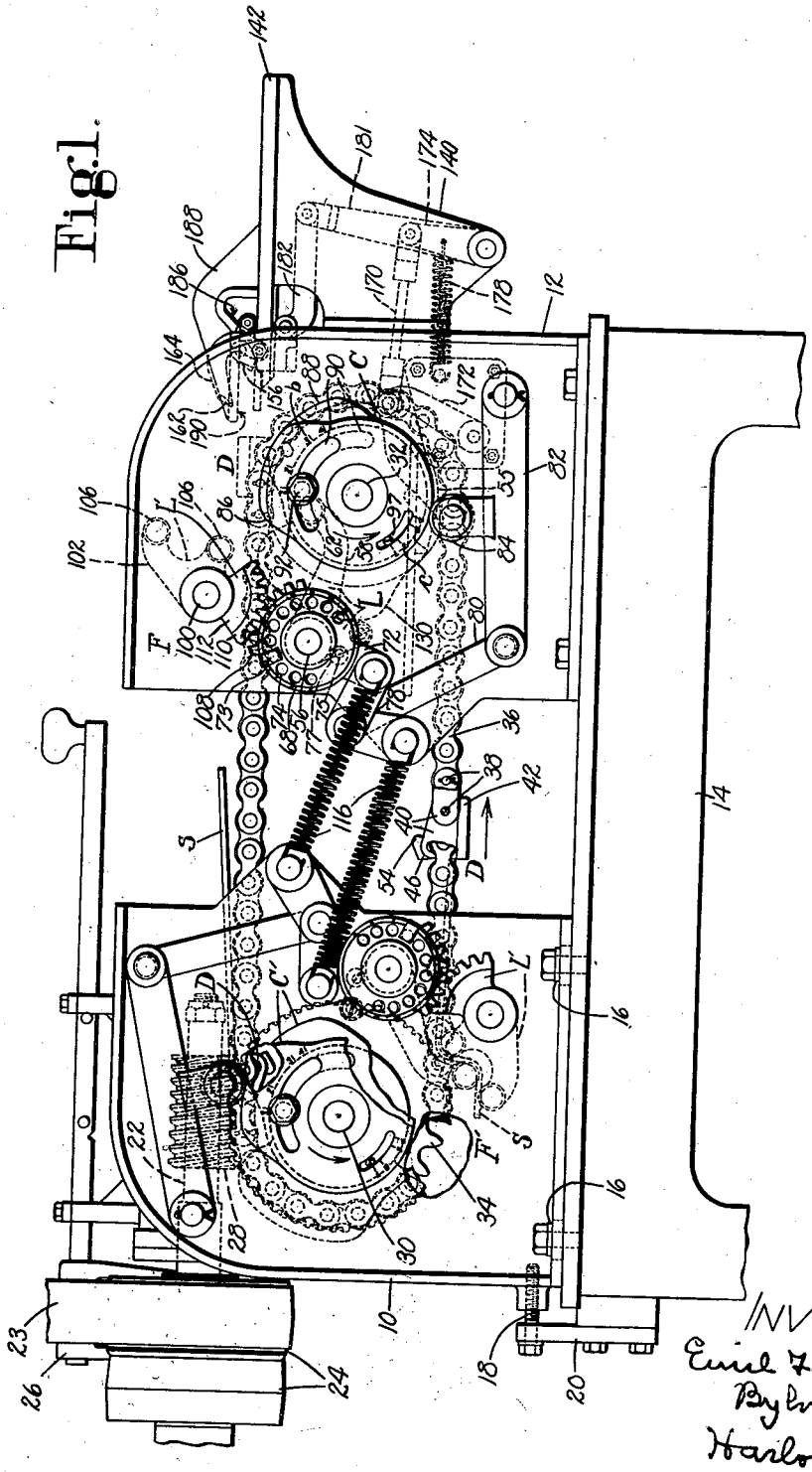
Jan. 25, 1938. E. FOGELSON 2,106,171

FLEXING MACHINE

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Fig. 1.



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FLEXING MACHINE

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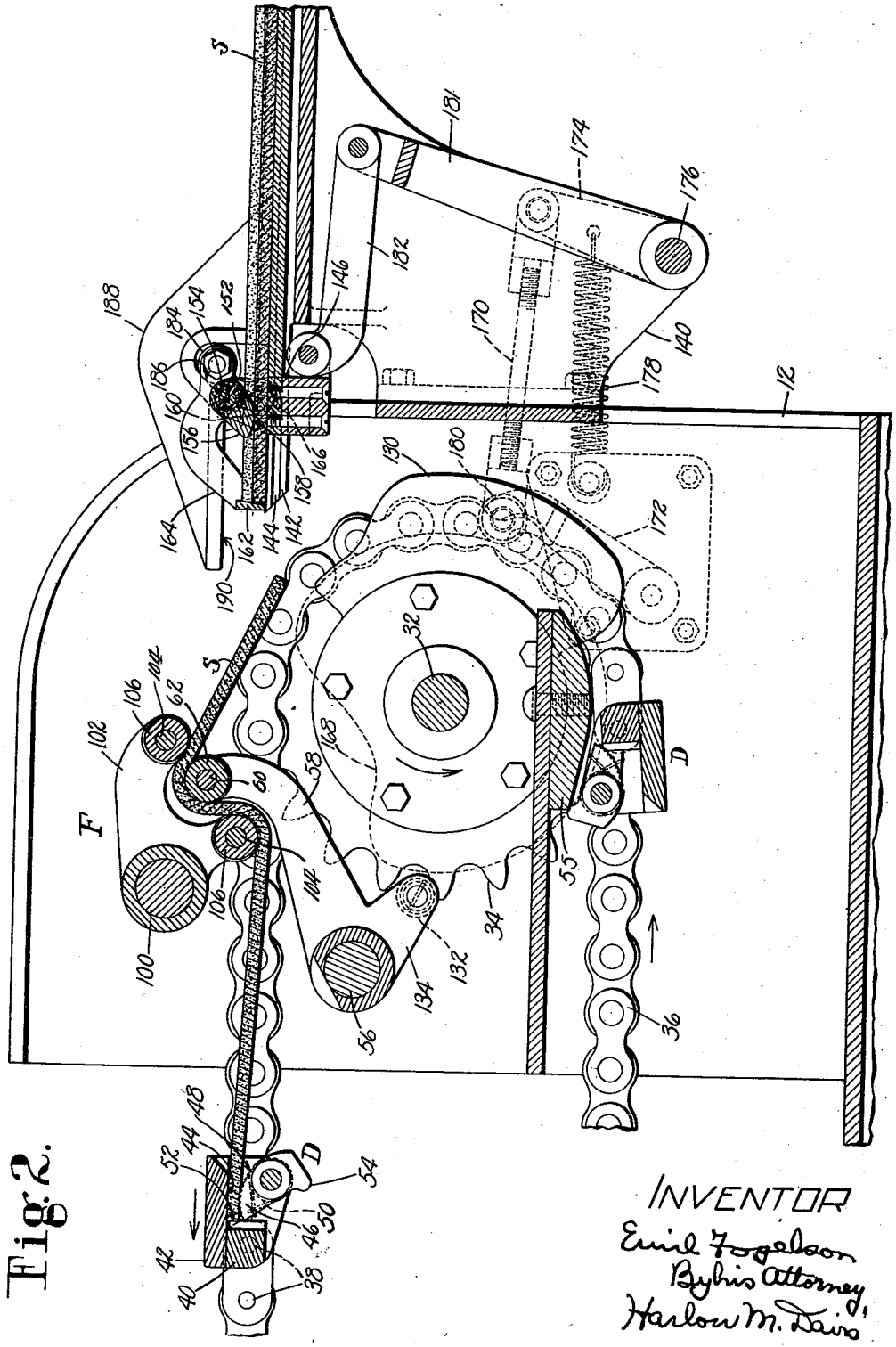


Fig. 2.

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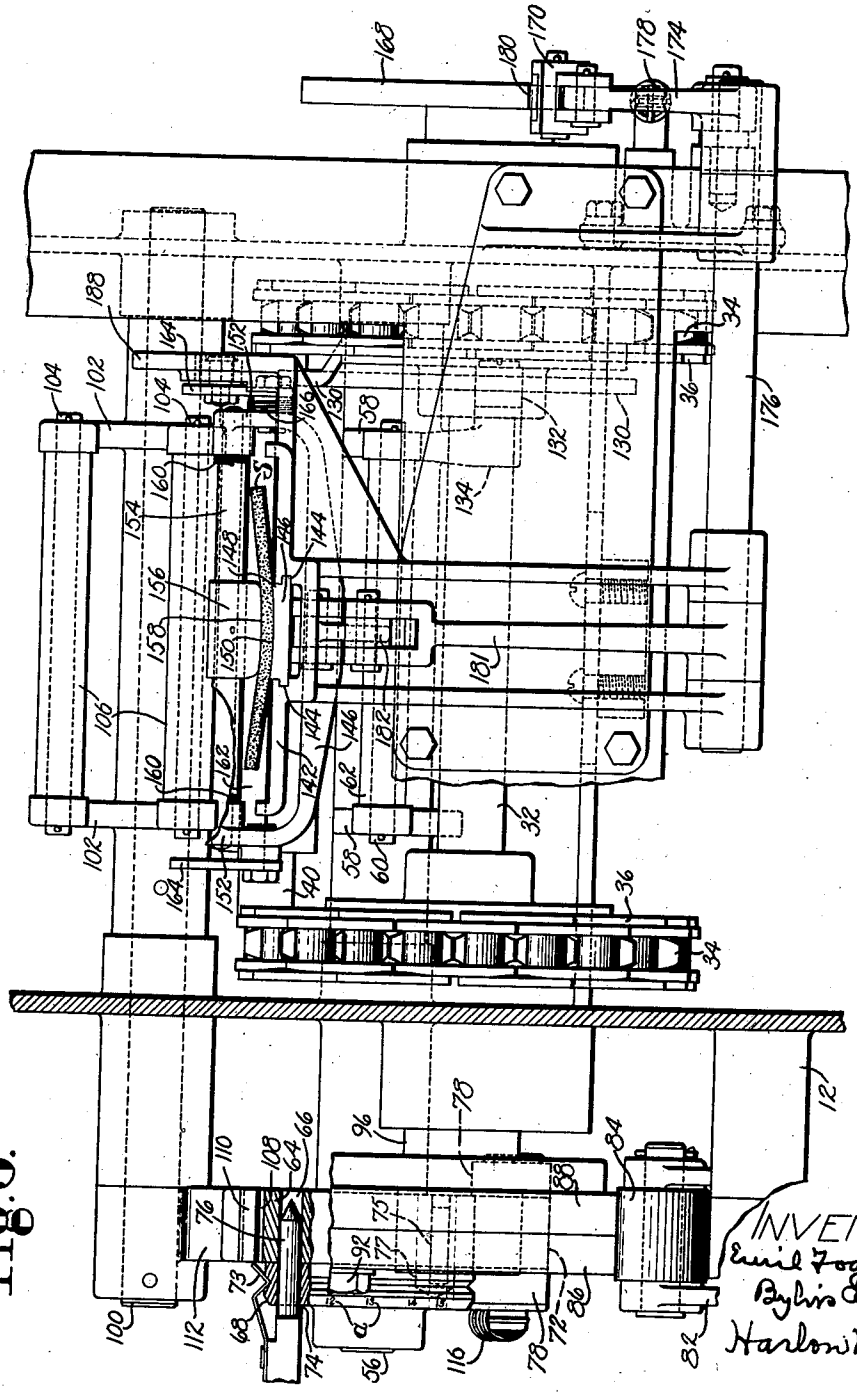


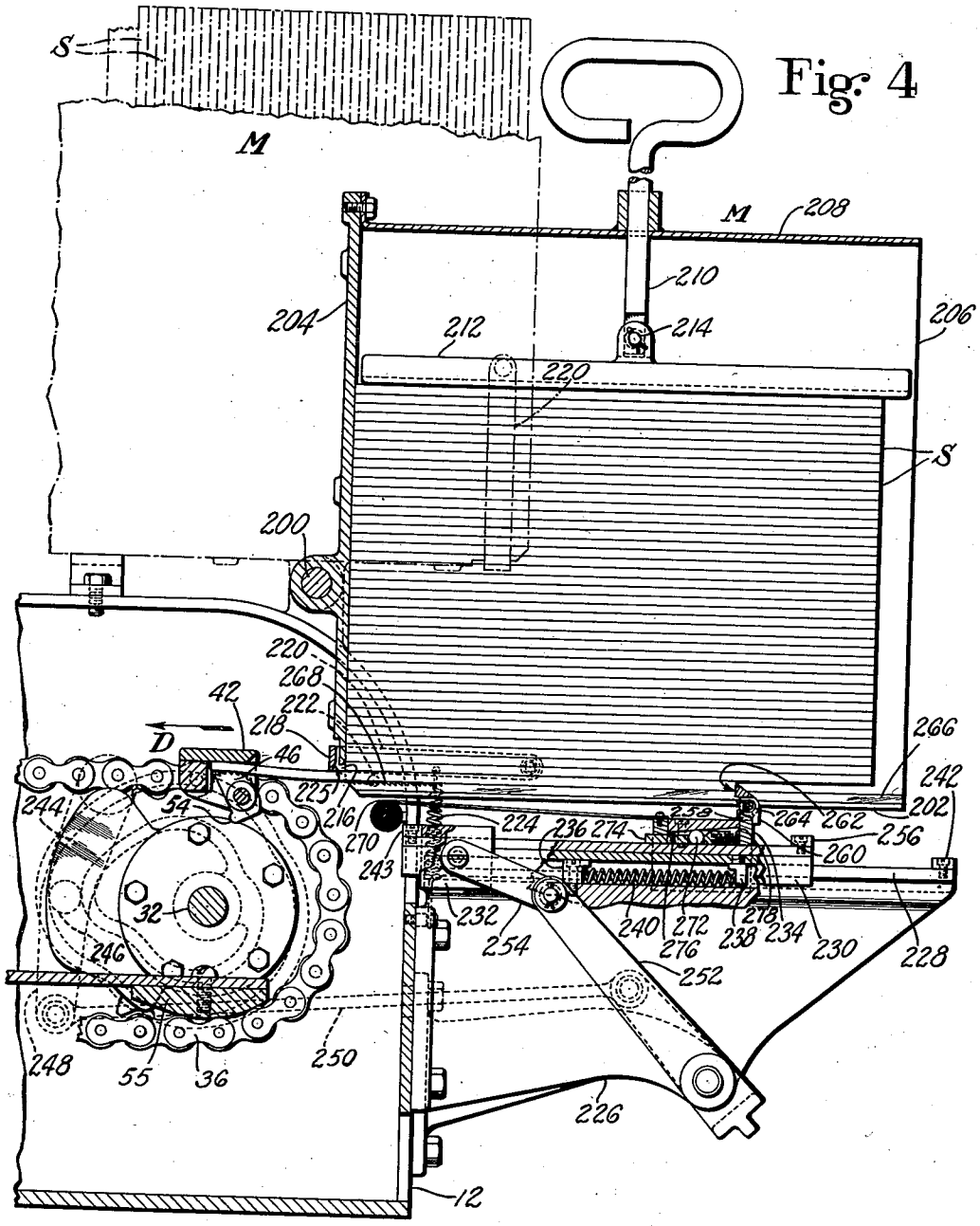
Fig. 3.

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FLEXING MACHINE

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Fig. 4



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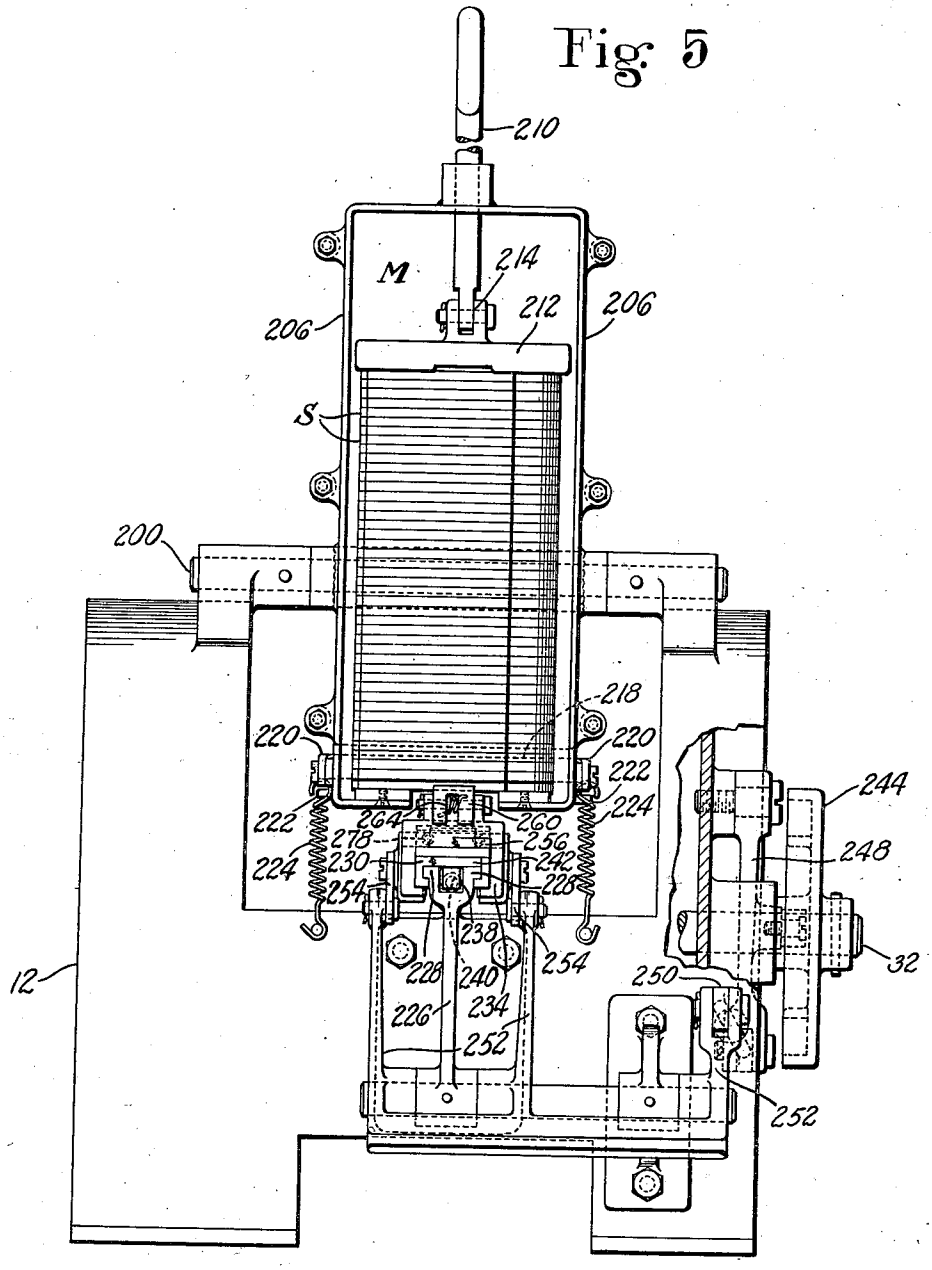
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FLEXING MACHINE

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Fig. 5



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UNITED STATES PATENT OFFICE

2,106,171

FLEXING MACHINE

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Application August 1, 1936, Serial No. 93,828

58 Claims. (Cl. 12—17)

My invention relates to machines by which work-pieces, such as soles for shoes, are rendered more flexible.

In the making of shoes, it is frequently desired to impart to the soles a greater degree of flexibility than is natural to the leather from which they are formed. The treatment required varies with the thickness and character of the stock and the preference of the manufacturer, a greater or less flexing action being called for and this being applied to different portions of the soles considered along their lengths. It is an object of this invention to meet these requirements by the provision of a machine which is simple, compact and efficient, applying to the work in a small compass repeated bending effects in opposite directions, by members which are controllable as to the degree and extent of action and which may be caused to produce considerable flexibility without danger of injury to the stock.

In the attainment of this object, as a feature of the invention, I advance the soles or other work-pieces preferably along a path which has one or more rectilinear portions, such as may be furnished by conveyor-chains having opposite runs. Toward and from the path of work-advance move opposite work-engaging members, at one side two of these members being shown and at the other one member, which passes between the other two. The members may consist of rods or rolls mounted upon levers which may be geared to move together and are actuated by a rotatable cam. The work is herein shown as grasped by a pair of jaws upon the conveyors, one of which jaws is forced toward the other, as by a spring, to prepare for a work-clutching action. The intermeshing of the flexing members causes the work-pieces to be bent in opposite directions as they are advanced by the jaws and thus subjected to an effective loosening of the fibers, and when this occurs during rectilinear movement of the work-pieces, the bending angle is constant, thus giving a uniform action during the entire treatment. As herein illustrated, the conveyors carry a plurality of pairs of jaws, and separate flexing mechanisms act successively upon work held between the jaws while pieces are traveling with opposite runs of the conveyors. At the same time, a work-piece, the operations upon which have been completed, may be released for discharge from the machine by means into co-operation with which a pair of the jaws is advanced.

To provide for operating upon different portions of the work-pieces and creating in them different degrees of flexibility, my invention, regardless of the particular arrangement of the flexing instrumentalities, as another feature provides for varying the time during which a movable flexing member acts upon the work and the extent of such movement. The first of these variations is preferably made both as to the time of initiation of the bending action and its termination. In the present instance, I accomplish this by employing such an actuating member as a cam having sections each of which may be secured in different positions to diversely affect the flexing member or members. Thus, with a shoe-sole, bending may begin in any relation to a limiting point, as the forward extremity of the shank-portion, and end at another point, as the rear of the box-area. To control the amount of bending, a flexing member has associated with it a projection which may be secured in different angular positions with relation to said member. Consequently, when an actuating member contacts with said projection, the extent of the effective bending movement will depend upon this relation. I have herein disclosed for this purpose the flexing member as carried by a spindle, about which an arm is capable of movement, there being provided a variable connecting device comprising a series of openings and a connecting pin. It is particularly to be observed that all these adjustments, as to points of application and degree of bending action, may be made without disturbing any other.

The connections through which the flexing members are actuated may be so affected, as by the breaking or removal of an element, that a part will assume an abnormal position in which it might be struck by the traveling work-advancing means. As a further feature of the invention, I guard against this by furnishing auxiliary means for moving the flexing members from the work in addition to the normal means which produces their movement. This auxiliary means preferably acts under the power of the machine and may consist of a cam which rotates with a normally acting cam, the function of the latter being to move the flexing members toward the work.

It may be desired to supply work-pieces in a more or less automatic manner to the means by which they are advanced for flexing. Consequently, as still another feature of the invention, I associate with the advancing means a member movable to deliver the work-pieces to it. This delivery member thrusts the work between the jaws upon the conveyor which preferably furnish the advancing means, said jaws thereupon clutching the piece and carrying it forward for the

flexing operation. The delivery is made from a support, and co-operating with the support is a member which determines the correct relation of the work for its advance, said member being thereafter moved out of its active position to avoid interference with delivery. The travel of the jaws, the operation of the flexing mechanism and the movement of the delivery member are all in synchronism, so accurate presentation of the work and operation upon it are assured. The supply means may be made fully automatic by including a magazine for a stack of work-pieces from which the delivery to the advancing means is made. This magazine, as illustrated, is mounted to move from a position in which work-pieces are placed in it and vertically alined at their forward extremities for accurate delivery, to a position in which the lowermost piece is prepared for delivery from the thus alined stack. The flexing machine may be required to operate upon pieces differing in length, and therefore to give this capability without the necessity for adjustment, I have arranged the delivery means to first measure a piece in the magazine and thus prepare for its delivery through a predetermined distance. This distance will be that from the plane of alinement of the work-pieces in the magazine to the correct receiving point for the advancing means, as where the piece is thrust between the grasping jaws. This measuring and delivering action is obtained in the herein disclosed embodiment of the invention by a compound delivery-slide associated with the magazine and comprising a carrier-slide and actuating and work-engaging slides movable thereon. A releasable lock connects the work-engaging slide to the carrier-slide to permit measurement of the pieces in the magazine, and power is applied to the actuating slide to cause this to release the lock and then to produce the delivery of the piece.

One of the many forms which my invention may assume is illustrated in the accompanying drawings, in which—

Fig. 1 is a side elevation of my improved flexing machine with parts broken away;

Fig. 2, an enlarged, partial, vertical, longitudinal section;

Fig. 3, an end elevation of the delivery mechanism looking from the right in Fig. 1;

Fig. 4, a vertical, longitudinal section through another form of delivery mechanism, and

Fig. 5, an end elevation looking from the right in Fig. 4.

The frame of the machine is shown as consisting of spaced end-sections 10 and 12 supported upon a base 14. The section 10 may be secured to the base by slot-and-screw connections 16, which allow it to be differently spaced from the companion section. A screw 18 rotatable in a bracket 20 fixed to the base and threaded into the section 10 facilitates this adjustment, which is for the purpose of tightening sprocket-chains, referred to below. The section 10 carries the means by which the machine is driven. In bearings at one side of this frame-section is journaled a short, longitudinally extending driving shaft 22, to which power may be applied through a belt 23 operating over fast and loose pulleys 24 upon the shaft and controlled by a belt-shifter 26. Through worm-gearing 28 power is transmitted from the shaft 22 to a shaft 30 journaled transversely of the frame in the section 10. Upon this shaft 30 and a parallel shaft 32 rotatable in the frame-section 12 are pairs of sprocket-wheels 34, 34 over which operate spaced conveyor-chains 36, 36. The shafts 30 and 32 furnish the driving means for the mechanisms carried by the respective frame-sections. The upper runs of these chains travel from right to left, as viewed in Fig. 1 of the drawings, and both runs are substantially rectilinear. At intervals about the chains there project inwardly pairs of transversely alined pins 38, 38 which may be furnished by extensions of the connecting pins for the chain-links. These pairs of pins enter pairs of openings in the opposite extremities of crossbars 40, which are thus carried upon and advanced by the chains. Three of these bars are disclosed, these belonging respectively to work-grasping devices D which are uniformly spaced about the chains and are advanced thereby at a definite rate. Attached to the outer face and forming a part of each bar is a plate 42, the inner face 44 of which furnishes an abutment-jaw against which a work-piece may be grasped. Pivoted at its ends upon the bar 40 of each of the grasping devices is a movable jaw 46 having a curved and preferably toothed surface 48 co-operating with the opposed plate-surface to grasp the work. Torsion-springs 50 surrounding the pivots of each jaw 46 urge the surface 48 toward the surface 44. When a piece of work to be flexed, as a block-sole, is thrust between the jaws to an extent determined by the contact of its end with a vertical surface 52 of the bar 40, the jaw 46 is forced aside, turning about its pivot. It then acts, by virtue of the relation of the pivotal point and the curvature of the surface 48, with the abutment-jaw 42 to clutch the piece firmly to advance it for the flexing operations, automatically resisting the withdrawing forces which are set up. After these operations have been performed, as will later be described, engagement of a projection 54 on the jaw 46 with a contact member 55 (Fig. 2) supported upon the section 12 of the frame will separate said jaw 46 from the jaw 42 to release the work-piece.

To operate upon pieces grasped between the jaws of the devices D, two flexing mechanisms F and F′ are provided, the mechanism F being mounted upon the frame-section 12 at the outer ends of the upper runs of the chains 36 outgoing from the work-receiving point and the mechanism F′ upon the frame-section 10 at the opposite ends of the lower runs of said chains incoming to the receiving point. These flexing mechanisms save for the location of the elements, may be substantially identical, so that one only will be described in detail. Since the work is introduced into the machine at the frame-section 12, the mechanism F of this section will be considered. Mounted in the section 12 below the upper runs of the chains 36 is an oscillatory spindle 56 on which is affixed a lever L. This lever has spaced arms 58, 58, which are connected by a long hub and are situated at opposite sides of the path of the work. The outer ends of the arms 58 are connected by a rod 60 on which a freely rotatable flexing roll 62 is mounted. Outside the frame at one side, the spindle has a tightly attached flange 68 (Fig. 3), in which is an arcuate series of openings 74. Co-operating with this flange 68 is a flange 64 loosely mounted on the spindle 56 and provided with an operating arm 72. In the flange 64 is an arcuate series of openings 66 spaced from one another by greater intervals than are the openings 74, so that registration may be produced at any time between only one of the openings 74 and one of the openings 66. By inserting a connecting pin 76 in different pairs of openings, the arms 58 may be

locked in different angular relations to the arms 72 to regulate the degree of the flexing effect. On account of the difference of spacing between the two series of openings, as the opening 74 chosen for the insertion of the pin is located farther along the series, a greater difference in the angular relation will be obtained. There may be associated with each of the openings 74 a character *a* inscribed upon the outer face of the flange 68 and corresponding to a certain thickness of material to be operated upon and therefore calling for a corresponding setting of the arms 58. The pin 76 has a tapered end which, when introduced into any one of the openings 74, will enter an overlapping opening 66 and force the two into registration. A spring 73 secured to the pin engages the periphery of the flange 68 to retain said pin against accidental displacement. To maintain such a relation between the two flanges 64 and 68 that the pin 76 may always enter both, the flange 64 carries a pin 75 that projects into a larger socket 77 in the flange 68. Contact of the pin with the wall of the socket prevents too great relative angular movement of the flanges. Articulated to the arm 72 is one extremity of a toggle 78, the opposite end of which is pivoted to the frame. The center of the toggle is joined by a link 80 to a lever 82 which carries a roll 84 contacting with a cam C secured to the shaft 32, said shaft being driven from the shaft 30 of the mechanism F through the chains 36. This cam C is preferably variable in form to determine the time in the operating cycle at which it first acts upon the roll 84 and, consequently, when movement of the flexing arms 58 begins and ends. For this purpose, the cam is formed in two sections 86 and 88, each of which may be independently adjustable angularly about the shaft. In each section is an arcuate opening 90, these openings registering with each other radially of the sections. Through the openings passes a clamping screw 92, this being threaded into a flange projecting from a collar 96 fast upon the shaft 32. With the screw 92 loosened, either or both of the cam-sections may be adjusted circumferentially of the shaft and fixed in position by tightening the screw. The right-hand end of the slot in section 86 when in contact with the screw 92 (Fig. 1) fixes the earliest time of initiation of the cam-action upon the flexing members, while a slot-and-pin connection 97 between the sections furnishes the limits between which the action of the section 88 upon the roll 84 may be caused to terminate. Scales *b* and *c* may be provided upon the section 86, associated respectively with the screw 92 and the pin of the connection 97 as index members, to guide the operator in arriving at the proper angular positions of the sections to give the result sought. The flexing mechanism F' has a cam C' corresponding in arrangement and function to the cam C.

Above the path of the grasping devices D upon the upper run of the chains 36 a spindle 100 is mounted to turn in the frame-section 12. Projecting from this spindle are spaced arms 102, 102 of a lever L', these arms being joined by rods 104 carrying work-engaging rolls 106. A difference in the length of the arms causes one of the work-engaging members to move along an arc closer to the spindle than does the other. The levers L and L' oscillate in synchronism by reason of connections including gear-segments 108, 110. The segment 108 is shown as formed upon the periphery of the flange 64. The segment 110 is provided by a flange 112 fast upon the spindle 100 and is, in effect, an arm upon the lever L'. Springs 116, 116 anchored respectively to the anchoring pivots of the toggles 78 and connected respectively to the arms 72 of the flexing mechanisms F and F', normally retract the flexing rolls 62 and 106 of the levers L and L' from the path of the work-grasping devices D and maintain the rolls 84 of the levers 82 against the cams C and C'. This is as appears at the mechanism F in Fig. 1 of the drawings. Were the springs 116 to break, or be omitted by mistake, the flexing members might foul the grasping devices D as they travel under the influence of the chains. To avoid the possibility of such an accident, I preferably provide in addition to the springs which normally retract the flexing members, auxiliary means acting under the power of the machine to accomplish such retraction. Upon the shaft 32 at the inner side of one of the sprocket-wheels 34 is a cam 130, the periphery of which, if the flexing members are in abnormal positions, will engage a roll 132 projecting from one side of a short arm 134 formed with the flexing arms 58. The contour of the cam 130 is such that it will retract the flexing members only in the event that the springs 116 fail to do so.

Assuming that soles S for shoes are to be operated upon by my improved machine, the adjustments which have been described may be employed in the following manner to meet the various conditions which may be encountered. It is usually desired that only a portion of the forepart of a sole shall be rendered more flexible, the area to be acted upon being that between the shank and a point somewhat at the rear of the toe-end. The beginning and end of this area will, of course, vary in its relation to the grasping devices D according to the size of the shoe for which the sole is intended. Each sole engaged at its end by the jaws 42 and 46 of one of the devices D will arrive at the flexing rolls 62 and 106 of both flexing mechanisms F and F' of the machine at definite times in the operating cycle. To determine where along the length of the sole the rolls shall come into contact with it, it is only necessary to adjust the section 86 of each of the cams C and C' under the guidance of the scale *b* to make contact with the roll 84, so the movement of the arms 58 and 102 is started at such time that the rolls 62 and 106 will begin their action at a chosen portion. Similarly, by setting each cam-section 88 as indicated by the scale *c*, the action of the cam will terminate so the spring 116 will cause the retraction of the flexing rolls at the desired portion of the sole. Thus, by changing the effective length of the actuating surface of the cam-sections, the time during which the flexing members act upon the work is altered. The degree of flexing action may also require variation. Heavy stock will endure less sharp bending than lighter without straining the fibers, and shoe-manufacturers may have different views as to the correct degree of flexibility of soles. Or it may be considered desirable to produce different flexing effects at the succeeding mechanisms. A greater flexing effect may be applied at the second mechanism F' after the preliminary flexing of the work at the first mechanism F without danger of injury to the stock. The degree of bending is controlled by the extent to which the roll 62 upon the arms 58 and the rolls 106 upon the arms 102 intermesh. This, in turn, is governed by the angles through which the cams C and C' move the corresponding arms 72 in contact with the stock. The rolls are normally spaced from the path of the work-pieces

so there is lost motion before they engage the work. The adjustment of the angles between the actuating arms **72** and the flexing arms **58** of the levers L, by the insertion of the pins **76** in different registering pairs of the openings **74** and **66** guided by the characters inscribed at *a* upon the mechanisms F and F', provides for this effect.

With the above adjustments made in accordance with the requirements of the particular work to be performed, it is only necessary to introduce the work, piece by piece, between the jaws **42** and **46** of the devices D as these are brought up to the upper horizontal runs of the chains **36**, **36** at the entrance side of the first flexing mechanism F. Nothing is necessary but to thrust an end of a sole between the jaws until it is stopped by contact with the surface **52**. The sole is then so located that it will be firmly clamped by the clutching effect of the pivoted jaw **46**, which holds it more tenaciously as the withdrawing force increases. After the jaws have passed the flexing field, the arms **58** of the levers L rise and the arms **102** of the levers L' descend, causing the roll **62** upon the former to pass between the rolls **106** upon the latter. The sole is thereby bent both down and up as best shown in Fig. 2, so it is subjected to a double and opposite flexing action as the advancing jaws drag it between the rolls. Before the second flexing mechanism F' has been reached, the first operation will have been completed. The grasping device and the work-piece held by it then turn and descend to the lower runs of the chains. Here, the action is repeated at the mechanism F'. The flexing operations being thus performed, the piece is released from the jaws by contact of the projection **54** with the stationary member **55**. It is to be noted that throughout the operations at both mechanisms the bending effect is uniform, because the jaws follow a rectilinear path as long as the sole is between the flexing members. If, instead, the jaws were to move up or down, as would be the case when mounted on a rotatable turret, the degree of bending would gradually decrease or increase longitudinally of the sole, introducing uncertainty as to the result. All the operations occur in a floor-space little more than the area of the largest sole to be treated.

To bring about the application of the soles S to the grasping devices D mechanically at the proper times, thus relieving the operator of the difficulty of locating said devices, the machine may be provided with a delivery mechanism. Supported on brackets **140** at opposite sides of the incoming end of the frame-section **12** is a horizontal table **142**. Longitudinally of this table in ways **144** moves a carriage **146**, which is provided with a central portion **148** (Fig. 3) projecting upwardly through a slot in the table. The portion **148** preferably has a transversely concaved work-engaging surface **150**. In a pair of carriage-arms **152**, **152** located at opposite sides of the table is mounted to oscillate a horizontal spindle **154**, lying across the portion **148** of the carriage and having secured to it above said portion a member **156**. The members **148** and **156** furnish together a pair of work-grasping jaws, the face **158** of the member **156** being curved downwardly and forwardly. It is forced toward the surface **150** by torsion-springs **160** surrounding the spindle **154**. Because of the angle and curvature of the spring-actuated member **156**, the jaws permit the free introduction of a sole in the direction of delivery but automatically clutch it to resist opposite or rearward displacement, as in the case of the devices D. The face **158** is also curved transversely, so it is in this direction generally complemental to the surface **150**. When a work-piece is grasped between these surfaces, it is bent transversely, so it is stiffened to better resist longitudinal distortion during its delivery. To fix definitely the point at which a sole or other piece to be delivered shall be introduced between the jaws **148** and **156**, there is carried upon the arms **152** in advance of said jaws a gate or stop-bar **162**. This gate extends between arms **164**, **164** pivoted upon the outside of the carriage-arms **152** and is held normally down against or in close proximity to the surface of the table **142** by a spring **166** encircling one of its pivots. The carriage **146** is reciprocated by a cam **168** fast upon the shaft **32** of the flexing mechanism F. The effect of the cam is communicated to the carriage by a link **170**, adjustable as to length, this link being guided at one extremity adjacent to the cam by an arm **172** pivoted upon the frame, while its opposite end is articulated to an arm **174** fixed to a spindle **176** turning in the brackets **140**. A spring **178** joining the arm **174** to the frame holds against the cam **168** a roll **180** rotatable at the juncture of the link **170** and the arm **172**. Fast upon the spindle **176** is an arm **181**, the upper end of which is connected by a link **182** to the carriage **146**. The action of the cam is to hold the carriage **146** with the jaws and gate for a time in their rearward positions, and then allow them to travel forward under the influence of the spring **178** to deliver the work-piece held between the jaws. During this advance, a roll **184** turning upon a rearward extension from one of the gate-arms **164** is carried down by contact with an inclined surface **186** upon a bracket **188** rising from one side of the table. The gate is thereby lifted above the plane of the sole which is between the jaws and is thus maintained during delivery by a horizontal surface **190** upon the bracket, into contact with which the roll **184** passes after leaving the surface **186**.

In the use of this delivery mechanism, the operator, while the jaws **148** and **156** are in their rearward position, thrusts between them over the table **142** a sole, until its end is stopped by the gate **162**, and then releases it. The carriage **146** now travels forward in synchronism with the particular grasping device D which is being brought into work-receiving position at the flexing mechanism F by the chains **36**. As this occurs, the gate is raised clear of the sole and so held by the stationary cam-surfaces **186** and **190**, respectively. Just as the grasping device, advanced by the chains at a definite rate, starts upon its horizontal movement toward the flexing mechanism, the sole being delivered overtakes it, and its end which is outside the delivery-jaws **148** and **156** is pressed between the receiving jaws **42** and **46** against or in proximity to the stop-surface **52**. At this time, the pivoted jaw **156** clutches the sole to prevent rearward displacement, but as the delivery-jaws stop and the travel of the device D continues, the sole is drawn from said jaws with little resistance, to be carried through the machine. The carriage **146** thereupon starts its reverse travel.

Instead of the work being supplied piece by piece to the delivery mechanism by the operator, the feed may be made in a fully automatic manner from a magazine. Referring to Figs. 4 and 5, we have pivoted at **200** upon the rear of the frame-section **12** a magazine M provided with a normally horizontal bottom wall **202**, a front wall **204**, opposite side walls **206**, **206** and a top wall

208. Through an opening near the center of the wall 208 passes a rod 210, this carrying within the magazine a follower 212, the pivotal connection 214 between the rod and follower being sufficiently loose to permit some universal movement of self-adjustment. With the follower close to the wall 208, the magazine may be tilted forward upon its pivot, to the position indicated in dash-dot lines in Fig. 4, and a stack of soles inserted, this bringing all their ends in approximately uniform contact with the wall 204 and therefore in substantial alinement. Then, upon restoring the magazine to its normal position, the follower 212 urges the stack toward the wall 202 and maintains the bottom sole in the correct relation for delivery. At this time, the alined ends will occupy a substantially vertical plane which is in a definite relation to the work-grasping jaws 42 and 46 as they approach the flexing mechanism F. Delivery is made through an opening 216 at the bottom of the wall 204, this opening being normally closed by an upwardly yieldable gate 218, which retains the bottom sole against discharge during the filling of the magazine and substantially alines it with the remainder of the stack. The gate extends between arms 220, 220 pivoted upon the magazine-walls 206 and thus held normally across the opening 216 against stops 222 by springs 224. At the inner lower edge of the gate is a downwardly and outwardly inclined surface 225. When the lowest sole in the magazine is forced by the delivery mechanism against this surface, the gate yields to permit its passage.

Projecting rearwardly from the frame is a bracket 226 carrying at its top a horizontal guideway 228 extending beneath the magazine. Movable upon the guideway is a compound delivery device comprising three independently movable slides. A main carrier-slide 230 is mounted directly upon the guideway to reciprocate toward and from the flexing mechanism F. Movable longitudinally of the guideway upon the slide 230 are an actuating and controlling slide 232 and a work-engaging slide 234. Interposed between a projection 236 rising from the bracket and a depending projection 238 from the outer extremity of the slide 230 is an expansion-spring 240, the effect of which is to urge said slide toward a stop 242 at the outer end of the guideway 228. This movement is opposed by the slide 232, with which contacts a stop-projection 243 fixed at the upper side of the inner end of the slide 230. The actuating slide 232 is positively reciprocated upon the carrier-slide 230 to an extent determined by a driving cam 244. This cam is secured upon the shaft 32 of the flexing mechanism F and has a closed path to receive a roll 246 upon a lever 248 fulcrumed upon the frame-section 12. A link 250 joins this lever to a lever 252 fulcrumed upon the bracket 226, the lever 252 being, in turn, connected to the slide 232 by links 254. The work-engaging slide 234 is movable upon the carrier-slide 230 similarly to the slide 232, being interposed between the latter and a stop 256 rising above the outer end of the carrier-slide. At the outer extremity of the slide 234 are upward projections 258, between which is pivoted the work-engaging portion proper of said slide. This is in the form of a finger or pawl 260, which has a contact-face 262 held normally in substantially vertical position by a torsion-spring 264 surrounding its pivot. The finger extends upwardly through a slot 266 in the bottom wall 202 of the magazine, so its face 262 may engage the outer end of the bottom sole of the stack within the magazine and advance this toward the flexing mechanism F, when the slide travels in that direction. Upon movement of the slide in the opposite direction, the finger yields, passing idly along the under face of the sole which is next to be delivered. To insure against rearward displacement of the lower sole during this return movement, a toothed surface 268 may be formed upon the wall 202 of the magazine, the inclination of the teeth resisting outward movement of the engaged sole but being without effect for inward travel. A light spiral spring 270, mounted upon the frame and secured at its outer end to the slide 234, exerts a constant force tending to cause said slide to follow the actuating slide 232 when this travels inwardly. Or the spring may be sufficiently strong to furnish some feeding effect. The work-engaging slide 234 may be releasably locked to the main slide 230, to prevent relative movement between the slides, by a clutch device shown herein as of the Horton type. This consists of a roll 272 lying across the upper face of the slide 230 within a slot in a shiftable cage member 274, said member being guided upon the slide 230 between the side walls of the slide 234 and beneath a downwardly inclined wall 276 of said slide 234. Springs 278 carried in bores in the cage member and contacting with a vertical wall upon the slide 234 force said cage member inwardly and the roll 272 against the inclined wall 276, so, when movement of the slide 234 in the direction of delivery is resisted, this slide is locked to the carrier-slide. The inner end of the cage member projects beyond the slide 234 to receive contact of the slide 232.

As shown in the drawings, the delivery mechanism has completed its delivering movement and is ready for the reverse movement. The stack of soles S in the magazine M has had the heel-ends vertically alined by contact with the wall 204 and the gate 218 of the magazine, as already described. The slide 232 starts back from the extreme forward position, driven by the cam 244. As it travels outwardly, the carrier-slide 230 which it has been holding is caused to follow under the influence of the spring 240. The slide 230 will be arrested in this movement by the stop 242. With it has been carried the work-engaging slide 234, which was left locked to it by the roll 272 at the termination of the preceding delivery. At its extreme of outward travel, as determined by the movement of the carrier-slide, the finger 260 will have been so positioned that it will be outside the outer end of the longest sole which the mechanism will be called upon to deliver. Rearward movement of the actuating slide 232 continues sufficiently after the slides 230 and 234 have been thus stopped, to permit it to engage the inwardly projecting end of the cage member 274, which is thereby shifted to release the roll 272 from its locking engagement. By this action, the slide 234 is freed from the slide 230 for movement inwardly by the spring 270. Consequently, when the travel of the slide 232 is reversed, the slide 234 follows it until the surface 262 of the finger 260 contacts with the end of the bottom sole in the magazine. Upon encountering this resistance, the member 274 is actuated by the springs 278 to cause the roll 272 to exert its locking effect, so the slide 234 is made fast to the slide 230. Movement of the work-engaging slide 234 from its outward position to that just indicated provides a measuring action, by which the finger 260 is prepared to correctly start the feed of any sole the magazine may con-

tain, regardless of its length. During this measuring, the slide **230** is retained against the stop **242** by the spring **240**, but as the slide **232** advances, it strikes the projection **243**. The slide **230** with the slide **234** secured to it and with the finger **260** engaging the sole, is thereby moved forward through a predetermined distance determined by the contour of the cam **244**. This movement is such that the forward extremity of the engaged sole thrust beneath the gate **218** will enter between the jaws **42** and **46** of the grasping device D which is just being elevated by the chains **36** to start upon its horizontal travel in cooperation with the flexing mechanism F. As in the delivery mechanism already described, the movements of the slide **232** and of the jaws **42** and **46** are synchronized to insure this delivery. The receiving jaws firmly clutch the thus-delivered sole and complete its withdrawal from the magazine. The delivery mechanism is now ready for the feed of the next sole in the stack this being in synchronism with the arrival at the flexing mechanism F of the next grasping device D of the series on the chains **36**.

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

1. In a flexing machine, means for advancing a workpiece along a path having two rectilinear portions outgoing and incoming with respect to a work-receiving point, flexing mechanism acting upon the work over the outgoing rectilinear portion, and flexing mechanism acting upon the work over the incoming rectilinear portion.

2. In a sole-flexing machine, spaced conveyor-chains having opposite runs, a plurality of pairs of sole-grasping jaws carried by the chains, and flexing mechanisms associated respectively with the opposite runs of the chains.

3. In a flexing machine, means for advancing a work-piece, two work-flexing members movable toward and from the path of work-advance, a work-flexing member movable from the opposite side of said path between the two first-mentioned members, and means for moving the members simultaneously in opposite directions.

4. In a flexing machine, means for advancing a work-piece, two levers fulcrumed at opposite sides of the advancing work, each lever being provided with a work-engaging portion extending across the path of advance, and means for oscillating the levers simultaneously to cause the portions to engage and flex the work.

5. In a flexing machine, means for advancing a work-piece, two levers fulcrumed at opposite sides of the advancing work, each lever having an arm at each side of the path of advance and a work-flexing rod extending between the arms, and means for oscillating the levers simultaneously in opposite directions.

6. In a flexing machine, means for advancing a work-piece, two levers fulcrumed at opposite sides of the advancing work, each lever having an arm at each side of the path of advance, one of the levers being provided with two work-flexing rods extending between the arms and the other lever having a work-flexing rod connecting the arms and movable between the rods of the companion lever, and means for oscillating the levers.

7. In a flexing machine, oscillatory flexing members arranged to operate upon opposite sides of the work, gearing compelling the members to oscillate together, an arm projecting from one member, and a rotatable cam engaging the arm.

8. In a flexing machine, an endless conveyor, opposite work-engaging jaws connected to the conveyor to advance a work-piece, and flexing members movable from opposite sides of the path of the conveyor into engagement with work grasped by the jaws.

9. In a flexing machine, an endless conveyor, opposite work-engaging jaws connected to the conveyor to advance a work-piece, and flexing members movable from opposite sides of the path of the conveyor into engagement with work grasped by the jaws, said jaws having means whereby they are caused to clutch said work to resist its withdrawal by the action of the flexing members.

10. In a flexing machine, spaced endless conveyors, a jaw attached at its opposite extremities to the conveyors, a jaw movable upon the conveyor-attached jaw, means for moving said movable jaw to cause it to grasp a work-piece, and flexing members movable upon opposite sides of the path of the conveyors for engagement with the work grasped between the jaws and during its advance by the conveyors.

11. In a flexing machine, spaced endless conveyors, a jaw attached at its opposite extremities to the conveyors, a jaw movable upon the conveyor-attached jaw, means for moving said movable jaw to cause it to grasp a work-piece, there being a surface upon the conveyor-attached jaw by which the extent of introduction of the work between the jaws is determined, and flexing members movable upon opposite sides of the path of the conveyors for engagement with the work grasped between the jaws and during its advance by the conveyors.

12. In a flexing machine, an endless conveyor, opposite work-engaging jaws connected to the conveyor to advance a work-piece, flexing members movable into engagement with the work from opposite sides of the path of the conveyor, and means into co-operation with which the jaws are advanced by the conveyor for releasing the work from said jaws.

13. In a flexing machine, spaced endless conveyors, a jaw attached at its opposite extremities to the conveyors, a jaw pivoted upon the conveyor-attached jaw, a spring for forcing the pivoted jaw toward the companion jaw, flexing members movable at opposite sides of the path of the conveyors for engagement with the work grasped between the jaws and during its advance by the conveyors, and a member situated adjacent to the path of the conveyors for contact with the pivoted jaw to release the work.

14. In a sole-flexing machine, a conveyor-chain provided with means for grasping a sole, levers fulcrumed upon opposite sides of the path of the sole, and sole-engaging members extending from the levers.

15. In a sole-flexing machine, a conveyor-chain provided with means for grasping a sole, levers fulcrumed upon opposite sides of the path of the sole, and sole-engaging members extending from the levers and movable thereby in intermeshing relation to flex the sole in opposite directions.

16. In a sole-flexing machine, spaced conveyor-chains, a sole-engaging jaw joined at its opposite extremities to the chains, a jaw pivoted upon the first-mentioned jaw, and flexing members acting upon opposite sides of a sole grasped between the jaws.

17. In a flexing machine, means for advancing a work-piece, a flexing member for engagement

with the advancing work, means for moving the member to effect the engagement, and means arranged to vary the time during which the flexing member acts upon the work.

18. In a flexing machine, means for advancing a work-piece, a flexing member for engagement with the advancing work, means for moving the member to effect the engagement, and means arranged to vary the point at which engagement with the work by the flexing member is initiated.

19. In a flexing machine, means for advancing a work-piece, a flexing member movable into and out of engagement with the advancing work, means for moving the member to effect the engagement and disengagement, and means arranged to vary the point at which the member is separated from the work.

20. In a flexing machine, means for advancing a work-piece, a flexing member for engagement with the advancing work, driving means, a member variable in effective length through which power is transmitted from the driving means to the flexing member, and means arranged to adjust the length of the member to determine the time during which the flexing member acts upon the work.

21. In a flexing machine, means for advancing a work-piece, a flexing member for engagement with the advancing work, driving means, a member formed in sections and through which power is transmitted from the driving means to the flexing member, and means arranged to secure the sections in different positions differently affecting the flexing member.

22. In a flexing machine, means for advancing a work-piece, a flexing member movable into and out of engagement with the advancing work, a rotatable driving shaft, a cam carried by the shaft and formed in sections which transmit power from the shaft to the flexing member, and means arranged to secure the cam-sections in different effective positions upon the shaft.

23. In a flexing machine, means for advancing a work-piece, a flexing member movable into and out of engagement with the advancing work, a rotatable driving shaft, a cam carried by the shaft and formed in two sections which transmit power from the shaft to the flexing member, means arranged to secure one cam-section in different angular positions about the shaft, and means arranged to secure the other section in different positions relatively to the first section.

24. In a flexing machine, means for advancing a work-piece, a flexing member for engagement with the advancing work, said member having a projection, means arranged to secure the projection in different positions with relation to the flexing member, and an actuating member acting upon the projection.

25. In a flexing machine, means for advancing a work-piece, an oscillatory flexing member for engagement with the advancing work, said member having a spindle upon which the member is carried for its oscillation, an arm capable of movement about the spindle, the arm and spindle being provided with a series of openings and with a connecting pin which may be introduced into one of the openings, and means for actuating the arm.

26. In a flexing machine, means for advancing a work-piece, an oscillatory flexing member for engagement with the advancing work, said member having a spindle upon which the member is carried for its oscillation, an arm capable of movement about the spindle, the arm and spindle each being provided with a series of openings a single pair of which may be brought at one time into registration by rotation of the arm about the spindle, means entering the registering openings for securing the arm to the spindle, and an actuating member for the arm.

27. In a flexing machine, oscillatory flexing members arranged to operate upon opposite sides of the work, actuating means acting upon one member to oscillate it, connections from the thus actuated member to oscillate its companion member, and means arranged to vary the time in an operating cycle during which the actuating means acts upon the flexing member.

28. In a flexing machine, oscillatory flexing members arranged to operate upon opposite sides of the work, gearing compelling the members to oscillate together, an arm projecting from one member, and a rotatable cam acting upon the arm, said cam being formed in sections variable in position with relation to each other.

29. In a flexing machine, oscillatory flexing members arranged to operate upon opposite sides of the work, actuating means acting upon one member to oscillate it, connections from the thus actuated member to oscillate its companion member, and means arranged to vary the distance through which the thus connected flexing members are moved in engagement with the work by the actuating means.

30. In a flexing machine, oscillatory flexing members arranged to operate upon opposite sides of the work, gearing compelling the members to oscillate together, an arm projecting from one member, means arranged to secure the arm in different angular positions with reference to said member, and a rotatable cam acting upon the arm.

31. In a flexing machine, means for advancing a work-piece, a flexing member for engagement with the advancing work, means for moving the member to effect the engagement, means arranged to vary the time during which the flexing member acts upon the work, and means arranged to vary the distance through which the flexing member is moved in engagement with the work.

32. In a flexing machine, means for advancing a work-piece, a flexing member for engagement with the advancing work, driving means for the flexing member, and a series of connecting members between the driving means and the flexing member, one of said connecting members having means arranged to vary the time in the operating cycle during which the driving means acts upon the flexing member and another of said connecting members having means arranged to vary the distance through which the flexing member is moved in engagement with the work.

33. In a flexing machine, means for advancing a work-piece, a flexing member for engagement with the advancing work, driving means, a member through which power is transmitted from the driving means to the flexing member, means arranged to secure the transmitting member in different angular positions relatively to the flexing member, a member variable in effective length and acting upon the transmitting member, and means arranged to vary the length of said member.

34. In a flexing machine, oscillatory flexing members arranged to operate upon opposite sides of the work, gearing compelling the members to oscillate together, an arm projecting from one member, a rotatable cam acting upon the arm, said cam being formed in sections variable in

position with relation to each other, and means arranged to secure the arm in different angular positions with reference to the member from which it projects.

35. In a flexing machine, a movable flexing member, means for advancing a work-piece to receive the action of the flexing member, normally acting means for moving the member toward and from the work, and auxiliary means for moving the member from the work.

36. In a flexing machine, a movable flexing member, means for advancing a work-piece to receive the action of the flexing member, a power-actuated member for moving the flexing member toward the work, a spring for moving the flexing member from the work, and a power-actuated member for moving the flexing member from the work.

37. In a flexing machine, an oscillatory flexing member, a pair of jaws traveling to present a work-piece to the flexing member, a rotatable shaft, and means carried by the shaft for oscillating the flexing member in opposite directions.

38. In a flexing machine, means for advancing a work-piece, two flexing members movable toward and from the opposite sides of the advancing work, a rotatable shaft, a cam carried by the shaft for moving the members toward the work, and a cam carried by the shaft for moving the members from the work.

39. In a flexing machine, means for advancing a work-piece, two flexing members movable toward and from the opposite sides of the advancing work, a spring arranged to move the members from the work, a rotatable shaft, a cam carried by the shaft for moving the members toward the work, and a cam carried by the shaft for moving the members from the work.

40. In a flexing machine, flexing means movable to bend a work-piece simultaneously in opposite directions, means engaging the work-piece to advance it during the action of the flexing means, and means movable to deliver the work-piece to the advancing means.

41. In a flexing machine, a flexing member, means for advancing a work-piece to receive the action of the flexing member, means movable to deliver the work-piece to the advancing means, and means movable into and out of active position to locate the work for such delivery.

42. In a flexing machine, a flexing member, means for advancing a work-piece to receive the action of the flexing member, a support for a work-piece, and a member movable along the support in contact with the work-piece thereon to deliver it to the advancing means.

43. In a flexing machine, a flexing member, means for advancing a work-piece to receive the action of the flexing member, a support for a work-piece, a member co-operating with the support to determine the relation of the work-piece to the advancing means, said member being movable into and out of its active position, and a member movable along the support in contact with the positioned work-piece to deliver it to the advancing means.

44. In a flexing machine, a flexing member, opposite jaws traveling to advance a work-piece to receive the action of the flexing member, and a member movable to thrust the work-piece between the jaws.

45. In a sole-flexing machine, a flexing member, opposite jaws traveling to advance a sole to receive the action of the flexing member, one of said jaws being pivoted to move toward and from the other to clutch automatically a sole thrust between them, a spring for producing the pivotal movement of the jaws, and a member movable under the power of the machine to thrust a sole between the jaws.

46. In a sole-flexing machine, a movable flexing member, opposite chains traveling past the flexing member, means for advancing the chains at a definite rate, sole-grasping jaws carried by the chains, a delivery member movable to thrust a sole between the jaws, and means for operating the flexing member, the chains with their jaws and the delivery member in synchronism.

47. In a flexing machine, a flexing member, means for advancing a work-piece to receive the action of the flexing member, a support for the work-piece extending toward the advancing means, and a pair of jaws movable along the support and delivering therefrom to the advancing means a work-piece received between them.

48. In a flexing machine, a flexing member, means for advancing a work-piece to receive the action of the flexing member, a support for the work-piece extending toward the advancing means, a pair of jaws movable along the support and delivering therefrom to the advancing means a work-piece received between them, and a stop member movable toward and from the support in advance of the delivery jaws.

49. In a flexing machine, a flexing member, means for advancing a work-piece to receive the action of the flexing member, a support for the work-piece extending toward the advancing means, a pair of jaws movable along the support and delivering therefrom to the advancing means a work-piece received between them, a gate co-operating with the support and arranged to receive contact of a work-piece inserted between the jaws, and means for separating the gate from the support.

50. In a flexing machine, a flexing member, means for advancing a work-piece to receive the action of the flexing member, a support for the work-piece extending toward the advancing means, a pair of jaws movable along the support and delivering therefrom to the advancing means a work-piece received between them, a gate movable with the jaws and co-operating with the support, said gate being arranged to receive contact of a work-piece inserted between the jaws, and means into engagement with which the gate travels for separating it from the support.

51. In a sole-flexing machine, a movable sole-flexing member, a pair of jaws arranged to receive a sole and advance it for the action upon it of the flexing member, and a pair of jaws arranged to deliver the sole to the receiving jaws, the receiving jaws and delivering jaws respectively resisting disengagement of the sole by the opposite applied forces of sole-advance and sole-delivery.

52. In a flexing machine, flexing means movable to bend a work-piece simultaneously in opposite directions, means engaging the work-piece to advance it during the action of the flexing means, a magazine for work-pieces, and means movable to deliver the work-pieces one by one from the magazine to the advancing means.

53. In a flexing machine, a flexing member, means for advancing a work-piece to receive the action of the flexing member, a magazine movable between a position in which contained work-pieces aline themselves as to their ends toward the advancing means and a position in which the lowest work-piece in the magazine is pre-

pared for delivery, and means movable to deliver the work-pieces one by one from the magazine to the advancing means.

54. In a flexing machine, a flexing member, means for advancing a work-piece to receive the action of the flexing member, a magazine for work-pieces, and delivery means movable to first measure work-pieces contained in the magazine and thereafter to deliver the measured pieces through a predetermined distance to the advancing means.

55. In a flexing machine, a flexing member, means for advancing a work-piece to receive the action of the flexing member, a magazine for work-pieces, and a compound slide delivering to the advancing means and comprising a carrier-portion, an actuating portion and a work-engaging portion, said portions being movable independently of one another.

56. In a sole-flexing machine, a movable flexing member, a pair of jaws arranged to receive between them a sole and advance it for the action upon it of the flexing member, a magazine in which soles are arranged in a stack with their forward extremities alined in a plane at a definite distance from the receiving position of the jaws as these approach the flexing member, and a slide by which the soles in the magazine are successively engaged and moved through such definite distance and between the jaws.

57. In a sole-flexing machine, a movable flexing member, a pair of jaws arranged to receive between them a sole and advance it for the action upon it of the flexing member, a magazine for a stack of soles, a movable carrier-slide, an engaging slide movable upon the carrier-slide and provided with a finger for engagement with the bottom sole in the magazine, means for moving the engaging slide upon the carrier-slide to measure the sole to be delivered, means for thereupon locking the engaging slide to the carrier-slide, and means for imparting to the carrier-slide movement to deliver the sole to the jaws.

58. In a sole-flexing machine, a movable flexing member, a pair of jaws arranged to receive between them a sole and advance it for the action upon it of the flexing member, a magazine in which soles are arranged in a stack with their forward extremities alined in a plane at a definite distance from the receiving position of the jaws as these approach the flexing member, a carrier-slide movable through such definite distance, an engaging slide movable upon the carrier-slide and provided with a finger for engagement with the bottom sole in the magazine, means for moving the engaging slide upon the carrier-slide to measure the sole to be delivered, means for thereupon locking the engaging slide to the carrier-slide, and an actuating slide oppositely movable to unlock the engaging slide and to impart to the carrier-slide its delivery movement.

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